SCHOOL OF ENGINEERING AND TECHNOLOGY
Bachelor of Technology- Computer Science & Engineering
And
Specialization

Programme Code: SET0101
Duration- 4 Years Full Time

PROGRAM STRUCTURE
AND
CURRICULUM & SCHEME OF EXAMINATION
2020

Program and Course Structure

OF

Bachelor of Technology- Computer Science & Engineering

B.Tech-CSE with specialization in Artificial Intelligence & Machine Learning

B.Tech-CSE with specialization in BLOCKCHAIN

B.Tech-CSE with specialization in Cyber Security & Forensics

B.Tech CSE with specialization in Data Science

B.Tech-CSE with specialization in Internet of Things & Applications

B.Tech-CSE with specialization in Business Analytics & Optimization

B.Tech-CSE Cloud Computing & Virtualization

B.Tech-CSE Cloud Technology & Information Security

1. Standard Structure of the Program at University Level

1.1 Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. **Transformative educational experience**
2. **Enrichment by educational initiatives that encourage global outlook**
3. **Develop research, support disruptive innovations and accelerate entrepreneurship**
4. **Seeking beyond boundaries**

Core Values

- **Integrity**
- **Leadership**
- **Diversity**
- **Community**

Note: Detailed Mission Statements of University can be used for developing Mission Statements of Schools/ Departments.

Vision of the School

To become a globally acclaimed institution of higher learning in engineering and technology promoting excellence in research, innovation and entrepreneurship

Mission of the School

1. **To impart quality education with strong industry & academic connectivity in the expanding fields of Engineering and Technology in a conductive and enriching learning environment.**
2. **To product technocrats equipped with technical & soft skills and experiential learning required to stay current with the modern tools in emerging technologies to fulfill professional responsibilities and uphold ethical values.**
3. **To inculcate a culture of interdisciplinary research, innovation and entrepreneurship to provide sustainable solutions to meet the growing challenges and societal needs.**
4. **To foster collaborative learning and to play adaptive leadership role in professional career and pursuit of higher education through effective mentoring and counseling.**

Core Values

- **Industry & Academic Connectivity**
- **Experiential learning**
- **Interdisciplinary research**
- **Global**

1.2 Vision and Mission of the Department

Vision of the Department

To be recognized as the fountainhead of excellence in technical knowledge and research in computer science and engineering to attract students and scholars across the globe

Mission of the Department

1. **To strengthen core competency of students to be successful, ethical, effective problem solver in Computer Science & Engineering through analytical learning.**
2. **To promote interdisciplinary research & innovation-based activities in emerging areas of technology globally**
3. **To facilitate and foster the industry-academia collaboration to enhance entrepreneurship skills and acquaintance with corporate culture.**
4. **To inculcate in them a higher degree of social consciousness and moral values towards solving interdisciplinary societal problems using industry-academia collaboration**

Core Values

- **Competency**
- **Global**
- **Entrepreneurship Skills**
- **Interdisciplinary research**

1.3 Programme Educational Objectives (PEO)

1.3.1 Writing Programme Educational Objectives (PEO)

Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

The Program Educational Objectives (PEOs) of UG Program in Computer Science & Engineering are:

PEO-1 The graduates will establish themselves as professionals by solving real-life problems using exploratory and analytical skills acquired in the field of Computer Science and Engineering.

PEO-2 The graduates will provide sustainable solutions to ever changing interdisciplinary global problems through their Research & Innovation capabilities.

PEO-3 The graduates will become employable, successful entrepreneur as an outcome of Industry-Academia collaboration.

PEO-4 The graduates will embrace professional code of ethics while providing solution to multidisciplinary social problems in industrial, entrepreneurial and research environment to demonstrate leadership qualities

Methods of Forming PEO's

STEP 1 : The needs of the Nation and society are identified through scientific publications, industry interaction and media.

STEP 2. Taking the above into consideration, the PEOs are established by the Coordination Committee of the department.

STEP 3. The PEOs are communicated to the alumni and their suggestions are obtained.

STEP 4. The PEOs are communicated to all the faculty members of the department and their feedback is obtained.

STEP 5. The PEOs are then put to the Board of Studies of the department for final approval.

[Note: Prepare a file for the same, how you arrive for PEO's]

1.3.2 Map PEOs with Mission Statements:

DEPARTMENT PEOs / DEPT OF CSE MISSION STATEMENTS	1. The graduates will establish themselves as professionals by solving real-life problems using exploratory and analytical skills acquired in the field of Computer Science and Engineering.	2. The graduates will be able to provide sustainable solutions to ever changing interdisciplinary global problems through their Research & Innovation capabilities.	3. The graduates will become employable, successful entrepreneur and innovator as an outcome of Industry-Academia collaboration.	4. The graduates will be able to embrace professional code of ethics while providing solution to multidisciplinary social problems in industrial, entrepreneurial and research environment to demonstrate leadership qualities.	
1. To strengthen core competency of students to be successful, ethical, effective problem solver in Computer Science & Engineering through analytical learning.	3	3	2	2	10/12
2. To promote interdisciplinary research & innovation based activities in emerging areas of technology globally.	2	3	2	2	9/12
3. To facilitate and foster the industry-academia collaboration to enhance entrepreneurship skills and acquaintance with corporate culture.	2	2	3	3	10/12
4: To inculcate in them a higher degree of social consciousness and moral values towards solving interdisciplinary societal problems using industry-academia collaboration	2	2	2	3	9/12
	9/12	10/12	9/12	10/12	83%

Enter correlation levels 1, 2, or 3 as defined below:

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

If there is no correlation, put “-“

1.3.3 Program Outcomes (PO's)

PO1:	**Engineering knowledge:**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2:	**Problem analysis:**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3:	**Design/development of solutions:**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4:	**Conduct investigations of complex problems:**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5:	**Modern tool usage:**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6:	**The engineer and society:**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7:	**Environment and sustainability:**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8:	**Ethics:**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9:	**Individual and team work:**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10:	**Communication:**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11:	**Project management and finance:**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12:	**Life-long learning:**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1:		Experiment and prepare programming concepts and provide new ideas and innovations towards research and societal issues.
PSO2:		Analyse and develop computer programs in the areas related to algorithms, system software, cloud computing, artificial intelligence & machine learning, bioinformatics, big data analytics, block chain, cyber security and networking for efficient design of computer-based systems of varying complexity.
PSO3:		Apply standard Software Engineering practices and strategies in software project development using open-source programming environment to deliver a quality product for business success.

1.3.4 Mapping of Program Outcome Vs Program Educational Objectives

Mapping	PEO1	PEO2	PEO3	PEO4
PO1	3	3	2	1
PO2	3	3	3	1
PO3	2	2	3	3
PO4	2	2	3	2
PO5	2	3	2	2
PO6	1	2	2	3
PO7	1	1	2	3
PO8	1	1	2	3
PO9	1	2	3	1
PO10	1	1	3	2
PO11	3	2	3	1
PO12	2	3	1	1
PSO1	2	3	1	3
PSO2	3	3	2	2
PSO3	3	3	2	2

1. Slight (Low) ***2. Moderate (Medium)*** ***3. Substantial (High)***

1.3.5 Program Outcome Vs Courses Mapping Table[1]:

Course Code	Course Name	Outcome State	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO1	PSO2	PSO3
CSE113	Programming for Problem Solving	CO-1	1	2	2	_	_	-	_	_	2	_	_	_	1	2	_
		CO-2	2	_	3	2	2	-	_	_	1	_	1	_	2	2	_
		CO-3	3	_	2	1	_	_	_	_	3	_	_	_	_	2	_
		CO-4	1	_	2	1	_	_	_	_	1	_	_	_	_	3	_
		CO-5	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_
		CO-6	3	3	3	2	-	-	_	_	2	_	2	_	2	3	1
MTH142	Calculus and Abstract Algebra	CO-1	3	3	2	2	3	1	-	-	-	1	1	1			
		CO-2	3	3	3	2	2	2	-	-	-	1	1	2			
		CO-3	3	3	2	2	2	1	-	-	-	1	1	1			
		CO-4	3	3	2	2	2	1	-	-	-	1	1	1			
		CO-5	3	3	2	2	2	1	-	-	-	1	1	2			
		CO-6	3	3	2	3	2	2	-	-	-	1	1	2			
PHY117	Semiconductor Physics	CO-1	3	2	1	1	1	1	1	1	2	1	1	1			
		CO-2	3	3	2	3	3	2	1	1	1	1	1	1			
		CO-3	3	3	2	3	3	2	1	1	1	1	1	1			
		CO-4	3	3	3	2	3	2	1	1	1	1	1	1			
		CO-5	3	3	3	2	3	2	1	1	1	1	1	1			
		CO-6	3	3	3	3	3	2	1	1	1	1	1	1			
EEE112	Principles of Electrical and Electronics	CO-1	3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
		CO-2	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-
		CO-3	2	2	1	-	-	-	-	-	--	-	-	-	-	-	-

[1] Cel value will contain the correlation value of respective course with PO.

	Engineering	CO-4	2	1	2	-	-	-	-	-	-	-	1	-	-	-	-
		CO-5	3	2	1	-	-	-	-	-	-	-	1	-	-	-	-
		CO-6	2	2	3	1	-	-	-	-	-	-	1	-	-	-	-
EVS112	Environmental Studies	CO-1	1	1	1	1	1	1	2	1	-	1	1	1	-	1	-
		CO-2	1	2	2	1	-	1	2	-	-	1	1	-	-	1	-
		CO-3	1	2	2	1	-	2	2	-	-	1	2	-	-	2	2
		CO-4	1	2	2	1	-	2	2	-	-	1	2	-	-	2	2
		CO-5	1	2	2	1	1	2	1	2	-	1	2	-	-	2	1
		CO-6	1	2	2	2	1	2	2	1	-	1	2	1	-	2	1
ARP101	Communicative English-1	CO-1	-	-	-	-	-	-	-	-	-	3	-	-			
		CO-2	-	-	-	-	-	-	-	1	1	2	-	-			
		CO-3	-	-	-	1	-	-	-	1	2	-	-	-			
		CO-4	-	1	1	-	-	-	-	-	-	1	2	-			
		CO-5															
		CO-6															
CSP113	Programming for Problem Solving Lab	CO-1	2	-	3	2	2	-	-	-	2	-	-	-	3	2	2
		CO-2	3	-	3	2	2	-	-	-	3	-	-	-	3	3	1
		CO-3	2	-	3	1	2	-	-	-	2	-	-	-	2	3	2
		CO-4	1	-	2	1	1	-	-	-	2	-	-	-	2	2	-
		CO-5	2	-	3	2	2	-	-	-	3	-	-	-	3	2	2
		CO-6	3	-	3	3	1	-	-	-	2	-	-	-	2	3	2
CSP101	Introduction to Computer Science and Engineering	CO-1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	3
		CO-2	3	2	-	-	-	-	-	-	-	-	-	3	-	3	2
		CO-3	3	2	-	-	-	-	-	-	-	-	-	3	-	2	3
		CO-4	3	-	-	-	-	-	-	-	-	-	-	3	-	3	2
		CO-5	3	-	-	-	-	2	-	2	-	-	-	3	-	3	3
		CO-6															

MEP106	Computer Aided Design & Drafting	CO-1	2	2	2	-	3	-	-	-	-	-	-	3	3	3	
		CO-2	2	2	2	-	3	-	-	-	-	-	-	3	3	3	
		CO-3	2	2	2	-	3	-	-	-	-	-	-	3	3	3	
		CO-4	2	2	2	2	3	-	-	-	2	2	-	3	3	3	
		CO-5	2	2	2	2	3	-	-	-	2	2	-	3	3	3	
		CO-6	2	2	2	2	3	-	-	-	2	2	-	3	3	3	
EEP112	Principles of Electrical and Electronics Engineering	CO-1															
		CO-2															
		CO-3															
		CO-4															
		CO-5															
		CO-6															
PHY161	Physics Lab – I	CO-1	2	2	2	1	1	1	2	3	3	3	2	3			
		CO-2	2	2	2	1	1	1	2	3	3	3	2	3			
		CO-3	2	2	2	1	1	1	2	3	3	3	2	3			
		CO-4	2	2	2	1	1	1	2	3	3	3	2	3			
		CO-5	2	2	2	1	1	1	2	3	3	3	2	3			
		CO-6	2	2	2	1	1	1	2	3	3	3	2	3			
Semester II																	
CSE114	Application based Programming in Python	CO-1	2	1	1	-	-	-	-	2	-	-	-	2	-	1	-
		CO-2	2	2	2	1	-	-	-	2	-	-	-	2	-	2	1
		CO-3	2	2	1	-	-	-	-	2	-	-	-	2	1	2	1
		CO-4	2	2	2	2	1	2	-	2	-	-	-	2	1	2	2
		CO-5	2	2	2	2	3	2	-	2	-	-	-	2	2	2	1
		CO-6	3	3	2	2	2	2	-	2	-	-	-	2	2	3	2
MTH145	Probability and Statistics	CO-1	3	3	2	2	3	1	-	-	-	1	1	1			
		CO-2	3	2	3	2	2	2	-	-	-	1	1	2			

		CO-3	3	3	2	2	2	1	-	-	-	1	1	1			
		CO-4	3	2	2	2	2	1	-	-	-	1	1	1			
		CO-5	3	3	2	2	2	1	-	-	-	1	1	2			
		CO-6	3	3	2	3	2	2	-	-	-	1	1	2			
CHY111	Engineering Chemistry	CO-1	3	1	1	2	1	1	1	1	1	1	1	1	1	1	
		CO-2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	
		CO-3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	
		CO-4	3	1	1	1	1	1	1	1	1	1	1	1	1	1	
		CO-5	3	1	2	1	2	1	1	1	1	1	1	1	1	1	
		CO-6	3	1	2	1	2	1	1	1	1	1	1	1	1	1	
HMM111	Human Value & Ethics	CO-1	1	1	1	1	2	1	2			2	3	1	1	3	
		CO-2	1	3	2	2	1	3	1	1	2		3	3	2	2	1
		CO-3		2	2	2		2	2		1		1		1	3	2
		CO-4	1		1	2	3				2	3		2			1
		CO-5		3		1	2	3	2	1		2	2	1	3	1	
		CO-6	2		1			1			1	1				2	3
PHY116	Engineering Physics	CO-1	3	3	3	3	3	3	3	2	3	3	1	3			
		CO-2	3	3	3	3	3	3	2	2	3	2	2	2			
		CO-3	3	2	2	2	2	2	1	-	2	2	1	1			
		CO-4	3	2	2	3	2	2	1	-	2	2	1	1			
		CO-5	3	3	3	2	1	2	2	-	2	3	2	3			
		CO-6	3	3	3	2	3	3	3	1	2	2	1	3			
ARP102	Communicative English -2	CO-1	-	-	-	-	1	1	1	1	1	-	-	-			
		CO-2	-	-	1	-	-	-	-	-	-	-	1	-			
		CO-3	-	-	-	-	-	-	-	-	-	1	-	-			
		CO-4	-	-	-	-	-	-	-	-	-	1	-	-			
		CO-5															

		CO-6															
CSP103	Multimedia Application Lab	CO-1	3	3	2	2	3	2	-	-	-	3	-	-	2	2	-
		CO-2	3	3	3	3	3	3	3	-	2	3	-	-	2	2	-
		CO-3	2	2	3	3	-	3	3	3	-	3	-	-	1	2	-
		CO-4	2	2	3	3	-	-	-	3	3	3	-	-	2	3	-
		CO-5	2	2	3	-	-	-	-	3	3	3	-	-	1	1	-
		CO-6	2	3	2	3	3	3	3	-	-	-	-	-	2	1	-
CSP114	Application based Programming in Python	CO-1	1	1	1	1	-	-	-	2	-	-	-	2	-	1	-
		CO-2	2	2	1	1	2	-	-	2	-	-	-	2	-	1	1
		CO-3	2	2	1	1	1	1	-	2	-	-	-	2	1	2	1
		CO-4	2	2	2	2	1	1	-	2	-	-	-	2	2	2	1
		CO-5	2	2	2	2	2	2	-	2	-	-	-	2	2	2	2
		CO-6	3	3	2	2	2	3	-	2	-	-	-	2	2	2	2
MEP105	Mechanical Workshop	CO-1	1	-	-	-	-	2	-	-	-	-	-	2	-	-	-
		CO-2	1	-	-	-	1	2	-	-	-	-	-	1	1	-	1
		CO-3	2	-	1	-	1	2	-	-	-	-	-	2	1	-	1
		CO-4	2	-	1	-	2	2	-	-	-	-	-	2	1	-	1
		CO-5	2	-	1	-	2	2	-	-	-	-	-	2	2	-	1
		CO-6	2	-	1	-	2	2	-	-	-	-	-	2	2	-	1
CHY161	Engineering Chemistry	CO-1	2	-	1	-	2	2	-	-	-	-	-	2	2	-	1
		CO-2	2	3	1	-	2	1	2	-	3	3	2	2	-	-	
		CO-3	2	3	1	-	2	1	2	-	3	3	2	2	-	-	
		CO-4	2	3	1	-	2	1	2	-	3	3	2	2	-	-	
		CO-5	2	2	2	-	2	1	1	-	3	3	1	2	-	-	
		CO-6	2	2	2	-	2	1	1	-	3	3	1	2	-	-	
PHY162	Physics Lab-II	CO-1	2	2	2	1	1	1	2	3	3	3	2	3	2		
		CO-2	2	2	2	1	1	1	2	3	3	3	2	3	2		

		CO-3	2	2	2	1	1	1	2	3	3	3	2	3	2		
		CO-4	2	2	2	1	1	1	2	3	3	3	2	3	2		
		CO-5	2	2	2	1	1	1	2	3	3	3	2	3	2		
		CO-6	2	2	2	1	1	1	2	3	3	3	2	3	2		
Semester III																	
BTY223	Introduction to Biology for Engineers	CO-1	3	1	-	-	-	1	3	-	-	-	-	3	-	-	-
		CO-2	3	2	-	-	-	2	-	-	-	-	-	3	-	-	-
		CO-3	3	3	3	1	1	3	3	2	1	3	-	3	1	1	-
		CO-4	3	2	-	-	-	2	2	3	1	2	-	3	1	-	-
		CO-5	3	1	1	1	3	1	3	2	1	2	1	3	1	1	-
		CO-6	3	3	1	1	2	3	5	1	1	1	-	3	1	-	-
CSE242	Data Structures	CO-1	2	-	2	-	-	-	-	-	2	-	-	-	2	2	-
		CO-2	1	2	3	-	-	-	-	-	1	-	-	-	3	1	2
		CO-3	2	3	3	2	-	-	-	-	2	-	-	-	2	3	-
		CO-4	-	-	2	-	-	-	-	-	3	-	-	1	2	2	-
		CO-5	3	2	3	2	1	-	-	-	2	-	--	-	3	2	2
		CO-6	2	-	3	3	2	-	-	-	1	-	-	-	2	3	3
CSE243	Object Oriented Programming Using Java	CO-1	-	-	-	-	2	-	-	-	-	-	-	2	-	-	-
		CO-2	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
		CO-3	2	3	3	-	2	-	-	-	3	-	-	2	2	3	-
		CO-4	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
		CO-5	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
		CO-6	3	3	3	-	2	3	2	-	3	-	2	3	3	3	2
CSE244	Principles of Operating System	CO-1	3	3	3	3	--	--	--	2	2	1	2	1	3	2	2
		CO-2	3	2	3	3	--	--	--	2	2	2	1	1	2	3	2
		CO-3	3	3	3	3	--	--	--	1	1	1	3	2	3	2	1
		CO-4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2

		CO-5	2	2	3	-	-	-	-	3	3	1	2	-	3	-	-
		CO-6	3	2	-	-	-	-	-	-	-	2	3	-	2	2	-
CSE245	Discrete Structures	CO-1	2	3	3	1	-	3	-	-	3	-	-	3	3	3	-
		CO-2	2	2	3	-	-	2	-	-	-	-	-	3	3	2	-
		CO-3	3	2	3	3	3	-	-	-	2	-	-	-	-	3	2
		CO-4	2	2	3	3	3	-	-	-	-	-	3	3	3	-	3
		CO-5	2	2	2	3	-	3	-	-	3	-	3	3	-	2	3
		CO-6	1	2	1	2	3	-	-	-	3	-	3	-	3	3	2
CSE247	Computer Organization and Architecture	CO-1	3	1	1	-	-	2	-	-	-	-	-	2	-	1	3
		CO-2	3	3	3	-	-	3	-	-	-	-	-	3	-	2	3
		CO-3	3	2	3	-	-	2	-	-	-	-	-	3	-	2	3
		CO-4	3	2	2	-	-	1	-	-	-	-	-	3	-	3	2
		CO-5	3	3	3	-	-	2	-	-	-	-	-	3	-	2	2
		CO-6	3	3	3	-	-	2	-	-	-	-	-	3	-	1	2
ARP203	Aptitude Reasoning and Business Communication Skills - Basic	CO-1		1	1												
		CO-2						1		1	1						
		CO-3								1	1						
		CO-4									1			1			
		CO-5										1					
		CO-6		1													
CSP242	Data Structures Lab	CO-1	2	2	3	-	-	-	-	-	3	-	-	2	3	2	2
		CO-2	3	2	2	2	2	-	-	-	2	-	-	-	2	3	3
		CO-3	3	1	3	3	-	-	-	-	3	-	-	1	3	2	2
		CO-4	3	2	3	2	-	-	-	-	2	-	-	2	2	3	2
		CO-5	2	2	2	-	-	-	-	-	-	-	-	-	1	2	2
		CO-6	3	3	2	3	-	-	-	-	3	-	-	-	2	3	2
CSP243	Object	CO-1	-	-	-	-	2	-	-	-	-	-	-	2	-	-	-

	Oriented Programming Using Java	CO-2	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
		CO-3	2	3	3	-	2	-	-	-	3	-	-	2	2	3	-
		CO-4	-	-	-	-	2	-	-	-	-	-	-	-	-		-
		CO-5	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
		CO-6	3	3	3	-	2	3	2	-	3	-	2	3	3	3	2
CSP244	Principles of Operating System Lab	CO-1	3	3	3	3	--	--	--	2	2	1	2	1	3	2	2
		CO-2	3	2	3	3	--	--	--	2	2	2	1	1	2	3	2
		CO-3	3	3	3	3	--	--	--	1	1	1	3	2	3	2	1
		CO-4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
		CO-5	2	2	3	-	-	-	-	3	3	1	2	-	3	-	-
		CO-6	3	2	-	-	-	-	-	-	-	2	3	-	2	2	-
CSP251	Project Based Learning (PBL) -1	CO-1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
		CO-2	3	2	-	3	-	-	2	-	3	3	2	3	-	-	1
		CO-3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	-
		CO-4	3	3	-	-	-	2	-	-	3	3	2	3	-	2	-
		CO-5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	-
		CO-6	3	3	-	3	-	-	-	-	3	3	2	3	-	-	1
CSP294	Summer Internship-I	CO-1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		CO-2		3	2	-	2	-	-	-	-	-	-	-	2	2	-
		CO-3	2	2	3	-	-	-	-	-	3	-	-	-	1	-	-
		CO-4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
		CO-5	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-
		CO-6	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-
Semester IV																	
CSE249	Data Base Management System	CO-1	3	-	-	-	-	2	-	-	-	-	-	3	3	3	-
		CO-2	2	-	-	-	3	2	-	-	2	-	-	3	3	3	-
		CO-3	3	3	3	-	3	2	-	-	-	-	-	2	2	3	-

		CO-4	3	3	3	3	-	2	-	2	3	-	-	2	-	-	3
		CO-5	2	3	2	-	2	2	-	2	-	-	-	1	-	3	-
		CO-6	3	3	3	3	3	3	-	3	3	3	2	3	-	-	3
CSE251	Theory of Computation	CO-1	3	3	3	3	2	--	--	--	3	--	--	3	3	2	--
		CO-2	3	--	3	3	2	--	--	--	2	--	--	2	--	3	2
		CO-3	3	3	3	3	--	--	--	--	2	--	--	--	3	2	--
		CO-4	2	2	2	--	2	--	--	--	3	--	--	2	--	--	3
		CO-5	3	3	3	3	3	--	--	--	--	--	--	3	3	2	2
		CO-6	3	2	3	3	3	--	--	--	2	--	--	3	3	3	2
CSE252	Computer Networks	CO-1		2	-	-	-	-	-	-	-	-	2	3	-	3	-
		CO-2	2	-	2	2	3	-	-	-	-	-	2	3		3	-
		CO-3	3	2	-	2	-	2	-	-	-	-	-	-	2	-	2
		CO-4	-	2	2	-	-	-	-	-	-	-	-	-	-	2	2
		CO-5	2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
		CO-6	2	-	-	2	-	-	-	2	-	-	2	-	-	2	-
CSE011	Mathematical Techniques	CO-1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
		CO-2	2	3	1	1	1	-	1	-	-	1	2	1	1	1	-
		CO-3	3	1	1	1	-	-	1	-	-	2	1	1	3	1	-
		CO-4	2	3	2	1	1	-	1	-	-	1	1	1	2	1	-
		CO-5	1	1	1	2	2	-	1	-	-	1	2	1	2	1	-
		CO-6	3	1	3	1	2	-	2	-	-	2	2	3	3	1	-
CSE012	Introduction to Graph Theory and its Applications	CO-1	3	3	2	2	1	2	2	-	-	2	1	2	3	1	-
		CO-2	3	3	3	2	-	1	1	-	-	1	-	2	3	1	-
		CO-3	1	3	1	3	2	2	-	-	-	1	-	2	2	2	-
		CO-4	1	3	1	3	1	1	-	-	-	2	-	1	3	2	-
		CO-5	2	2	2	3	2	1	-	-	-	1	-	2	1	2	-
		CO-6	1	1	2	3	1	2	-	-	-	2	-	2	1	2	2

CSP249	Data Base Management System Lab	CO-1	3	-	-	-	2	-	-	-	-	-	-	-	2	3	2
		CO-2	-	3	3	3	2	-	-	-	3	-	-	-	2	3	3
		CO-3	-	2	2	2	2	-	-	-	3	-	-	-	2	2	3
		CO-4	-	2	2	2	2	-	-	-	3	-	-	-	2	2	3
		CO-5	-	2	2	2	2	-	-	-	3	-	-	-	2	2	3
		CO-6	-	2	3	2	3	-	-	-	3	-	-	2	3	3	3
CSP252	Computer Networks Lab	CO-1	-	2	-	-	-	-	-	-	-	-	2	3	-	3	-
		CO-2	2	-	2	2	3	-	-	-	-	-	2	3		3	-
		CO-3	3	2	-	2	-	2	-	-	-	-	-	-	2	-	2
		CO-4	-	2	2	-	-	-	-	-	-	-	-	-	-	2	2
		CO-5	2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
		CO-6	2	-	-	2	-	-	-	2	-	-	2	-	-	2	-
CSP298	Project Based Learning (PBL) -2	CO-1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
		CO-2	3	2	-	3	-	-	2	-	3	3	2	3	-	-	1
		CO-3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	
		CO-4	3	3	-	-	-	2	-	-	3	3	2	3		2	
		CO-5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
		CO-6	3	3	-	3	-	-	-	-	3	3	2	3	-	-	1
ARP204	Aptitude Reasoning and Business Communication Skills-Intermediate	CO-1								1		1		1			
		CO-2										1					
		CO-3									1	1					
		CO-4										1					
		CO-5										1					
		CO-6		1	1						1						
Semester V																	
CSE350	Design and Analysis of	CO-1	2	3	1	2	-	--	--	-	2	-	-	-	3	2	2
		CO-2	2	2	2	2	-	--	--	-	3	-	-	-	2	3	2

	Algorithm	CO-3	2	1	2	-	-	--	--	-	1	-	-	-	3	2	-
		CO-4	1	2	2	3	-	--	--	-	2	-	-	-	2	2	2
		CO-5	3	3	1	3	-	-	-	-	3	-	-	-	2	1	3
		CO-6	2	2	3	2	2	-	-	--	2	-	-	-	3	2	-
CSE351	Software Engineering and Testing Methodologies	CO-1	3	-	2	-	-	-	-	1	2	3	-	3	1	-	2
		CO-2	3	3	2	3	3	-	-	1	2	3	2	3	2	-	3
		CO-3	3	2	3	3	3	-	-	1	2	3	1	2	2	-	3
		CO-4	3	1	-	1	3	2	2	2	3	3	2	3	1	-	3
		CO-5	3	1	3	3	3	3	3	2	3	3	1	3	1	-	3
		CO-6	2	-	-	1	3	-	-	1	2	2	2	-	-	-	3
CSE021	Introduction to Cloud Computing	CO-1	2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
		CO-2	2	2	2	3	-	-	-	-	-	-	-	-	-	-	-
		CO-3	1	3	1	2	-	-	-	-	-	-	-	-	-	2	3
		CO-4	3	1	2	2	-	-	-	-	-	-	-	-	-	3	2
		CO-5	2	2	3	1	-	-	-	-	-	-	-	-	-	2	2
		CO-6	1	3	1	2	-	-	-	-	-	-	-	-	2	3	3
CSE022	Android Application Development	CO-1	-	-	-	-	3	-	-	-	2	-	-	1	-	-	2
		CO-2	-	-	-	-	3	-	-	-	2	-	-	1	-	-	2
		CO-3	-	-	2	-	3	-	-	-	2	-	-	1	2	-	2
		CO-4	-	-	-	-	3	-	-	-	2	-	2	1	-	-	2
		CO-5	-	-	2	3	3		2	-	2	-	2	1	-	-	2
		CO-6	1	2	3	3	3	3	3	-	3	-	3	1	3	3	3
CSE023	Quantum Computing	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-

		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSE024	Parallel Computing Algorithms	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSE025	3D Printing and Software Tools	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
ECC001	Community Connect	CO-1															
		CO-2															
		CO-3															
		CO-4															
		CO-5															
		CO-6															
ARP301	Quantitative Aptitude Behavioral and Interpersonal Skills	CO-1						1			1			1			
		CO-2						1			1			1			
		CO-3									1	1		1			
		CO-4						1	1		1			1			
		CO-5						1	1		1			1			
		CO-6		1	1												
CSP350	Design and Analysis of	CO-1	3	3	2	3	1	--	--	-	2	-	-	-	2	3	3
		CO-2	2	3	3	2	2	--	--	-	2	-	-	-	3	2	2

	Algorithm Lab	CO-3	3	2	2	-	3	--	--	-	1	-	-	-	2	1	-
		CO-4	2	3	3	3	1	--	--	-	3	-	-	-	3	3	1
		CO-5	3	2	2	3	2	-	-	-	2	-	-	-	2	3	2
		CO-6	2	3	3	1	3	-	-	--	1	-	-	-	3	2	3
CSP395	Technical Skill Enhancement Course-1 Simulation Lab	CO-1	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
		CO-2	1	-	1	-	2	-	-	-	-	2	-	1	1	2	1
		CO-3	1	2	1	-	2	-	-	-	-	-	-	1	1	2	1
		CO-4	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
		CO-5	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
		CO-6	2	2	3	3	2	2	1	-	2	3	2	2	2	3	1
CSP351	Project Based Learning (PBL) -3	CO-1	3	3	-	2	-	1	-	1	2	-	2	1	2	2	3
		CO-2	3	2	2	2	2	-	-	1	2	-	2	1	2	1	1
		CO-3	3	2	2	2	2	3	-	1	2	-	2	1	2	2	-
		CO-4	3	3	2	2	3	-	-	1	2	-	-	1	2	2	2
		CO-5	3	2	-	-	3	-	-	1	2	-	-	1	2	2	-
		CO-6		1	-	1	-	-	-	2	2	3	3	3	1	-	1
CSP398	Summer Internship-II	CO-1	3	3	-	2	-	1	-	1	2	-	2	1	2	2	3
		CO-2	3	2	2	2	2	-	-	1	2	-	2	1	2	1	1
		CO-3	3	2	2	2	2	3	-	1	2	-	2	1	2	2	-
		CO-4	3	3	2	2	3	-	-	1	2	-	-	1	2	2	2
		CO-5	3	2	-	-	3	-	-	1	2	-	-	1	2	2	-
		CO-6	-	1	-	1	-	-	-	2	2	3	3	3	1	-	1
Semester VI																	
HMM305	Management for Engineers	CO-1	2	1	2	2	2	2	-	2	1	3	-	-	1	1	2
		CO-2	1	1	2	2	1	2	1	-	-	2	2	1	1	1	2
		CO-3	3	1	1	2	3	2	-	2	-	-	1	2	1	2	2
		CO-4	-	2	2	1	-	1	-	1	-	2	1	-	1	1	2

		CO-5	-	1	2	2	-	2	3	1	2	-	-	1	2	2	1
		CO-6	1	2	1	1	2	2	2	-	1	-	-	1	2	2	2
CSE352	Web Technologies	CO-1					1									1	
		CO-2					3							1		1	
		CO-3		1	3		2	1			2				1	2	2
		CO-4		1	3		1	1			2				1	2	2
		CO-5					2									1	
		CO-6	2	3	3	1	3	3	1		3		2	2	1	2	3
CSE353	Compiler Design	CO-1	3	--	--	--	3	--	--	--	2	--	--	3	2	1	--
		CO-2	2	2	3	3	2	--	--	--	--	--	--	2	3	2	--
		CO-3	3	3	3	--	--	--	--	--	--	--	--	--	3	2	--
		CO-4	1	2	3	3	3	--	--	--	3	--	--	--	--	3	2
		CO-5	1	1	2	3	2	--	--	--	3	--	--	3	1	2	2
		CO-6	2	--	3	3	2	--	--	--	3	--	--	3	3	2	3
CSE031	Digital Image Processing	CO-1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
		CO-2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
		CO-3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
		CO-4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO-5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO-6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3
CSE032	Cryptography and Network Security	CO-1	3	2	--	--	--	--	--	--	--	--	--	--	3	1	--
		CO-2	2	3	2	1	--	--	--	--	--	--	--	--	2	3	--
		CO-3	2	-	2	-	3	-	-	-	-	-	-	-	2	2	1
		CO-4	2	-	-	2	-	2	2		-	-	-	-	2	2	-
		CO-5	-	-	-	-	2	-	2	2	2	-	-	-	1	-	-
		CO-6	-	-	-	-	-	-	-	-	-	2	2	2	2		2
CSE041	Software	CO-1	3	-	1	-	1	-	-	-	3	2	3	2	-	-	2

	Project Management	CO-2	2	-	2	-	2	-	-	-	3	3	3	3	-	-	2
		CO-3	2	-	3	-	2	-	-	1	3	2	3	3	-	-	3
		CO-4	2	-	2	-	2	-	-	1	3	2	3	3	-	-	3
		CO-5	1	-	3	-	2	3	-	1	3	3	3	3	-	-	3
		CO-6	2	-	3	3	2	2	-	1	3	3	3	2	-	-	2
CSE042	Software Testing	CO-1	2	1	-	-	-	-	-	-	-	3	-	2	-	-	3
		CO-2	3	3	3	2	3	1	-	1	2	3	-	2	2	-	3
		CO-3	3	3	3	2	2	2	-	1	2	3	-	2	2	-	3
		CO-4	3	3	3	2	3	1	-	1	2	3	-	2	2	-	3
		CO-5	3	3	2	2	2	2	-	1	2	3	-	2	2	-	3
		CO-6	3	3	3	2	3	2	3	2	3	3	3	3	2	-	3
ARP302	Higher Order Mathematics and Advanced People Skills	CO-1						1	1		1	1		1			
		CO-2						1	1		1	1		1			
		CO-3						1	1		1	1		1			
		CO-4						1	1		1	1		1			
		CO-5						1	1		1	1		1			
		CO-6		1	1												
CSP352	Web Technologies Lab	CO-1	-	-	-	-	1	-	-	-	2	-	-	-	-	1	-
		CO-2	-	1	1	-	3	-	-	-	2	-	-	1	-	1	2
		CO-3	-	-	1	-	2	1	-	-	2	-	-	-	-	1	2
		CO-4	-	-	-	-	1	1	-	-		-	-	-	-	-	-
		CO-5		1	-	-	2	-	-	-	2	-	-	1	-	1	2
		CO-6	2	3	3	1	3	3	-	-	3	-	2	2	1	2	3
CSP353	Compiler Design Lab	CO-1	3	--	--	--	3	--	--	--	2	--	--	3	2	1	--
		CO-2	2	2	3	3	2	--	--	--	--	--	--	2	3	2	--
		CO-3	3	3	3	--	--	--	--	--	--	--	--	--	3	2	--
		CO-4	1	2	3	3	3	--	--	--	3	--	--	--	--	3	2

		CO-5	1	1	2	3	2	--	--	--	3	--	--	3	1	2	2
		CO-6	2	--	3	3	2	--	--	--	3	--	--	3	3	2	3
CSP396	Technical Skill Enhancement Course-2(Application Development Lab)	CO-1	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
		CO-2	1	-	1	-	2	-	-	-	-	2	-	1	1	2	1
		CO-3	1	2	1	-	2	-	-	-	-	-	-	1	1	2	1
		CO-4	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
		CO-5	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
		CO-6	2	2	3	3	2	2	1	-	2	3	2	2	2	3	1
CSP392	Project Based Learning (PBL) -4	CO-1	3	3	-	2	-	1	-	1	2	-	2	1	2	2	3
		CO-2	3	2	2	2	2	-	-	1	2	-	2	1	2	1	1
		CO-3	3	2	2	2	2	3	-	1	2	-	2	1	2	2	-
		CO-4	3	3	2	2	3	-	-	1	2	-	-	1	2	2	2
		CO-5	3	2	-	-	3	-	-	1	2	-	-	1	2	2	-
		CO-6	-	1	-	1	-	-	-	2	2	3	3	3	1	-	1
Semester VII																	
CSE451	Artificial Intelligence	CO-1	1	2	3	2	2					2		2	3	2	2
		CO-2	2	3	3	2	3					2		2	3	3	2
		CO-3	3	3	3	3	2	1	1			1	2	3	3	2	3
		CO-4	3	3	3	3	2	2	1			2	1	3	3	2	3
		CO-5	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
		CO-6	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
CSE051	Wireless Networks	CO-1	3	-	3	-	-	-	-	1	-	-	-	-	-	-	2
		CO-2	3	2	3	-	-	-	-	1	-	-	-	-	-	-	2
		CO-3	3	2	3	-	-	-	-	1	-	-	-	-	-	-	2
		CO-4	3	2	3	-	-	-	-	1	-	-	-	-	-	-	2
		CO-5	3	2	3	2	2	-	-	1	-	-	-	-	-	-	3

		CO-6	3	2	3	2	2	-	-	1	-	-	-	-	-	-	3
CSE052	Risk Management	CO-1	3	-	-	-	-	-	1	-	-	-	-	1	2	-	-
		CO-2	2	2	-	3	2	-	-	1	2	1	1	1	-	-	2
		CO-3	2	-	-	-	-	-	-	-	2	-	-	1	1	-	-
		CO-4	1	-	2	-	3	-	-	-	2	2	2	-	-	-	1
		CO-5	2	2	-	2	1	-	1	-	2	1	1	-	-	-	1
		CO-6	2	2	2	-	-	-	1	-	2	1	1	1	-	1	-
CSE061	Introduction to Internet of Things	CO-1															
		CO-2															
		CO-3															
		CO-4															
		CO-5															
		CO-6															
CSE062	Mobile Computing	CO-1	3	3	-	2	3	-	-	-	-	2	-	-	3	2	-
		CO-2	3	3	-	2	3	-	-	-	-	2	-	-	3	2	-
		CO-3	3	3	-	2	3	-	-	-	-	2	-	-	2	3	-
		CO-4	3	3	-	2	3	-	-	-	-	2	-	-	3	2	-
		CO-5	3	3	-	2	3	-	-	-	-	2	-	-	2	2	-
		CO-6	3	3	-	2	3	-	-	-	-	2	-	-	2	2	-
CSP451	Artificial Intelligence Lab	CO-1	1	2	3	2	2					2		2	3	2	2
		CO-2	2	3	3	2	3					2		2	3	3	2
		CO-3	3	3	3	3	2	1	1			1	2	3	3	2	3
		CO-4	3	3	3	3	2	2	1			2	1	3	3	2	3
		CO-5	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
		CO-6	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
CSP497	Major Project- 1	CO-1	3	3	3	2	2	2	2	1	2	1	1	2	2	3	3
		CO-2	3	3	3	3	2	1	1	1	2	1	1	2	3	3	3

		CO-3	3	1	3	3	2	1	1	1	2	1	1	2	3	3	3
		CO-4	1	1	2	1	2	3	3	1	2	3	1	2	1	2	3
		CO-5	1	2	2	1	2	1	1	1	2	2	1	2	1	2	3
		CO-6	2	1	2	1	3	-	-	1	2	3	1	2	3	3	3
CSP499	Summer Internship-III	CO-1	3	3	3	3	3	2	1	1	2	2	1	1	2	2	2
		CO-2	-	2	2	2	2	-	-	3	2	-	-	2	2	2	2
		CO-3	1	2	1	1	2	-	-	-	2	3	2	2	1	1	1
		CO-4	-	-	-	-	--	-	-	-	2	-	3	2	1	1	1
		CO-5	-	-	-	-	-	-	-	-	2	-	3	2	2	1	-
		CO-6	-	-	-	-	-	2	-	-	1	1	-	2	1	3	2
Semester VIII																	
CSP498	Major Project - 2	CO-1	2	1	2	2	3	2	2	2	2	2	2	2	3	3	3
		CO-2	2	2	3	2	3	2	2	2	2	2	2	2	11	3	3
		CO-3	3	3	3	3	3	2	2	2	2	2	2	1	1	3	3
		CO-4	2	2	2	2	3	2	2	2	2	3	2	1	1	2	2
		CO-5	1	2	2	1	3	2	2	2	2	3	2	1	1	2	2
		CO-6	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
B.Tech-Computer Science & Engineering with specialization in Artificial Intelligence & Machine Learning																	
CSA103	Introduction To AI & ML	CO-1	3	3	3	1	2	1	1	1	2	3	1	3	2	3	1
		CO-2	3	3	3	1	2	3	3	1	2	3	1	3	2	3	2
		CO-3	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
		CO-4	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
		CO-5	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
		CO-6	3	3	3	1	2	3	3	3	3	3	3	3	3	3	3
CSA202	Concept of Machine Learning	CO-1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
		CO-2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO-3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3

		CO-4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO-5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO-6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CAL201	Concept of Machine Learning Lab	CO-1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
		CO-2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO-3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO-4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO-5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
		CO-6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CSA203	Concepts of Neural Networks	CO-1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO-2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO-3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO-4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO-5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO-6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CSA301	Soft Computing	CO-1	3	3	1	1	1	1	1	1	2	1	1	3	1	3	1
		CO-2	3	3	3	3	2	3	2	2	2	2	3	3	3	3	3
		CO-3	3	3	3	3	3	3	1	2	2	2	3	3	3	3	3
		CO-4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
		CO-5	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
		CO-6	3	3	3	3	3	1	3	2	3	2	3	3	3	3	3
CSA302	Pattern Recognition	CO-1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO-2	3	3	3	3	2	3	1	1	3	3	1	3	3	3	3
		CO-3	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
		CO-4	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
		CO-5	3	3	3	3	2	3	1	1	2	3	1	3	3	3	3
		CO-6	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3

CAL302	Pattern Recognition Lab	CO-1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO-2	3	3	3	3	2	3	1	1	3	3	1	3	3	3	3
		CO-3	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
		CO-4	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
		CO-5	3	3	3	3	2	3	1	1	2	3	1	3	3	3	3
		CO-6	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CSA303	Deep Learning and Its Applications	CO-1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO-2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO-3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO-4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO-5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO-6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CAL303	Deep Learning and Its Applications Lab	CO-1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO-2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO-3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO-4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO-5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO-6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CSA402	Applications of AIML in healthcare/ ICT/ Computer Networks	CO-1	3	3	3	3	3	1	2	3	1	3	1	3	3	3	1
		CO-2	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
		CO-3	3	3	3	3	3	2	2	3	2	3	3	3	3	3	3
		CO-4	3	3	3	3	3	2	2	3	2	3	3	3	3	3	3
		CO-5	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
		CO-6	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
CSA042	Cyber Physical Embedded	CO-1	3	2	1	1	1	2	1	1	2	1	1	2	2	1	1
		CO-2	3	3	3	1	3	1	1	1	2	1	1	2	2	1	3
		CO-3	3	3	3	3	3	2	1	1	3	1	1	2	2	1	3

	Systems	CO-4	3	2	1	1	3	1	1	1	3	1	1	2	2	1	3
		CO-5	3	3	3	3	3	2	1	1	3	1	1	2	2	1	3
		CO-6	3	2	1	1	1	2	1	1	2	1	1	2	2	1	1
CSA401	Computer Vision	CO-1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
		CO-2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
		CO-3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
		CO-4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO-5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO-6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3
CAL401	Computer Vision Lab	CO-1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
		CO-2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
		CO-3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
		CO-4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO-5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO-6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3
CSA021	Human Computer Interaction	CO-1	3	3	2	2	1	1	1	1	1	2	1	3	2	2	1
		CO-2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
		CO-3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
		CO-4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO-5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
		CO-6	3	3	3	3	2	1	1	1	1	2	1	3	3	3	3
CSA022	Introduction to Cloud Computing with Machine learning	CO-1	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
		CO-2	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
		CO-3	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
		CO-4	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
		CO-5	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
		CO-6	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3

CSA041	Introduction to Natural Language Processing	CO-1	3	3	3	3	3	1	1	1	1	3	1	3	2	3	1
		CO-2	3	3	3	3	3	1	1	1	1	3	1	3	3	3	2
		CO-3	3	3	3	3	3	2	1	1	1	3	1	3	3	3	1
		CO-4	3	3	3	3	3	1	2	1	1	3	1	3	3	3	3
		CO-5	3	3	3	3	3	2	2	1	2	3	1	3	3	3	3
		CO-6	3	3	3	3	3	3	3	1	3	3	2	3	3	3	3
CSA051	Recommender Systems	CO-1	3	3	2	3	2	1	1	1	2	1	-	3	3	2	2
		CO-2	3	3	3	3	3	2	2	1	2	2	-	3	3	3	2
		CO-3	3	3	3	3	3	3	3	1	3	2	-	3	3	2	2
		CO-4	3	3	3	3	3	2	2	1	3	2	-	3	3	3	2
		CO-5	3	3	3	3	3	3	3	1	3	2	-	3	3	3	2
		CO-6	3	3	3	3	3	3	3	1	3	3	-	3	3	3	3
CSA061	Robotics and Intelligent Systems	CO-1	3	3	3	3	3	1	1	1	1	2	3	2	3	3	1
		CO-2	3	3	3	3	3	1	2	1	2	2	3	2	3	3	2
		CO-3	3	3	3	3	3	2	1	1	2	2	3	3	3	3	3
		CO-4	3	3	3	3	3	1	1	1	2	2	3	2	3	3	3
		CO-5	3	3	3	3	3	1	1	1	2	2	3	2	3	3	3
		CO-6	3	3	3	3	3	2	2	2	3	3	2	2	3	3	3
B.Tech-Computer Science & Engineering with specialization in Internet of Things & Applications																	
CSI104	Introduction to IoT	CO-1	3	1	1	-	-	2	1	-	-	-	-	3	3	-	-
		CO-2	2	2	1	-	-	1	3	-	-	-	-	3	3	-	-
		CO-3	3	1	1	2	-	2	1	-	-	-	-	3	3	-	-
		CO-4	3	2	3	2	-	1	2	-	-	-	-	3	3	-	-
		CO-5	3	3	3	3	3	2	3	-	-	-	-	3	3	-	-
		CO-6	2	2	2	2	3	2	3	-	-	-	-	3	3	-	-
CSI201	Embedded System	CO-1	3	-	-	-	-	1	1	-	-	-	-	3	-	1	-
		CO-2	3	2	-	-	3	-	-	-	2	2	1	3	2	2	-

		CO-3	3	3	-	2	2	-	2	-	2	2	-	3	2	-	-
		CO-4	3	3	3	3	3	2	3	2	3	3	3	3	3	2	3
		CO-5	3	-	2	2	-	-	-	-	2	2	-	3	-	-	-
		CO-6	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3
CIP201	Embedded System Lab	CO-1	3	-	-	1	1	1	1	-	3	1	-	3	1	1	1
		CO-2	3	2	2	2	3	-	2	2	2	2	1	3	2	2	2
		CO-3	3	3	2	2	2	-	2	2	2	2	3	3	2	-	3
		CO-4	3	3	3	3	3	1	3	2	3	3	3	3	3	2	3
		CO-5	3	-	2	2	-	-	1	1	2	2	3	3	2	-	-
		CO-6	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3
CSI202	IoT Architecture and Programming	CO-1	2	-	-	-	-	-	-	-	1	-	-	2	-	2	-
		CO-2	2	-	-	-	-	-	-	-	2	-	-	2	2	2	-
		CO-3	2	3	2	3	3	-	2	1	2	3	-	2	3	2	-
		CO-4	2	-	-	2	2	-	2	-	2	2	-	2	-	2	-
		CO-5	2	2	-	-	3	-	-	-	2	3	-	2	-	2	2
		CO-6	3	3	3	3	3	2	3	3	3	3	2	2	3	3	3
CIP202	IoT Architecture and Programming Lab	CO-1	2	2	1	2	2	2	2	-	2	1	3	3	2	2	-
		CO-2	2	2	2	1	2	-	-	-	2	-	2	3	2	2	-
		CO-3	2	2	2	1	2	-	-	-	2	-	3	3	2	2	-
		CO-4	2	2	2	1	2	-	-	2	2	-	3	3	2	2	-
		CO-5	2	2	2	2	2	-	-	2	2	-	3	3	3	3	-
		CO-6	2	2	2	2	2	3	2	2	3	1	3	3	3	3	2
CSI301	Programming with SENSEnuts IoT Platform	CO-1	2	-	-	1	2	2	-	-	1	1	1	2	2	1	1
		CO-2	2	2	2	1	2	2	2	-	1	1	1	2	2	1	1
		CO-3	2	2	2	2	3	2	2	-	2	2	2	2	3	2	1
		CO-4	2	3	2	2	3	2	2	-	2	2	2	2	3	2	1
		CO-5	2	3	3	3	3	2	2	2	2	2	2	2	3	3	1

		CO-6	3	3	3	3	3	2	2	3	3	3	3	3	3	3	2
CIP301	Programming with SENSEnuts IoT Platform Lab	CO-1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO-2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
		CO-3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO-4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO-5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO-6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI302	IoT: Sensing & Actuator Devices	CO-1	2	1	1	1	1	1	1	1	-	1	-	2	1	-	-
		CO-2	2	2	1	1	1	2	2	1	2	2	2	2	2	1	1
		CO-3	2	2	1	1	1	2	3	1	2	2	2	2	2	1	1
		CO-4	2	2	1	1	1	2	1	1	2	2	2	2	2	1	1
		CO-5	2	2	1	1	1	2	1	1	2	2	2	2	2	1	1
		CO-6	3	3	3	3	2	3	2	1	3	3	3	3	3	3	2
CIP302	IoT: Sensing & Actuator Devices Lab	CO-1	3	2	2	2	3	1	1	-	3	3	3	2	1	-	-
		CO-2	3	3	2	2	3	2	2	-	3	3	3	2	2	2	-
		CO-3	3	3	2	2	3	2	3	-	3	3	3	2	2	2	-
		CO-4	3	3	2	2	3	2	1	-	3	3	3	2	2	2	-
		CO-5	3	3	2	2	3	2	1	2	3	3	3	2	2	2	-
		CO-6	3	3	3	3	3	3	2	2	3	3	3	3	3	3	2
CSI303	Wireless Technologies for IoT	CO-1	3	-	2	-	-	-	-	-	1	2	-	1	-	-	-
		CO-2	3	2	-	-	-	-	-	1	1	2	-	1	-	-	-
		CO-3	3	2	-	2	-	-	-	2	2	2	2	2	-	-	-
		CO-4	3	2	2	-	-	-	-	2	2	2	2	2	-	-	-
		CO-5	3	2	-	2	3	-	3	2	3	2	3	3	2	-	-
		CO-6	3	3	3	3	3	-	3	3	3	3	3	3	2	3	3
CIP303	Wireless Technologies	CO-1	3	3	-	-	2	-	-	-	2	-	-	3	-	-	-
		CO-2	3	3	2	-	3	3	-	-	2	-	-	3	3	2	-

	for IoT Lab	CO-3	3	3	3	2	3	3	-	-	3	-	2	3	3	2	-
		CO-4	3	3	3	2	3	3	-	-	3	-	2	3	3	2	-
		CO-5	3	3	3	2	3	3	-	-	3	-	3	3	3	3	-
		CO-6	3	3	3	3	3	3	-	-	3	-	3	3	3	3	-
CSI401	IoT Security	CO-1	3	1	2	1	-	-	-	2	-	-	-	2	-	-	-
		CO-2	3	1	1	1	-	-	-	2	-	-	-	2	-	-	-
		CO-3	3	2	2	2	2	-	-	2	-	-	-	2	-	-	-
		CO-4	3	3	3	3	2	2	-	3	3	3	3	3	2	2	3
		CO-5	3	3	3	3	2	2	-	1	2	-	2	3	2	-	-
		CO-6	3	3	3	3	3	3	-	2	3	3	3	3	2	3	3
CSI011	Android with IoT	CO-1	2	-	-	-	2	-	-	-	-	1	2	2	-	-	-
		CO-2	2	-	-	-	2	-	-	-	-	-	2	2	-	-	1
		CO-3	2	2	-	2	2	2	3	-	2	2	2	3	-	-	-
		CO-4	2	2	-	2	2	-	-	-	2	2	2	3	1	1	3
		CO-5	2	2	2	3	2	3	2	2	3	3	2	3	3	3	3
		CO-6	2	3	3	3	2	3	2	2	3	3	2	3	3	3	3
CIP011	Android with IoT Lab	CO-1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO-2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
		CO-3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO-4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO-5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO-6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI021	Sensor-Cloud for Internet of Things	CO-1	2	2	-	2	-	1	-	-	1	-	-	2	-	1	-
		CO-2	2	2	-	2	-	1	-	-	1	-	-	2	-	1	-
		CO-3	2	1	1	2	-	1	-	-	1	1	-	2	-	2	-
		CO-4	2	2	1	2	-	1	2	-	2	1	-	3	-	2	-
		CO-5	2	2	2	2	-	1	2	-	2	1	2	3	2	2	-

		CO-6	3	3	3	2	3	2	2	2	2	2	2	3	3	3	2
CIP021	Sensor-Cloud for Internet of Things Lab	CO-1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO-2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
		CO-3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO-4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO-5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO-6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI022	Wireless Sensor Networks	CO-1	2	2	-	2	-	2	-	-	1	-	-	2	-	1	-
		CO-2	2	2	-	2	-	2	-	-	1	-	-	2	-	1	-
		CO-3	2	1	1	2	-	2	-	-	2	2	-	2	-	2	-
		CO-4	2	2	1	2	-	2	2	-	2	2	-	3	-	2	-
		CO-5	2	2	3	2	-	2	2	-	3	2	2	3	2	3	-
		CO-6	3	3	3	2	3	2	2	2	3	2	2	3	3	3	2
CIP022	Wireless Sensor Networks Lab	CO-1	2	1	-	-	2	-	-	-	-	-	-	2	-	-	-
		CO-2	3	2	1	1	3	-	2	-	1	1	1	2	1	2	2
		CO-3	3	1	2	2	3	1	3	-	2	2	2	2	3	2	2
		CO-4	3	2	2	2	2	1	3	-	2	2	2	2	1	2	2
		CO-5	3	2	2	2	3	2	3	-	3	3	3	3	2	3	3
		CO-6	3	2	3	2	3	2	3	2	3	3	3	3	3	3	3
CSI023	Micro-controller programming using Arduino	CO-1	2	-	-	1	2	2	-	-	1	1	1	2	2	1	1
		CO-2	2	2	2	1	2	2	2	-	1	1	1	2	2	1	1
		CO-3	2	2	2	2	3	2	2	-	2	2	2	2	3	2	1
		CO-4	2	3	2	2	3	2	2	-	2	2	2	2	3	2	1
		CO-5	2	3	3	3	3	2	2	2	2	2	2	2	3	3	1
		CO-6	3	3	3	3	3	2	2	3	3	3	3	3	3	3	2
CIP023	Micro-controller	CO-1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO-2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2

	programming using Arduino Lab	CO-3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO-4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO-5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO-6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI024	Raspberry Pi and its Programming	CO-1	2	1	1	-	3	1	1	-	1	1	2	2	1	1	-
		CO-2	2	2	2	-	3	2	2	2	1	1	1	2	3	2	2
		CO-3	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO-4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO-5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO-6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CIP024	Raspberry Pi and its Programming Lab	CO-1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO-2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
		CO-3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO-4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO-5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO-6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI031	Artificial Intelligence for IoT	CO-1	3	-	-	-	-	-	-	2	-	-	-	2	-	-	-
		CO-2	3	2	2	2	3	2	-	-	2	2	2	2	2	2	2
		CO-3	3	2	2	2	3	2	3	2	2	2	2	2	2	2	-
		CO-4	3	3	3	3	3	-	-	-	2	2	-	2	2	2	2
		CO-5	3	3	3	3	3	3	3	2	2	2	3	3	2	3	2
		CO-6	3	3	3	3	3	3	-	2	3	3	3	3	2	3	3
CIP031	Artificial Intelligence for IoT Lab	CO-1	2	2	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO-2	3	3	2	2	3	2	2	2	1	1	1	3	3	2	3
		CO-3	3	2	2	2	3	2	2	2	3	3	3	3	3	2	3
		CO-4	3	3	2	2	3	2	2	2	3	3	3	3	3	2	3
		CO-5	3	3	2	3	3	2	2	2	3	3	3	3	3	2	3

		CO-6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CSI032	Data Analytics for IoT	CO-1	2	3	-	2	-	-	-	-	-	-	-	2	-	1	-
		CO-2	3	-	-	2	2	-	-	-	-	-	2	2	2	1	-
		CO-3	3	2	3	2	2	-	-	-	-	2	2	2	2	1	-
		CO-4	2	-	-	2	-	-	-	-	-	2	2	2	-	1	-
		CO-5	3	3	3	2	2	3	2	-	2	2	2	2	2	2	-
		CO-6	3	3	3	2	3	3	2	2	2	2	2	2	3	2	-
CSI033	Image Processing with IoT	CO-1	3	-	-	-	2	-	-	2	-	-	-	2	-	2	-
		CO-2	3	2	2	2	3	2	-	-	2	2	2	2	2	2	2
		CO-3	3	2	2	2	3	2	-	2	2	2	-	2	2	2	-
		CO-4	3	3	3	3	3	-	-	-	2	2	-	2	2	2	2
		CO-5	3	3	3	3	3	3	-	2	2	2	-	3	2	3	2
		CO-6	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3
CIP033	Image Processing with IoT Lab	CO-1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
		CO-2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
		CO-3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
		CO-4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
		CO-5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
		CO-6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CSI041	Fog Computing and IoT	CO-1	2	2	-	-	-	-	-	-	-	-	-	2	-	-	-
		CO-2	3	2	2	2	-	-	1	-	-	-	-	2	-	-	-
		CO-3	3	2	2	2	2	-	2	-	2	2	2	3	2	2	-
		CO-4	3	2	2	2	-	-	2	-	2	2	2	3	2	2	-
		CO-5	3	3	3	2	3	2	2	3	3	3	3	3	2	2	2
		CO-6	3	3	3	2	3	3	2	3	3	3	3	3	2	2	3
CSI042	Industrial IoT 4.0	CO-1	1	-	-	-	-	1	2	2	-	-	-	2	-	-	-
		CO-2	2	2	-	1	-	1	2	2	1	-	-	2	-	-	-

		CO-3	2	1	-	1	2	1	2	2	2	1	2	2	1	2	-
		CO-4	2	2	1	2	2	1	2	2	2	1	2	2	1	2	-
		CO-5	2	2	-	2	2	1	2	2	2	2	2	2	2	3	2
		CO-6	2	2	2	2	3	1	2	2	3	2	3	3	2	3	2
CSI051	IoT in Healthcare	CO-1	3	2	2	-	2	3	3	2	2	2	2	3	2	2	-
		CO-2	3	3	3	2	2	3	3	2	2	3	2	3	2	2	-
		CO-3	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-
		CO-4	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-
		CO-5	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-
		CO-6	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
CSI052	Drones in IoT	CO-1	3	2	2	-	3	2	2	2	2	2	-	3	2	2	-
		CO-2	3	3	3	2	3	3	3	2	2	3	-	3	2	2	-
		CO-3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO-4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO-5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	-
		CO-6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CSI061	Industrial IoT: Smart Manufacturin g	CO-1	2	2	2	2	-	2	2	-	-	1	-	2	-	-	-
		CO-2	2	2	2	3	-	2	2	-	-	-	2	2	-	-	-
		CO-3	3	2	2	3	3	2	2	2	-	-	-	2	-	-	2
		CO-4	3	2	2	3	-	2	2	-	-	2	2	2	-	-	2
		CO-5	3	2	3	3	-	2	2	-	2	2	-	2	-	-	-
		CO-6	3	3	3	3	3	2	2	3	2	2	2	3	3	2	2
CSI062	IoT Applications	CO-1	3	3	2	3	3	3	3	2	3	3	3	3	3	2	2
		CO-2	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2
		CO-3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO-4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO-5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2

		CO-6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
CIP062	IoT Applications Lab	CO-1	3	3	2	3	3	3	3	2	3	3	3	3	3	2	2
		CO-2	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2
		CO-3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO-4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO-5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
		CO-6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
B.Tech-Computer Science & Engineering with specialization in Data Science & Analytics																	
CSD102	Introduction to Data Science	CO-1	3	2	3	2	2	----	1	---	1	1	---	----	3	1	1
		CO-2	3	1	1	2	2	--	---	3	2	1	1	1	1	1	---
		CO-3	2	1	3	2	2	----	1	---	1	1	---	----	3	2	2
		CO-4	3	2	2	1	1	--	--	1	3	3	3	2	2	1	3
		CO-5	3	2	1	-	2	-	-	-	2	-	3	3	-	-	3
		CO-6	3	2	2	-	2	-	-	-	2	-	3	2	-	-	3
CSD201	Data Collection and Preprocessing	CO-1	3	2	-	2	-	2	-	1	-	2	1	3	-	-	-
		CO-2	3	2	2	3	2	-	-	-	-	2	-	2	1	-	-
		CO-3	2	3	3	2	3	-	-	-	-	-	-	2	-	-	2
		CO-4	-	-	3	3	2	-	-	-		-	-	-	-	3	2
		CO-5	2	3	-	-	-	-	-	2	-	-	-	-	1	3	2
		CO-6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2
CDP201	Data Collection and Preprocessing Lab	CO-1	3	2	-	2	-	2	-	1	-	2	1	3	-	-	-
		CO-2	3	2	2	3	2	-	-	-	-	2	-	2	1	-	-
		CO-3	2	3	3	2	3	-	-	-	-	-	-	2	-	-	2
		CO-4	-	-	3	3	2	-	-	-		-	-	-	-	3	2
		CO-5	2	3	-	-	-	-	-	2	-	-	-	-	1	3	2
		CO-6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2
CSD202	Data	CO-1	3	2	-	2	-	2	2	1	-	2	1	3	-	-	-

	Warehouse	CO-2	3	2	2	3	2	-	-	-	1	2	-	2	1	-	-
		CO-3	2	3	3	2	3	-	1	-	-	-	-	2	-	-	2
		CO-4	-	-	3	3	2	-	-	-	2	-	-	-	-	3	2
		CO-5	2	3	-	-	-	-	1	2	-	-	-	-	1	3	2
		CO-6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2
CSD301	Data Mining	CO-1	3	2	-	2	-	2	2	1	-	2	1	3	-	-	-
		CO-2	3	2	2	3	2	-	-	-	1	2	-	2	1	-	-
		CO-3	2	3	3	2	3	-	1	-	-	-	-	2	-	-	2
		CO-4	-	-	3	3	2	-	-	-	2	-	-	-	-	3	2
		CO-5	2	3	-	-	-	-	1	2	-	-	-	-	1	3	2
		CO-6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2
CDP301	Data Mining Lab	CO-1	3	2	-	2	-	2	2	1	-	2	1	3	-	-	-
		CO-2	3	2	2	3	2	-	-	-	1	2	-	2	1	-	-
		CO-3	2	3	3	2	3	-	1	-	-	-	-	2	-	-	2
		CO-4	-	-	3	3	2	-	-	-	2	-	-	-	-	3	2
		CO-5	2	3	-	-	-	-	1	2	-	-	-	-	1	3	2
		CO-6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2
CSD302	Data Exploration and Visualization	CO-1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
		CO-2	2	-	-	-	-	-	-	-	-	-	-	-	-	3	2
		CO-3	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
		CO-4	-	-	-	3	2	3	-	-	-	-	-	-	-	-	-
		CO-5	2	3	-	-	-	-	-	-	-	-	-	-	-	2	3
		CO-6	-	2	3	-	3	-	-	-	-	-	-	-	-	3	2
CDP302	Data Exploration and Visualization	CO-1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
		CO-2	2	-	-	-	-	-	-	-	-	-	-	-	-	3	2
		CO-3	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
		CO-4	-	-	-	3	2	3	-	-	-	-	-	-	-	-	-

	Lab	CO-5	2	3	-	-	-	-	-	-	-	-	-	-	-	2	3
		CO-6	-	2	3	-	3	-	-	-	-	-	-	-	-	3	2
CSD303	Big Data Analytics	CO-1	3	2	-	-	-	1	1	-	2	2	-	3	-	-	-
		CO-2	2	2	3	3	2	2	-	2	-	-	-	2	-	3	-
		CO-3	-	-	3	3	2	-	-	2	3	-	-	-	2	3	-
		CO-4	-	2	3	2	2	2	2	-	-	2	2	-	-	3	2
		CO-5	-	-	3	2	2	-	-	-	-	-	2	2	2	3	-
		CO-6	-	-	-	2	3	2	1	2	-	-	2	2	2	3	-
CDP303	Big Data Analytics Lab	CO-1	3	2	-	-	-	1	1	-	2	2	-	3	-	-	-
		CO-2	2	2	3	3	2	2	-	2	-	-	-	2	-	3	-
		CO-3	-	-	3	3	2	-	-	2	3	-	-	-	2	3	-
		CO-4	-	2	3	2	2	2	2	-	-	2	2	-	-	3	2
		CO-5	-	-	3	2	2	-	-	-	-	-	2	2	2	3	-
		CO-6	-	-	-	2	3	2	1	2	-	-	2	2	2	3	-
CSD401	Business Intelligence	CO-1	3	2	2	1	1	1	1	1	1	1	1	1	2	3	2
		CO-2	2	3	2	2	2	2	3	3	1	1	3	2	2	2	3
		CO-3	2	3	3	2	3	3	3	1	2	2	2	1	3	2	3
		CO-4	3	3	3	3	3	2	3	1	2	2	2	2	3	3	2
		CO-5	2	2	2	3	2	3	3	2	1	3	2	1	2	2	3
		CO-6	3	1	2	2	2	3	2	1	1	3	2	3	2	2	2
CSD011	Business Process Management	CO-1	1	1	1	1	1	1	1	1	-	-	1	1	-	-	3
		CO-2	2	2	2	2	1	1	1	1	1	2	1	2	1	1	3
		CO-3	3	2	3	3	3	2	1	2	3	3	1	3	1	3	3
		CO-4	3	1	3	3	3	1	1	2	3	3	1	3	-	-	3
		CO-5	1	2	2	2	2	2	1	2	1	2	1	2	-	2	3
		CO-6	3	1	3	3	3	1	1	2	3	3	1	3	-	-	3
CSD012	Introduction	CO-1	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1

	to ML for Data Science	CO-2	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
		CO-3	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
		CO-4	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
		CO-5	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
		CO-6	3	3	1	1	2	1	1	1	1	2	1	3	2	3	1
CDP012	Introduction to ML for Data Science Lab	CO-1	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
		CO-2	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
		CO-3	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
		CO-4	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
		CO-5	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
		CO-6	3	3	1	1	2	1	1	1	1	2	1	3	2	3	1
CSD021	Neural Networks for Data Science	CO-1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO-2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO-3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO-4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO-5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO-6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CDP021	Neural Networks for Data Science Lab	CO-1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
		CO-2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO-3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO-4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
		CO-5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
		CO-6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CSD022	Business for Data driven Companies	CO-1	3	2	2	-	-	1	-	1	2	-	2	3	1	-	-
		CO-2	-	3	2	-	3	2	-	-	-	2	2	-	2	-	-
		CO-3	2	3	3	3	3	-	-	-	-	-	1	2	-	2	1
		CO-4	-	-	2	2	-	2	-	2	3	-	2	-	-	-	-

		CO-5	-	2	3	-	2	2	-	-	-	1	2	-	-	3	-
		CO-6	2	2	3	-	2	1	-	-	-	2	2	2	-	3	-
CSD031	Deep Learning and Its Applications	CO-1	3	3	-	-	3	-	-	-	-	3	-	2	3	3	-
		CO-2	3	3	-	3	3	-	-	-	-	3	-	3	3	3	-
		CO-3	3	3	3	3	3	2	-	-	3	3	-	3	3	3	-
		CO-4	3	3	3	3	3	2	-	-	3	3	-	3	3	3	-
		CO-5	3	3	3	3	3	2	3	-	3	3	-	2	3	3	-
		CO-6	3	3	3	3	3	2	3	-	3	3	-	3	3	3	-
CDP031	Deep Learning and Its Applications Lab	CO-1	3	3	-	-	3	-	-	-	-	3	-	2	3	3	-
		CO-2	3	3	-	3	3	-	-	-	-	3	-	3	3	3	-
		CO-3	3	3	3	3	3	2	-	-	3	3	-	3	3	3	-
		CO-4	3	3	3	3	3	2	-	-	3	3	-	3	3	3	-
		CO-5	3	3	3	3	3	2	3	-	3	3	-	2	3	3	-
		CO-6	3	3	3	3	3	2	3	-	3	3	-	3	3	3	-
CSD041	Web & Text Analysis	CO-1	3	2	2	2	3	1	1	1	1	1	1	1	1	2	1
		CO-2	3	3	2	2	2	2	1	1	1	2	1	1	1	1	1
		CO-3	2	3	3	3	2	2	1	1	2	1	1	1	1	1	1
		CO-4	3	2	2	2	2	2	1	1	1	2	1	1	1	1	1
		CO-5	3	1	1	1	1	2	1	1	1	1	1	1	3	3	1
		CO-6	3	1	1	1	1	3	1	1	1	1	1	1	2	3	1
CDP041	Web & Text Analysis Lab	CO-1	3	2	2	2	3	1	1	1	1	1	1	1	1	2	1
		CO-2	3	3	2	2	2	2	1	1	1	2	1	1	1	1	1
		CO-3	2	3	3	3	2	2	1	1	2	1	1	1	1	1	1
		CO-4	3	2	2	2	2	2	1	1	1	2	1	1	1	1	1
		CO-5	3	1	1	1	1	2	1	1	1	1	1	1	3	3	1
		CO-6	3	1	1	1	1	3	1	1	1	1	1	1	2	3	1
CSD042	Social Media	CO-1	2	1	-	1	-	1	-	2	-	-	1	3	1	2	1

	Analytics	CO-2	3	1	3	2	1	1	-	-	2	3	2	3	2	1	2
		CO-3	2	3	2	3	3	2	3	-	2	-	2	1	2	3	1
		CO-4	1	3	3	3	3	3	3	3	3	2	3	2	2	3	3
		CO-5	2	3	2	3	3	3	3	2	-	2	3	1	3	3	2
		CO-6	2	2	1	3	3	3	3	3	2	-	2	3	2	3	3
CDP042	Social Media Analytics Lab	CO-1	2	1	-	1	-	1	-	2	-	-	1	3	1	2	1
		CO-2	3	1	3	2	1	1	-	-	2	3	2	3	2	1	2
		CO-3	2	3	2	3	3	2	3	-	2	-	2	1	2	3	1
		CO-4	1	3	3	3	3	3	3	3	3	2	3	2	2	3	3
		CO-5	2	3	2	3	3	3	3	2	-	2	3	1	3	3	2
		CO-6	2	2	1	3	3	3	3	3	2	-	2	3	2	3	3
CSD051	HealthCare Analytics	CO-1	2	2	-	2	-	-	-	-	-	-	2	2	1	2	1
		CO-2	3	2	2	2	3	3	3	2	2	1	2	3	1	1	2
		CO-3	2	3	2	3	2	1	1	2	2	-	1	2	2	1	1
		CO-4	3	2	3	3	3	3	2	2	1	2	3	2	2	3	2
		CO-5	2	3	2	3	3	3	2	1	2	1	2	2	3	2	2
		CO-6	2	2	2	2	2	2	1	2	2	1	2	3	1	3	2
CDP051	HealthCare Analytics Lab	CO-1	2	2	-	2	-	-	-	-	-	-	2	2	1	2	1
		CO-2	3	2	2	2	3	3	3	2	2	1	2	3	1	1	2
		CO-3	2	3	2	3	2	1	1	2	2	-	1	2	2	1	1
		CO-4	3	2	3	3	3	3	2	2	1	2	3	2	2	3	2
		CO-5	2	3	2	3	3	3	2	1	2	1	2	2	3	2	2
		CO-6	2	2	2	2	2	2	1	2	2	1	2	3	1	3	2
CSD061	Predictive Analytics	CO-1	2	2	-	2	-	-	-	-	-	-	2	2	1	2	1
		CO-2	3	2	2	2	3	3	3	2	2	1	2	3	1	1	2
		CO-3	2	3	2	3	2	1	1	2	2	-	1	2	2	1	1
		CO-4	3	2	3	3	3	3	2	2	1	2	3	2	2	3	2

		CO-5	2	3	2	3	3	3	2	1	2	1	2	2	3	2	2
		CO-6	2	2	2	2	2	2	1	2	2	1	2	3	1	3	2
B.Tech-Computer Science & Engineering with specialization in Cyber Security & Forensics																	
CSC102	Introduction To Cyber Security & Laws	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC201	Digital Forensics	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CCP201	Digital Forensics Lab	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC202	Security Architecture	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

CSC301	Ethical Hacking	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CCP301	Ethical Hacking Lab	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC302	Cryptography and Network Security	CO-1	2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
		CO-2	2	2	2	-	-	-	-	-	-	-	-	-	2	2	-
		CO-3	2	-	2	-	2	-	-	-	-	-	-	-	2	2	-
		CO-4	2	-	-	2	-	2	2	-	-	-	-	-	2	2	-
		CO-5	-	-	-	-	2	-	2	2	2		-	-	2	-	-
		CO-6	-	-	-	-	-	-	-	-	-	2	2	2	2	-	2
CCP302	Cryptography and Network Security Lab	CO-1	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
		CO-3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
		CO-6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3
CSC303	Intrusion Detection and Prevention	CO-1	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
		CO-3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3

	System	CO-4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
		CO-6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3
CCP303	Intrusion Detection and Prevention System Lab	CO-1	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
		CO-3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
		CO-6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3
CSC401	Introduction to IoT and It's Security	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC011	Machine Learning	CO-1	3	3	1	-	1	-	-	1	-	-	-	-	2	3	-
		CO-2	3	3	2	1	2	1	-	1	2	2	-	-	2	3	-
		CO-3	3	3	2	1	2	1	-	1	2	2	-	2	3	3	-
		CO-4	3	3	2	2	2	1	-	1	2	2	-	2	3	3	-
		CO-5	3	3	2	3	2	1	-	1	2	2	-	2	3	3	-
		CO-6	3	3	2	3	2	1	-	1	2	2	-	2	3	3	-
CSC012	Business Communication and Ethics	CO-1	1	1	2	-	2	-	-	-	-	2	-	3	1	1	-
		CO-2	3	2	-	1	-	2	-	-	-	-	-	-	-	-	-
		CO-3	1	1	2	-	2	-	-	-	-	2	-	3	1	1	-
		CO-4	1	1	2	-	2	-	-	-	-	2	-	2	1	1	-
		CO-5	3	2	3	2	-	-	-	-	-	2	-	1	1	1	-
		CO-6	2	2	-	-	-	-	-	-	-	1	-	-	-	-	

CSC021	Mobile and Wireless Security	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC022	Disaster Recovery Management	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC031	Exploit Writing	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC032	Malware Analysis	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC041	Cloud Security	CO-1	3	3	2	2	--	--	--	2	2	1	2	1	3	2	2
		CO-2	2	2	3	3	--	--	--	2	2	2	1	1	2	3	3
		CO-3	3	3	3	3	--	2	--	1	1	1	3	2	3	2	-

		CO-4	2	2	2	2	2	--	-2	2	3	3	3	1	2	2	-
		CO-5	-	-	-	-	2	-	2	2	2		-	-	2	-	-
		CO-6	-	-	-	-	-	-	-	-	-	2	2	2	2	-	1
CSC042	Penetration Testing	CO-1	3	3	3	-	-	2	-	-	3	-	-	-	3	-	-
		CO-2	2	3	3	2	-	-	-	-	-	-	-	-	-	-	-
		CO-3	3	3	3	2	-	2	-	-	-	2	-	-	2	3	-
		CO-4	1	3	3	-	3	2	3	-	2	-	-	-	-	-	3
		CO-5	3	3	2	3	-	-	-	-	3	3	-	-	-	-	3
		CO-6	2	3	3	-	3	3	3	3	-	-	3	3	-	3	-
CSC051	Digital Water Marking and Steganography	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
CSC052	Information Security & Audit Monitoring	CO-1	2	2		-	-	-	-	-	-	-	-	-	2	2	-
		CO-2	2	2	2	-	-	-	-	-	-	-	-	-	2	2	-
		CO-3	2	-	2	-	2	-	-	-	-	-	-	-	2	2	-
		CO-4	2	-	-	2	-	2	2	-	-	-	-	-	2	2	
		CO-5	-	-	-	-	2	-	2	2	2		-	-	2	-	-
		CO-6	-	-	-	-	-	-	-	-	-	2	2	2	2	-	2
CSC061	Security Threats Intelligence and Risk Management	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

CSC062	Web Application Security	CO-1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
		CO-2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
		CO-3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
		CO-4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
		CO-5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
		CO-6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-
B.Tech-Computer Science & Engineering with specialization in Blockchain Technology																	
BCC102	Introduction to Blockchain Technology	CO-1	3	2	2	2	2	1	-	-	-	-	1	-	1	3	1
		CO-2	3	3	2	2	2	-	1	-	-	1	-	1	-	3	2
		CO-3	3	3	3	2	2	-	-	1	1	-	-	-	1	3	1
		CO-4	2	3	2	2	2	-	-	1	1	-	-	1	1	3	-
		CO-5	2	2	2	3	2	-	1	-	-	1	-	-	2	3	1
		CO-6	2	3	2	2	3	1	-	-	-	-	1	1	1	3	1
BCC201	Bitcoin and Cryptocurrencies	CO-1	2	1	3	1	2	-	1	-	-	-	1	2	1	2	1
		CO-2	1	3	3	2	-	-	-	-	-	-	2	3	1	2	2
		CO-3	3	1	2	1	1	1	1	-	-	-	2	1	2	2	1
		CO-4	2	2	1	3	1	-	-	2	-	-	1	1	2	3	1
		CO-5	2	2	1	-	2	2	-	-	-	-	2	1	1	2	2
		CO-6	1	3	2	2	3	2	2	2	2	2	-	2	1	3	1
BCC202	Blockchain Using Multichain	CO-1	2	3	1	1	2	2	-	2	-	-	-	-	-	2	-
		CO-2	2	2	3	2	3	2	-	-	-	-	-	-	-	2	-
		CO-3	2	2	3	2	3	2	-	-	-	-	-	-	-	2	-
		CO-4	2	3	1	1	2	2	-	1	-	-	-	-	-	2	-
		CO-5	3	3	3	1	1	1	-	1	-	1	-	-	1	2	2
		CO-6	3	3	3	1	2	1	-	1	-	-	-	-	-	3	2
BCC301	Programming in GO	CO-1	2	1	2	-	-	3	3	2	-	-	3	1	1	2	1
		CO-2	2	3	1	2	2	-	-	-	-	2	-	2	1	3	-

		CO-3	1	2	3	3	2	-	1	2	-	2	-	2	1	2	1
		CO-4	2	1	2	2	-	-	2	2	1	1	-	-	1	3	2
		CO-5	3	2	2	-	-	-	-	-	2	2	1	2	1	3	1
		CO-6	2	3	2	1	2	2	1	1	2	-	2	-	1	2	1
BCL301	Programming in GO Lab	CO-1	2	1	2	-	-	3	3	2	-	-	3	1	1	2	1
		CO-2	2	3	1	2	2	-	-	-	-	2	-	2	1	3	-
		CO-3	1	2	3	3	2	-	1	2	-	2	-	2	1	2	1
		CO-4	2	1	2	2	-	-	2	2	1	1	-	-	1	3	2
		CO-5	3	2	2	-	-	-	-	-	2	2	1	2	1	3	1
		CO-6	2	3	2	1	2	2	1	1	2	-	2	-	1	2	1
BCC302	Smart contracts using Ethereum	CO-1	2	1	2	-	-	3	1	1	-	-	1	1	1	2	1
		CO-2	2	3	1	2	2	-	-	-	-	1	-	2	1	2	2
		CO-3	1	2	3	3	2	-	1	1	-	1	-	2	1	2	1
		CO-4	2	1	2	2	-	-	1	1	1	1	-	-	1	3	2
		CO-5	3	2	3	-	-	-	-	-	2	1	1	2	1	2	1
		CO-6	2	3	2	1	2	2	1	1	1	-	1	-	1	2	1
BCC303	Smart Contracts using Hyperledger Fabric	CO-1	2	2	3	-	2	-	1	3	-	-	-	1	1	3	-
		CO-2	2	-	1	-	1	-	-	-	-	-	-	-	1	1	-
		CO-3	3	3	2	-	2	-	-	3	-	-	-	-	-	2	1
		CO-4	2	2	-	1	-	1	-	-	-	-	-	-	2	-	-
		CO-5	-	-	-	-	2	-	-	-	-	1	-	-	-	1	-
		CO-6	2	2	3	-	3	2	-	3	-	-	1	-	2	3	-
BCC401	Cyber Security in Blockchain Technology	CO-1	2	2	2	2	2	-	-	-	-	-	-	-	2	2	2
		CO-2	3	2	3	2	2	1	1	1	1	-	-	-	2	1	2
		CO-3	2	2	3	2	2	1	1	1	1	-	-	-	1	2	2
		CO-4	2	1	3	1	2	-	-	-	-	2	2	2	2	2	1
		CO-5	2	2	2	2	2	-	-	-	-	2	1	2	1	1	1

		CO-6	2	1	1	1	1	-	-	-	-	1	1	1	1	1	1
BCC011	Blockchain for Business	CO-1	2	2	1	-	-	-	-	3	-	-	1	-	1	-	1
		CO-2	2	-	1	-	1	-	-	2	-	-	2	-	1	1	-
		CO-3	1	2	-	-	-	-	-	3	-	-	-	-	-	1	1
		CO-4	2	2	2	3	-	-	2	2	-	-	-	-	-	3	-
		CO-5	-	-	1	1	2	-	-	1	-	-	-	-	2	1	-
		CO-6	1	1	1	-	2	2	-	1	-	-	1	-	1	1	-
BCC021	Implementing Blockchain on cloud	CO-1	2	1	2	-	-	3	3	2	-	-	3	1	2	2	3
		CO-2	2	2	1	2	2	-	-	-	-	2	-	2	1	2	2
		CO-3	3	2	2	2	2	-	1	2	-	2	-	2	1	2	1
		CO-4	2	1	2	2	-	-	2	2	1	1	-	-	1	3	2
		CO-5	3	2	3	-	-	-	-	-	2	2	1	2	1	1	1
		CO-6	2	3	2	1	2	2	1	1	2	-	2	-	2	1	2
BCC031	Cryptocurrency with Ethereum	CO-1	1	3	1	1	2	2	-	2	-	-	-	-	-	2	-
		CO-2	1	3	1	1	2	2	-	2	-	-	-	1	1	2	1
		CO-3	2	2	3	2	3	2	-	-	1	-	1	1	-	2	-
		CO-4	1	1	-	3	3	3	--	2	-	1	1	-	-	3	1
		CO-5	3	3	3	-	-	3	--	2	-	2	-	-	3	2	2
		CO-6	3	3	3	-	2	3	-	3	-	-	-	-	-	3	2
BCC041	Open source for Blockchain using Hyperledger	CO-1	2	2	-	1	-	2	-	-	-	2	2	2	3	2	2
		CO-2	1	3	3	2	2	-	1	2	-	-	2	3	2	1	1
		CO-3	2	1	2	1	1	3	-	1	-	-	1	1	2	1	2
		CO-4	1	2	-	3	-	-	-	2	2	-	-	2	2	3	-
		CO-5	2	2	2	-	1	-	-	-	1	-	2	-	1	2	2
		CO-6	2	3	2	3	2	2	2	2	-	2	-	-	1	1	2
CSE250	Theory of Computation	CO-1	3	2	2	2	3	--	--	2	2	--	--	2	3	--	--
		CO-2	2	3	3	1	2	--	--	3	--	--	--	--	--	3	2

	and Compiler Design	CO-3	3	3	3	2	--	--	--	--	2	--	--	2	2	2	--
		CO-4	1	2	3	--	2	--	--	3	3	--	--	3	3	3	2
		CO-5	1	2	2	2	2	--	--	1	2	--	--	--	1	2	2
		CO-6	2	--	3	2	1	--	--	2	3	--	--	3	3	2	3
CSP250	Theory of Computation and Compiler Design Lab	CO-1	3	--	--	--	3	--	--	--	2	--	--	3	2	1	--
		CO-2	2	2	3	3	2	--	--	--	--	--	--	2	3	2	--
		CO-3	3	3	3	--	--	--	--	--	--	--	--	--	3	2	--
		CO-4	1	2	3	3	3	--	--	--	3	--	--	--	--	3	2
		CO-5	1	1	2	3	2	--	--	--	3	--	--	3	1	2	2
		CO-6	2	--	3	3	2	--	--	--	3	--	--	3	3	2	3
Cloud Technology & Information Security																	
CSE221	Linux Administration	CO-1	2	_	1	_	_	_	_	_	_	_	_	_	2	_	1
		CO-2	_	2	_	1	_	_	_	_	2	_	_	_	3	1	_
		CO-3	3	3	2	_	_	_	_	_	3	_	_	_	_	3	_
		CO-4	3	3	2	3	_	_	_	_	3	_	_	_	_	3	_
		CO-5	_	1	2	_	_	_	_	_	_	_	_	_	_	_	2
		CO-6	_	_	3	3	2	_	_	_	_	_	_	_	_	_	3
CSP221	Linux Administration Lab	CO-1	1	_	2	_	3	_	_	_	_	_	_	_	3	_	1
		CO-2	2	3	_	1	_	_	_	_	2	_	_	_	2	1	_
		CO-3	_	2	2	_	3	_	_	_	_	_	_	_	_	2	_
		CO-4	3	2	_	3	_	_	_	_	3	_	_	_	_	3	2
		CO-5	_	1	2	_	_	_	_	_	_	_	_	_	_	_	_
		CO-6	_	_	3	3	2	_	_	_	3	_	_	_	_	_	3
CSE288	Principle of Virtualization	CO-1	_	3	1	_	3	_	_	_	_	_	1	_	2	_	2
		CO-2	_	3	_	_	3	3	_	_	_	1	_	3	_	_	1
		CO-3	_	3	3	3	3		_	_	_	_	_	3	_	1	1
		CO-4	_	3	3	_	_	_	_	_	_	3	_	3	1	_	_
		CO-5	_	3	3	_	3	_	_	_	3	3	_		1	_	_
		CO-6	_	2	_	3	_	2	_	_	3	3	_	2	2	1	2

CSE377	Mobile Security	CO-1	2	_	1	_	_	_	_	_	_	_	_	_	2	_	1
		CO-2	_	2	_	1	_	_	_	_	2	_	_	_	3	1	_
		CO-3	3	3	2	_	_	_	_	_	3	_	_	_	_	3	_
		CO-4	3	3	2	3	_	_	_	_	3	_	_	_	_	3	_
		CO-5	_	1	2	_	_	_	_	_	_	_	_	_	_	_	2
		CO-6	_	_	3	3	2	_	_	_	_	_	_	_	_	_	3
CSE375	Introduction to Cloud Technology	CO-1	1	2	1	1	3	2	2	2	1	2	1	3	_	1	_
		CO-2	2	2	2	2	2	2	2	2	2	2	2	3	3	_	2
		CO-3	2	2	3	1	2	1	1	2	2	3	2	3	_	2	_
		CO-4	2	2	3	1	3	1	1	2	3	3	3	2	_	3	2
		CO-5	2	2	3	2	3	1	2	2	3	3	2	2	_	_	_
		CO-6	2	2	3	1	3	1	1	2	3	3	3	2	_	_	3
CSP375	Introduction to Cloud Technology Lab	CO-1	3	3	3	3	_	_	_	2	2	1	2	1	3	2	2
		CO-2	3	2	3	3	_	_	_	2	2	2	1	1	2	3	2
		CO-3	3	3	3	3	_	_	_	1	1	1	3	2	3	2	1
		CO-4	2	2	2	2	1	_	_	2	3	3	3	1	2	2	2
		CO-5	_	3	_	3	2	_	3	_	2	3	3	--	--	--	2
		CO-6	2	_	_	3	_	2	3	2	3	3	3	_	_	_	2
CSE378	Information and Network Security	CO-1	2	_	1	_	_	_	_	_		_	_	_	2	_	1
		CO-2	_	2		1	_	_	_	_	2	_	_	_	3	1	_
		CO-3	3	3	2	_	_	_	_	_	3	_	_	_	_	3	_
		CO-4	3	3	2	3	_	_	_	_	3	_	_	_	_	3	_
		CO-5	_	1	2	_	_	_	_	_	_	_	_	_	_	_	2
		CO-6	_	_	3	3	2	_	_	_	_	_	_	_	_	_	3
CSP378	Information and Network Security Lab	CO-1	1	2	1	1	3	2	2	2	1	2	1	3	_	1	_
		CO-2	2	2	2	2	2	2	2	2	2	2	2	3	3	_	2
		CO-3	2	2	3	1	2	1	1	2	2	3	2	3	_	2	_
		CO-4	2	2	3	1	3	1	1	2	3	3	3	2	_	3	2
		CO-5	2	2	3	2	3	1	2	2	3	3	2	2	_	_	_

		CO-6	2	2	3	1	3	1	1	2	3	3	3	2	_	_	3
CSE475	Security and Privacy of Online Social Networks	CO-1	3	2	2	3	--	--	--	2	2	1	2	1	3	2	2
		CO-2	3	2	3	3	--	--	--	2	2	2	1	1	2	3	2
		CO-3	3	--	--	3	--	--	--	1	1	1	3	2	3	2	1
		CO-4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
		CO-5	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
		CO-6	_	3	_	1	2	_	1	_	2	2	_	3	3	_	1
CSE373	Ethical Hacking	CO-1	2	--	1	--	--	--	--	--	--	--	--	--	2	--	1
		CO-2	--	2	--	1	--	--	--	--	2	--	--	--	3	1	--
		CO-3	3	3	2	--	--	--	--	--	3	--	--	--	--	3	--
		CO-4	3	3	2	3	--	--	--	--	3	--	--	--	--	3	--
		CO-5	--	1	2	--	--	--	--	--	--	--	--	--	--	--	2
		CO-6															
CSE016	Cloud Computing Solutions	CO-1	3	3	2	3	--	--	--	2	2	1	2	1	3	2	2
		CO-2	3	3	3	3	--	--	--	2	2	2	1	1	2	3	2
		CO-3	3	3	2	3	--	--	--	1	1	1	3	2	3	2	1
		CO-4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
		CO-5	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
		CO-6	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
CSE026	Cloud Web Services	CO-1	2	3	1	_	_	_	_	_	_	_	_	_	2	_	1
		CO-2	_	2	_	1	3	_	_	_	2	_	_	_	3	1	_
		CO-3	3	3	2	2	_	_	_	_	3	_	_	_	_	3	_
		CO-4	3	3	2	3	_	3	_	_	3	_	_	_	_	3	_
		CO-5	3	3	2	2	_	_	_	_	3	_	_	_	_	3	_
		CO-6	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
CSE376	Emerging technology and Digital Transformatio	CO-1	2	--	1	--	--	--	--	--	--	--	--	--	2	--	1
		CO-2		2	--	1	--	--	--	--	2	--	--	--	3	1	--
		CO-3	3	3	2	--	--	--	--	--	3	--	--	--	--	3	--
		CO-4	3	3	2	3	--	--	--	--	3	--	--	--	--	3	--

	n	CO-5	--	1	2	--	--	--	--	--	--	--	--	--	--	--	2
		CO-6	--	--	3	3	2	--	--	--	--	--	--	--	--	--	3
CSE036	Advanced Linux Administration	CO-1	2	_	1	--	--	--	--	--	--	--	--	--	2	--	1
		CO-2	_	2	--	1	--	--	--	--	2	--	--	--	3	1	--
		CO-3	3	3	2	--	--	--	--	--	3	--	--	--	--	3	--
		CO-4	3	3	2	3	--	--	--	--	3	--	--	--	--	3	--
		CO-5	--	1	2		--	--	--	--	--	--	--	--	--	--	2
		CO-6	--	--	3	3	2	--	--	--	--	--	--	--	--	--	3
CSE046	Cloud Security and Data Protection	CO-1	3	3	2	3	--	--	--	2	2	1	2	1	3	2	2
		CO-2	3	3	3	3	--	--	--	2	2	2	1	1	2	3	2
		CO-3	3	3	2	3	--	--	--	1	1	1	3	2	3	2	1
		CO-4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
		CO-5	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
		CO-6	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
CSE047	Server Administration	CO-1	3	3	2	3	--	--	--	2	2	1	2	1	3	2	2
		CO-2	3	3	3	3	--	--	--	2	2	2	1	1	2	3	2
		CO-3	3	3	2	3	--	--	--	1	1	1	3	2	3	2	1
		CO-4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
		CO-5	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
		CO-6	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
CSE056	Security operation and Incident Management	CO-1	3	3	2	2	--	--	--	2	2	1	2	1	3	2	2
		CO-2	3	2	3	2	--	--	--	2	2	2	1	1	2	3	2
		CO-3	3	3	2	3	--	--	--	1	1	1	3	2	3	2	1
		CO-4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
		CO-5	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
		CO-6	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
CSE057	Cloud Forensics	CO-1	2	--	1	--	--	--	--	--	--	--	--	--	2	--	1
		CO-2	--	2	--	1	--	--	--	--	2	--	--	--	3	1	--
		CO-3	3	3	2	--	--	--	--	--	3	--	--	--	--	3	--

		CO-4	3	3	2	3	--	--	--	--	3	--	--	--	--	3	--
		CO-5	--	1	2	--	--	--	--	--		--	--	--	--	--	2
		CO-6	--	--	3	3	2	--	--	--	--	--	--	--	--	--	3
CSE066	Critical Infrastructure Security	CO-1	2	--	1	--	--	--	--	--	--	--	--	--	2	--	1
		CO-2	--	2		1	--	--	--	--	2	--	--	--	3	1	--
		CO-3	3	3	2	2	--	--	--	--	3	--	--	--	--	3	--
		CO-4	3	3	2	3	--	3	--	--	3	--	--	--	--	3	--
		CO-5	--	1	2	--	--	--	--	--	--	--	--	--	--	--	2
		CO-6	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
CSE067	Disaster Recovery and Business Continuity Management	CO-1	2	_	1	_	_	_	_	_	_	_	_	_	2	_	1
		CO-2	_	2	_	1	_	_	_	_	2	_	_	_	3	1	_
		CO-3	3	3	2	2	_	_	_	_	3	_	_	_	_	3	_
		CO-4	3	3	2	3	_	3	_	_	3	_	_	_	_	3	_
		CO-5	_	1	2	_	_	_	_	_	_	_	_	_	_	_	2
		CO-6	_	_	3	3	2	_	_	_	_	_	_	_	_	_	3

1. Slight (Low) ***2. Moderate (Medium)*** ***3. Substantial (High)***

1.3.5.2 COURSE ARTICULATION MATRIX[2]

Course Code	Course Name	PO-1 Engineering knowledge	PO-2 Problem analysis	PO-3 Design/development of solutions	PO-4 Conduct investigations of complex problems	PO-5 Modern tool usage	PO-6 The engineer and society	PO-7 Environment and sustainability	PO-8 Ethics	PO-9 Individual and team work	PO-10 Communication:	PO-11 Project management and finance	PO-12 Life-long learning	PSO 1 Familiarity and practical proficiency	PSO 2 Understand, analyse and develop	PSO 3 Apply standard Software
CSE113	Programming for Problem Solving	1.83	2.50	2.17	1.50	2.00				1.80		1.50		1.67	2.17	1.00
MTH142	Calculus and Abstract Algebra	3.00	3.00	2.17	2.17	2.17	1.33				1.00	1.00	1.50			
PHY117	Semiconductor Physics	3.00	2.83	2.33	2.33	2.67	1.83	1.00	1.00	1.17	1.00	1.00	1.00			
EEE112	Principles of Electrical and Electronics Engineering	2.17	1.83	1.83	1.50							1.00				
EVS112	Environmental Studies	1.00	1.83	1.83	1.17	1.00	1.67	1.83	1.33		1.00	1.67	1.00		1.67	1.50
ARP101	Communicative English-1		1.00	1.00	1.00				1.00	1.50	2.00	2.00				
CSP113	Programming for Problem Solving Lab	2.17		2.83	1.83	1.67				2.33				2.50	2.50	1.80
CSP101	Introduction to Computer Science and Engineering	3.00	2.00				2.00		2.00				3.00	3.00	2.75	2.60
MEP106	Computer Aided Design & Drafting	2.00	2.00	2.00	2.00	3.00				2.00	2.00		3.00	3.00	3.00	

[2] Each course outcome (Based on Blooms Taxanomy-CO1, CO2, CO3, CO4, CO5, and CO6) of the course needs to map with PO. This table evolves once faculty has mapped each course outcomes of their respective course with PO's.

EEP112	Principles of Electrical and Electronics Engineering															
PHY161	Physics Lab –I	2.00	2.00	2.00	1.00	1.00	1.00	2.00	3.00	3.00	3.00	2.00	3.00			
Semester II																
CSE114	Application based Programming in Python	2.17	2.00	1.67	1.75	2.00	2.00		2.00				2.00	1.50	2.00	1.40
MTH145	Probability and Statistics	3.00	2.67	2.17	2.17	2.17	1.33				1.00	1.00	1.50			
CHY111	Engineering Chemistry	3.00	1.00	1.33	1.17	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
HMM111	Human Value & Ethics	1.25	2.25	1.40	1.60	2.00	2.00	1.75	1.00	1.50	2.00	2.25	1.75	1.75	2.20	1.75
PHY116	Engineering Physics	3.00	2.67	2.67	2.50	2.33	2.50	2.00	1.67	2.33	2.33	1.33	2.17			
ARP102	Communicative English -2			1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00				
CSP103	Multimedia Application Lab	2.33	2.50	2.67	2.80	3.00	2.75	3.00	3.00	2.67	3.00			1.67	1.83	
CSP114	Application based Programming in Python	2.00	2.00	1.50	1.50	1.60	1.75		2.00				2.00	1.75	1.67	1.40
MEP105	Mechanical Workshop	1.67		1.00		1.60	2.00						1.83	1.40		1.00
CHY161	Engineering Chemistry	2.00	2.60	1.33		2.00	1.17	1.60		3.00	3.00	1.60	2.00	2.00		1.00
PHY162	Physics Lab-II	2.00	2.00	2.00	1.00	1.00	1.00	2.00	3.00	3.00	3.00	2.00	3.00	2.00		
Semester III																
BTY223	Introduction to Biology for Engineers	3.00	2.00	1.67	1.00	2.00	2.00	3.20	2.00	1.00	2.00	1.00	3.00	1.00	1.00	
CSE242	Data Structures	2.00	2.33	2.67	2.33	1.50				1.83			1.00	2.33	2.17	2.33
CSE243	Object Oriented Programming Using Java	2.50	3.00	3.00		2.00	3.00	2.00		3.00		2.00	2.33	2.50	3.00	2.00
CSE244	Principles of Operating System	2.67	2.33	2.80	2.75	1.00			2.00	2.20	1.67	2.33	1.25	2.50	2.20	1.75
CSE245	Discrete Structures	2.00	2.17	2.50	2.40	3.00	2.67			2.75		3.00	3.00	3.00	2.60	2.50

CSE247	Computer Organization and Architecture	3.00	2.33	2.50			2.00						2.83		1.83	2.50
ARP203	Aptitude Reasoning and Business Communication Skills - Basic		1.00	1.00			1.00		1.00	1.00	1.00		1.00			
CSP242	Data Structures Lab	2.67	2.00	2.50	2.50	2.00				2.60			1.67	2.17	2.50	2.17
CSP243	Object Oriented Programming Using Java	2.50	3.00	3.00		2.00	3.00	2.00		3.00		2.00	2.33	2.50	3.00	2.00
CSP244	Principles of Operating System Lab	2.67	2.33	2.80	2.75	1.00			2.00	2.20	1.67	2.33	1.25	2.50	2.20	1.75
CSP251	Project Based Learning (PBL) -1	3.00	2.67	2.00	2.75	2.00	2.00	2.50	3.00	3.00	3.00	2.00	3.00	2.00	2.00	1.00
CSP294	Summer Internship-I	2.00	2.50	2.50		2.00	2.00		3.00	3.00	3.00		2.00	1.33	2.00	
Semester IV																
CSE249	Data Base Management System	2.67	3.00	2.75	3.00	2.75	2.17		2.33	2.67	3.00	2.00	2.33	2.67	3.00	3.00
CSE251	Theory of Computation	2.83	2.60	2.83	3.00	2.40				2.40			2.60	3.00	2.40	2.25
CSE252	Computer Networks	2.25	2.00	2.00	2.00	3.00	2.00		2.00			2.00	3.00	2.00	2.40	2.00
PE-1	Program Elective-1															
CSE011	Mathematical Techniques	2.33	1.83	1.60	1.20	1.50		1.20			1.40	1.60	1.40	2.17	1.00	
CSE012	Introduction to Graph Theory and its Applications	1.83	2.50	1.83	2.67	1.40	1.50	1.50			1.50	1.00	1.83	2.17	1.67	2.00
OE1	Open Elective – 1															
CSP249	Data Base Management System Lab	3.00	2.20	2.40	2.20	2.17				3.00			2.00	2.17	2.50	2.83
CSP252	Computer Networks Lab	2.25	2.00	2.00	2.00	3.00	2.00		2.00			2.00	3.00	2.00	2.40	2.00
CSP298	Project Based Learning (PBL) -2	3.00	2.67	2.00	2.75	2.00	2.00	2.50	3.00	3.00	3.00	2.00	3.00	2.00	2.00	1.00
ARP204	Aptitude Reasoning and Business Communication Skills-Intermediate		1.00	1.00					1.00	1.00	1.00		1.00			
Semester V																

CSE350	Design and Analysis of Algorithm	2.00	2.17	1.83	2.40	2.00				2.17				2.50	2.00	2.25
CSE351	Software Engineering and Testing Methodologies	2.83	1.75	2.50	2.20	3.00	2.50	2.50	1.33	2.33	2.83	1.60	2.80	1.40		2.83
CSE021	Introduction to Cloud Computing	1.83	2.33	1.67	2.00									2.00	2.50	2.50
CSE022	Android Application Development	1.00	2.00	2.33	3.00	3.00	3.00	2.50		2.17		2.33	1.00	2.50	3.00	2.17
CSE023	Quantum Computing	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00	3.00
CSE024	Parallel Computing Algorithms	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00	3.00
CSE025	3D Printing and Software Tools	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00	3.00
OE-2	Open Elective – 2															
ECC001	Community Connect															
ARP301	Quantitative Aptitude Behavioral and Interpersonal Skills		1.00	1.00			1.00	1.00		1.00	1.00		1.00			
CSP350	Design and Analysis of Algorithm Lab	2.50	2.67	2.50	2.40	2.00				1.83				2.50	2.33	2.20
CSP395	Technical Skill Enhancement Course-1 Simulation Lab	1.17	2.00	1.33	3.00	2.00	2.00	1.00		2.00	2.50	2.00	1.17	1.17	2.17	1.00
CSP351	Project Based Learning (PBL) -3	3.00	2.17	2.00	1.80	2.50	2.00		1.17	2.00	3.00	2.25	1.33	1.83	1.80	1.75
CSP398	Summer Internship-II	3.00	2.17	2.00	1.80	2.50	2.00		1.17	2.00	3.00	2.25	1.33	1.83	1.80	1.75
Semester VI																
HMM305	Management for Engineers	1.75	1.33	1.67	1.67	2.00	1.83	2.00	1.50	1.33	2.33	1.33	1.25	1.33	1.50	1.83
CSE352	Web Technologies	2.00	1.67	3.00	1.00	2.00	1.67	1.00		2.33		2.00	1.50	1.00	1.50	2.33
CSE353	Compiler Design	2.00	2.00	2.80	3.00	2.40				2.75			2.75	2.40	2.00	2.33
PE3	Program Elective-3															
CSE031	Digital Image Processing	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00

CSE032	Cryptography and Network Security	2.25	2.50	2.00	1.50	2.50	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.50
PE4	Program Elective-4															
CSE041	Software Project Management	2.00		2.33	3.00	1.83	2.50		1.00	3.00	2.50	3.00	2.67			2.50
CSE042	Software Testing	2.83	2.67	2.80	2.00	2.60	1.60	3.00	1.20	2.20	3.00	3.00	2.17	2.00		3.00
OE-3	Open Elective – 3															
ARP302	Higher Order Mathematics and Advanced People Skills		1.00	1.00			1.00	1.00		1.00	1.00		1.00			
CSP352	Web Technologies Lab	2.00	1.67	1.67	1.00	2.00	1.67			2.20		2.00	1.33	1.00	1.20	2.25
CSP353	Compiler Design Lab	2.00	2.00	2.80	3.00	2.40				2.75			2.75	2.40	2.00	2.33
CSP396	Technical Skill Enhancement Course-2(Application Development Lab)	1.17	2.00	1.33	3.00	2.00	2.00	1.00		2.00	2.50	2.00	1.17	1.17	2.17	1.00
CSP392	Project Based Learning (PBL) -4	3.00	2.17	2.00	1.80	2.50	2.00		1.17	2.00	3.00	2.25	1.33	1.83	1.80	1.75
Semester VII																
CSE451	Artificial Intelligence	2.17	2.83	3.00	2.67	2.50	1.75	1.50	2.00	3.00	1.83	1.75	2.33	3.00	2.50	2.33
0	Program Elective-5															
CSE051	Wireless Networks	3.00	2.00	3.00	2.00	2.00			1.00							2.33
CSE052	Risk Management	2.00	2.00	2.00	2.50	2.00		1.00	1.00	2.00	1.25	1.25	1.00	1.50	1.00	1.33
0	Program Elective-6															
CSE061	Introduction to Internet of Things															
CSE062	Mobile Computing	3.00	3.00		2.00	3.00					2.00			2.50	2.17	
0	Comprehensive Examination															
OE4	Open Elective - 4															
CSP451	Artificial Intelligence Lab	2.17	2.83	3.00	2.67	2.50	1.75	1.50	2.00	3.00	1.83	1.75	2.33	3.00	2.50	2.33
CSP497	Major Project- 1	2.1	1.8	2.5	1.8	2.1	1.6	1.6	1.0	2.0	1.8	1.0	2.0	2.17	2.67	3.00

		7	3	0	3	7	0	0	0	0	3	0	0			
CSP499	Summer Internship-III	2.00	2.33	2.00	2.00	2.33	2.00	1.00	2.00	1.83	2.00	2.25	1.83	1.50	1.67	1.60
Semester VIII																
CSP498	Major Project - 2	1.83	2.00	2.33	2.00	2.83	2.00	2.00	2.00	2.00	2.33	2.00	1.50	3.17	2.50	2.50
B.Tech-Computer Science & Engineering with specialization in Artificial Intelligence & Machine Learning																
CSA103	Introduction To AI & ML	3.00	3.00	3.00	1.00	2.00	2.67	2.67	1.33	2.67	3.00	2.33	3.00	2.67	3.00	2.50
CSA202	Concept of Machine Learning	3.00	3.00	3.00	3.00	3.00	3.00	2.83	2.00	2.00	3.00	2.67	3.00	2.83	2.83	2.67
CAL201	Concept of Machine Learning Lab	3.00	3.00	3.00	3.00	3.00	3.00	2.83	2.00	2.00	3.00	2.67	3.00	2.83	2.83	2.67
CSA203	Concepts of Neural Networks	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67
CSA301	Soft Computing	3.00	3.00	2.67	2.67	2.50	2.33	2.17	1.83	2.33	1.83	2.67	3.00	2.67	3.00	2.67
CSA302	Pattern Recognition	3.00	3.00	3.00	3.00	2.17	2.33	1.50	1.17	2.17	3.00	1.33	3.00	3.00	3.00	2.67
CAL302	Pattern Recognition Lab	3.00	3.00	3.00	3.00	2.17	2.33	1.50	1.17	2.17	3.00	1.33	3.00	3.00	3.00	2.67
CSA303	Deep Learning and Its Applications	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67
CAL303	Deep Learning and Its Applications Lab	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67
CSA402	Applications of AIML in healthcare/ ICT/ Computer Networks	3.00	3.00	3.00	3.00	3.00	1.83	2.00	3.00	2.33	3.00	2.67	3.00	3.00	3.00	2.67
CSA042	Cyber Physical Embedded Systems	3.00	2.50	2.00	1.67	2.33	1.67	1.00	1.00	2.50	1.00	1.00	2.00	2.00	1.00	2.33
CSA401	Computer Vision	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00
CAL401	Computer Vision Lab	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00
CSA021	Human Computer Interaction	3.00	3.00	2.83	2.83	1.83	1.33	1.00	1.00	1.00	2.00	1.00	3.00	2.67	2.83	2.00
CSA022	Introduction to Cloud Computing with Machine learning	3.0	3.0	3.0	3.0	3.0	3.0	3.0	1.0	2.0	3.0	1.0	3.0	3.00	3.00	3.00

		0	0	0	0	0	0	0	0	0	0	0	0			
CSA041	Introduction to Natural Language Processing	3.00	3.00	3.00	3.00	3.00	1.67	1.67	1.00	1.50	3.00	1.17	3.00	2.83	3.00	2.17
CSA051	Recommender Systems	3.00	3.00	2.83	3.00	2.83	2.33	2.33	1.00	2.67	2.00		3.00	3.00	2.67	2.17
CSA061	Robotics and Intelligent Systems	3.00	3.00	3.00	3.00	3.00	1.33	1.33	1.17	2.00	2.17	2.83	2.17	3.00	3.00	2.50
B.Tech-Computer Science & Engineering with specialization in Internet of Things & Applications																
CSI104	Introduction to IoT	2.67	1.83	1.83	2.25	3.00	1.67	2.17					3.00	3.00		
CSI201	Embedded System	3.00	2.75	2.67	2.50	2.75	2.00	2.25	2.00	2.40	2.40	2.00	3.00	2.50	2.00	3.00
CIP201	Embedded System Lab	3.00	2.75	2.40	2.17	2.40	1.67	2.00	1.80	2.50	2.17	2.40	3.00	2.17	2.00	2.40
CSI202	IoT Architecture and Programming	2.17	2.67	2.50	2.67	2.75	2.00	2.33	2.00	2.00	2.75	2.00	2.00	2.67	2.17	2.50
CIP202	IoT Architecture and Programming Lab	2.00	2.00	1.83	1.50	2.00	2.50	2.00	2.00	2.17	1.00	2.83	3.00	2.33	2.33	2.00
CSI301	Programming with SENSEnuts IoT Platform	2.17	2.60	2.40	2.00	2.67	2.00	2.00	2.50	1.83	1.83	1.83	2.17	2.67	2.00	1.17
CIP301	Programming with SENSEnuts IoT Platform Lab	2.33	2.00	2.00	2.00	3.00	2.00	2.00	2.20	2.50	2.50	2.50	2.67	2.67	2.00	2.00
CSI302	IoT: Sensing & Actuator Devices	2.17	2.00	1.33	1.33	1.17	2.00	1.67	1.00	2.20	2.00	2.20	2.17	2.00	1.40	1.20
CIP302	IoT: Sensing & Actuator Devices Lab	3.00	2.83	2.17	2.17	3.00	2.00	1.67	2.00	3.00	3.00	3.00	2.17	2.00	2.20	2.00
CSI303	Wireless Technologies for IoT	3.00	2.20	2.33	2.33	3.00		3.00	2.00	2.00	2.17	2.50	2.00	2.00	3.00	3.00
CIP303	Wireless Technologies for IoT Lab	3.00	3.00	2.80	2.25	2.83	3.00			2.67		2.50	3.00	3.00	2.40	
CSI401	IoT Security	3.00	2.17	2.33	2.17	2.25	2.33		2.00	2.67	3.00	2.67	2.50	2.00	2.50	3.00
CSI011	Android with IoT	2.00	2.25	2.50	2.50	2.00	2.67	2.33	2.00	2.50	2.20	2.00	2.67	2.33	2.33	2.50
CIP011	Android with IoT Lab	2.33	2.00	2.00	2.00	3.00	2.00	2.00	2.20	2.50	2.50	2.50	2.67	2.67	2.00	2.00
CSI021	Sensor-Cloud for Internet of Things	2.1	2.0	1.7	2.0	3.0	1.1	2.0	2.0	1.5	1.2	2.0	2.5	2.50	1.83	2.00

		7	0	5	0	0	7	0	0	0	5	0	0			
CIP021	Sensor-Cloud for Internet of Things Lab	2.33	2.00	2.00	2.00	3.00	2.00	2.00	2.20	2.50	2.50	2.50	2.67	2.67	2.00	2.00
CSI022	Wireless Sensor Networks	2.17	2.00	2.00	2.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00	2.50	2.50	2.00	2.00
CIP022	Wireless Sensor Networks Lab	2.83	1.67	2.00	1.80	2.67	1.50	2.80	2.00	2.20	2.20	2.20	2.33	2.00	2.40	2.40
CSI023	Micro-controller programming using Arduino	2.17	2.60	2.40	2.00	2.67	2.00	2.00	2.50	1.83	1.83	1.83	2.17	2.67	2.00	1.17
CIP023	Micro-controller programming using Arduino Lab	2.33	2.00	2.00	2.00	3.00	2.00	2.00	2.20	2.50	2.50	2.50	2.67	2.67	2.00	2.00
CSI024	Raspberry Pi and its Programming	2.33	2.00	2.00	2.50	3.00	2.00	2.00	2.20	2.33	2.33	2.50	2.67	2.67	2.00	2.00
CIP024	Raspberry Pi and its Programming Lab	2.33	2.00	2.00	2.00	3.00	2.00	2.00	2.20	2.50	2.50	2.50	2.67	2.67	2.00	2.00
CSI031	Artificial Intelligence for IoT	3.00	2.60	2.60	2.60	3.00	2.50	3.00	2.00	2.20	2.20	2.50	2.33	2.00	2.40	2.25
CIP031	Artificial Intelligence for IoT Lab	2.83	2.67	2.00	2.40	3.00	2.00	2.00	2.20	2.50	2.50	2.50	2.83	2.67	2.00	3.00
CSI032	Data Analytics for IoT	2.67	2.75	3.00	2.00	2.25	3.00	2.00	2.00	2.00	2.00	2.00	2.00	2.25	1.33	
CSI033	Image Processing with IoT	3.00	2.60	2.60	2.60	2.83	2.50	3.00	2.00	2.20	2.20	2.50	2.33	2.00	2.33	2.25
CIP033	Image Processing with IoT Lab	2.33	2.00	2.00	2.00	3.00	2.00	2.00	2.20	2.50	2.50	2.50	2.67	2.67	2.00	2.00
CSI041	Fog Computing and IoT	2.83	2.33	2.40	2.00	2.67	2.50	1.80	3.00	2.50	2.50	2.50	2.67	2.00	2.00	2.50
CSI042	Industrial IoT 4.0	1.83	1.80	1.50	1.60	2.25	1.00	2.00	2.00	2.00	1.50	2.25	2.17	1.50	2.50	2.00
CSI051	IoT in Healthcare	3.00	2.83	2.83	2.80	2.00	3.00	3.00	2.17	2.67	2.83	2.67	3.00	2.67	2.67	3.00
CSI052	Drones in IoT	3.00	2.83	2.83	2.80	3.00	2.83	2.83	2.17	2.67	2.83	3.00	3.00	2.67	2.67	2.33
CSI061	Industrial IoT: Smart Manufacturing	2.67	2.17	2.33	2.83	3.00	2.00	2.00	2.50	2.00	1.75	2.00	2.17	3.00	2.00	2.00
CSI062	IoT Applications	3.00	3.00	2.83	3.00	3.00	3.00	3.00	2.00	3.00	3.00	3.00	3.00	3.00	2.67	2.00

CIP062	IoT Applications Lab	**3.00**	**3.00**	**2.83**	**3.00**	**3.00**	**3.00**	**3.00**	**2.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.67**	**2.00**
B.Tech-Computer Science & Engineering with specialization in Data Science & Analytics																
CSD102	Introduction to Data Science	**2.83**	**1.67**	**2.00**	**1.75**	**1.83**		**1.00**	**2.00**	**1.83**	**1.50**	**2.50**	**2.00**	**2.25**	**1.25**	**2.40**
CSD201	Data Collection and Preprocessing	**2.50**	**2.40**	**2.67**	**2.60**	**2.33**	**2.00**		**1.67**	**1.00**	**2.00**	**1.00**	**2.50**	**1.00**	**3.00**	**2.00**
CDP201	Data Collection and Preprocessing Lab	**2.50**	**2.40**	**2.67**	**2.60**	**2.33**	**2.00**		**1.67**	**1.00**	**2.00**	**1.00**	**2.50**	**1.00**	**3.00**	**2.00**
CSD202	Data Warehouse	**2.50**	**2.40**	**2.67**	**2.60**	**2.33**	**2.00**	**1.33**	**1.67**	**1.33**	**2.00**	**1.00**	**2.50**	**1.00**	**3.00**	**2.00**
CSD301	Data Mining	**2.50**	**2.40**	**2.67**	**2.60**	**2.33**	**2.00**	**1.33**	**1.67**	**1.33**	**2.00**	**1.00**	**2.50**	**1.00**	**3.00**	**2.00**
CDP301	Data Mining Lab	**2.50**	**2.40**	**2.67**	**2.60**	**2.33**	**2.00**	**1.33**	**1.67**	**1.33**	**2.00**	**1.00**	**2.50**	**1.00**	**3.00**	**2.00**
CSD302	Data Exploration and Visualization	**2.50**	**2.25**	**3.00**	**3.00**	**2.50**	**3.00**								**2.75**	**2.33**
CDP302	Data Exploration and Visualization Lab	**2.50**	**2.25**	**3.00**	**3.00**	**2.50**	**3.00**								**2.75**	**2.33**
CSD303	Big Data Analytics	**2.50**	**2.00**	**3.00**	**2.40**	**2.20**	**1.75**	**1.33**	**2.00**	**2.50**	**2.00**	**2.00**	**2.25**	**2.00**	**3.00**	**2.00**
CDP303	Big Data Analytics Lab	**2.50**	**2.00**	**3.00**	**2.40**	**2.20**	**1.75**	**1.33**	**2.00**	**2.50**	**2.00**	**2.00**	**2.25**	**2.00**	**3.00**	**2.00**
CSD401	Business Intelligence	**2.50**	**2.33**	**2.33**	**2.17**	**2.17**	**2.33**	**2.50**	**1.50**	**1.33**	**2.00**	**2.00**	**1.67**	**2.33**	**2.33**	**2.50**
CSD011	Business Process Management	**2.17**	**1.50**	**2.33**	**2.33**	**2.17**	**1.33**	**1.00**	**1.67**	**2.20**	**2.60**	**1.00**	**2.33**	**1.00**	**2.00**	**3.00**
CSD012	Introduction to ML for Data Science	**3.00**	**3.00**	**1.00**	**1.00**	**2.00**	**1.00**	**1.00**	**1.00**	**1.00**	**2.00**	**1.00**	**3.00**	**2.00**	**3.00**	**1.00**
CDP012	Introduction to ML for Data Science Lab	**3.00**	**3.00**	**1.00**	**1.00**	**2.00**	**1.00**	**1.00**	**1.00**	**1.00**	**2.00**	**1.00**	**3.00**	**2.00**	**3.00**	**1.00**
CSD021	Neural Networks for Data Science	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.33**	**2.33**	**1.17**	**2.33**	**3.00**	**2.67**	**3.00**	**3.00**	**3.00**	**2.67**
CDP021	Neural Networks for Data Science Lab	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.33**	**2.33**	**1.17**	**2.33**	**3.00**	**2.67**	**3.00**	**3.00**	**3.00**	**2.67**
CSD022	Business for Data driven Companies	**2.33**	**2.40**	**2.50**	**2.50**	**2.50**	**1.60**		**1.50**	**2.50**	**1.67**	**1.83**	**2.33**	**1.50**	**2.67**	**1.00**

CSD031	Deep Learning and Its Applications	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.00**	**3.00**		**3.00**	**3.00**		**2.67**	**3.00**	**3.00**	
CDP031	Deep Learning and Its Applications Lab	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.00**	**3.00**		**3.00**	**3.00**		**2.67**	**3.00**	**3.00**	
CSD041	Web & Text Analysis	**2.83**	**2.00**	**1.83**	**1.83**	**1.83**	**2.00**	**1.00**	**1.00**	**1.17**	**1.33**	**1.00**	**1.00**	**1.50**	**1.83**	**1.00**
CDP041	Web & Text Analysis Lab	**2.83**	**2.00**	**1.83**	**1.83**	**1.83**	**2.00**	**1.00**	**1.00**	**1.17**	**1.33**	**1.00**	**1.00**	**1.50**	**1.83**	**1.00**
CSD042	Social Media Analytics	**2.00**	**2.17**	**2.20**	**2.50**	**2.60**	**2.17**	**3.00**	**2.50**	**2.25**	**2.33**	**2.17**	**2.17**	**2.00**	**2.50**	**2.00**
CDP042	Social Media Analytics Lab	**2.00**	**2.17**	**2.20**	**2.50**	**2.60**	**2.17**	**3.00**	**2.50**	**2.25**	**2.33**	**2.17**	**2.17**	**2.00**	**2.50**	**2.00**
CSD051	HealthCare Analytics	**2.33**	**2.33**	**2.20**	**2.50**	**2.60**	**2.40**	**1.80**	**1.80**	**1.80**	**1.25**	**2.00**	**2.33**	**1.67**	**2.00**	**1.67**
CDP051	HealthCare Analytics Lab	**2.33**	**2.33**	**2.20**	**2.50**	**2.60**	**2.40**	**1.80**	**1.80**	**1.80**	**1.25**	**2.00**	**2.33**	**1.67**	**2.00**	**1.67**
CSD061	Predictive Analytics	**2.33**	**2.33**	**2.20**	**2.50**	**2.60**	**2.40**	**1.80**	**1.80**	**1.80**	**1.25**	**2.00**	**2.33**	**1.67**	**2.00**	**1.67**
B.Tech-Computer Science & Engineering with specialization in Cyber Security & Forensics																
CSC102	Introduction To Cyber Security & Laws	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CSC201	Digital Forensics	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CCP201	Digital Forensics Lab	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CSC202	Security Architecture	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CSC301	Ethical Hacking	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CCP301	Ethical Hacking Lab	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**
CSC302	Cryptography and Network Security	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**	**2.00**
CCP302	Cryptography and Network Security Lab	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**	**3.00**
CSC303	Intrusion Detection and Prevention System	**3.00**	**2.83**	**2.33**	**3.00**	**2.25**	**3.00**	**3.00**	**2.67**	**2.50**	**3.00**	**2.50**	**3.00**	**3.00**	**3.00**	**3.00**

CCP303	Intrusion Detection and Prevention System Lab	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	2.50	3.00	3.00	3.00	3.00
CSC401	Introduction to IoT and It's Security	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00	3.00
CSC011	Machine Learning	3.00	3.00	1.83	2.00	1.83	1.00		1.00	2.00	2.00		2.00	2.67	3.00	
CSC012	Business Communication and Ethics	1.83	1.50	2.25	1.50	2.00	2.00				1.80		2.25	1.00	1.00	
CSC021	Mobile and Wireless Security	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00	3.00
CSC022	Disaster Recovery Management	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00	3.00
CSC031	Exploit Writing	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00	3.00
CSC032	Malware Analysis	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00	3.00
CSC041	Cloud Security	2.50	2.50	2.50	2.50	2.00	2.00	0.00	1.80	2.00	1.80	2.20	1.40	2.33	2.25	2.00
CSC042	Penetration Testing	2.33	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00
CSC051	Digital Water Marking and Steganography	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00	3.00
CSC052	Information Security & Audit Monitoring	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
CSC061	Security Threats Intelligence and Risk Management	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00	3.00
CSC062	Web Application Security	3.00	2.83	2.33	3.00	2.25	3.00	3.00	2.67	2.50	3.00	3.00	2.50	3.00	3.00	3.00
B.Tech-Computer Science & Engineering with specialization in Blockchain Technology																
BCC102	Introduction to Blockchain Technology	2.50	2.67	2.17	2.17	2.17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.20	3.00	1.20
BCC201	Bitcoin and Cryptocurrencies	1.83	2.00	2.00	1.80	1.80	1.67	1.33	2.00	2.00	2.00	1.60	1.67	1.33	2.33	1.33
BCC202	Blockchain Using Multichain	2.33	2.67	2.33	1.33	2.17	1.67		1.25		1.00			1.00	2.17	2.00
BCC301	Programming in GO	2.00	2.00	2.00	2.00	2.00	2.50	1.75	1.75	1.67	1.75	2.00	1.75	1.00	2.50	1.20

BCL301	Programming in GO Lab	2.00	2.00	2.00	2.00	2.00	2.50	1.75	1.75	1.67	1.75	2.00	1.75	1.00	2.50	1.20
BCC302	Smart contracts using Ethereum	2.00	2.00	2.17	2.00	2.00	2.50	1.00	1.00	1.33	1.00	1.00	1.75	1.00	2.17	1.33
BCC303	Smart Contracts using Hyperledger Fabric			3.00		2.00		1.00	3.00		1.00		1.00	1.00	3.00	
BCC401	Cyber Security in Blockchain Technology	2.17	1.67	2.33	1.67	1.83	1.00	1.00	1.00	1.00	1.67	1.33	1.67	1.50	1.50	1.50
BCC011	Blockchain for Business	1.00	1.50	1.25	2.00	2.00		2.00	1.80			1.50		1.33	1.67	1.00
BCC021	Implementing Blockchain on cloud	2.33	1.83	2.00	1.75	2.00	2.50	1.75	1.75	1.67	1.75	2.00	1.75	1.33	1.83	1.83
BCC031	Cryptocurrency with Ethereum	1.83	2.50	2.20	1.75	2.40	2.50		2.20	1.00	1.50	1.00	1.00	2.00	2.33	1.50
BCC041	Open source for Blockchain using Hyperledger	1.67	2.17	2.25	2.00	1.50	2.33	1.50	1.75	1.50	2.00	1.75	2.00	1.83	1.67	1.80
BCC051	Disaster Recovery Management using Blockchain Technology															
BCC061	Blockchain Risk Management															
CSE250	Theory of Computation and Compiler Design	2.00	2.40	2.67	1.80	2.00			2.20	2.40			2.50	2.40	2.40	2.25
CSP250	Theory of Computation and Compiler Design Lab	2.00	2.00	2.80	3.00	2.40				2.75			2.75	2.40	2.00	2.33
CSE221	Linux Administration	2.67	2.25	2.00	2.33	2.00				2.67				2.50	2.33	2.00
CSP221	Linux Administration Lab	2.00	2.00	2.25	2.33	2.67				2.67				2.50	2.00	2.00
CSE288	Principle of Virtualization		2.83	2.50	3.00	3.00	2.50			3.00	2.50	1.00	2.75	1.50	1.00	1.50
CSE377	Mobile Security	2.67	2.25	2.00	2.33	2.00				2.67				2.50	2.33	2.00
CSE375	Introduction to Cloud Technology	1.83	2.00	2.50	1.33	2.67	1.33	1.50	2.00	2.33	2.67	2.17	2.50	3.00	2.00	2.33
CSP375	Introduction to Cloud Technology Lab	2.60	2.60	2.75	2.83	1.50	2.00	3.00	1.80	2.17	2.17	2.50	1.25	2.50	2.25	1.83
CSE378	Information and Network Security	2.67	2.25	2.00	2.33	2.00				2.67				2.50	2.33	2.00

CSP378	Information and Network Security Lab	**1.83**	**2.00**	**2.50**	**1.33**	**2.67**	**1.33**	**1.50**	**2.00**	**2.33**	**2.67**	**2.17**	**2.50**	**3.00**	**2.00**	**2.33**
CSE475	Security and Privacy of Online Social Networks	**2.60**	**2.20**	**2.25**	**2.33**	**1.33**		**1.00**	**1.80**	**2.17**	**2.00**	**2.40**	**1.50**	**2.50**	**2.20**	**1.67**
CSE373	Ethical Hacking	**2.67**	**2.25**	**1.75**	**2.00**					**2.67**				**2.50**	**2.33**	**1.50**
CSE016	Cloud Computing Solutions	**2.75**	**2.75**	**2.25**	**2.75**	**1.00**			**1.75**	**2.00**	**1.75**	**2.25**	**1.25**	**2.50**	**2.25**	**1.75**
CSE026	Cloud Web Services	**2.75**	**2.80**	**1.75**	**2.00**	**3.00**	**3.00**			**2.75**				**2.50**	**2.50**	**1.00**
CSE376	Emerging technology and Digital Transformation	**2.67**	**2.25**	**2.00**	**2.33**	**2.00**				**2.67**				**2.50**	**2.33**	**2.00**
CSE036	Advanced Linux Administration	**2.67**	**2.25**	**2.00**	**2.33**	**2.00**				**2.67**				**2.50**	**2.33**	**2.00**
CSE046	Cloud Security and Data Protection	**2.60**	**2.60**	**2.20**	**2.60**	**1.00**			**1.80**	**2.20**	**2.00**	**2.40**	**1.20**	**2.40**	**2.20**	**1.80**
CSE047	Server Administration	**2.60**	**2.60**	**2.20**	**2.60**	**1.00**			**1.80**	**2.20**	**2.00**	**2.40**	**1.20**	**2.40**	**2.20**	**1.80**
CSE056	Security operation and Incident Management	**2.60**	**2.40**	**2.20**	**2.20**	**1.00**			**1.80**	**2.20**	**2.00**	**2.40**	**1.20**	**2.40**	**2.20**	**1.80**
CSE057	Cloud Forensics	**2.67**	**2.25**	**2.00**	**2.33**	**2.00**				**2.67**				**2.50**	**2.33**	**2.00**
CSE066	Critical Infrastructure Security	**2.67**	**2.25**	**1.75**	**2.00**		**3.00**			**2.67**				**2.50**	**2.33**	**1.50**
CSE067	Disaster Recovery and Business Continuity Management	**2.67**	**2.25**	**2.00**	**2.25**	**2.00**	**3.00**			**2.67**				**2.50**	**2.33**	**2.00**

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

Course Outcome

- **Course Outcomes**–What is it?
    - Course outcomes (COs) are clear statements of what a student should be able to demonstrate on completion of a course.
    - COs should be assessable and measurable knowledge, skills, abilities and attitudes that student attains by the end of the course.
    - It is generally good idea to identify between 4 and 7 outcomes.
    - All courses in a particular programme shall have their own PO.
    - Each CO is mapped to relevant PO.
    - The teaching learning process and assessment process are to be designed in a way to achieve the COs.

Beginning words for Course Outcome:

Active verbs developed based on Bloom's Taxonomy

Knowledge	Understand	Apply	Analyze	Evaluate	Create
define	explain	solve	analyze	reframe	design
identify	describe	apply	compare	criticize	compose
describe	interpret	illustrate	classify	evaluate	create
label	paraphrase	modify	contrast	order	plan
list	summarize	use	distinguish	appraise	combine
name	classify	calculate	infer	judge	formulate
state	compare	change	separate	support	invent
match	differentiate	choose	explain	compare	hypothesize
recognize	discuss	demonstrate	select	decide	substitute
select	distinguish	discover	categorize	discriminate	write
examine	extend	experiment	connect	recommend	compile
locate	predict	relate	differentiate	summarize	construct
memorize	associate	show	discriminate	assess	develop
quote	contrast	sketch	divide	choose	generalize
recall	convert	complete	order	convince	integrate
reproduce	demonstrate	construct	point out	defend	modify
tabulate	estimate	dramatize	prioritize	estimate	organize
tell	express	interpret	subdivide	find errors	prepare
copy	Identify	Manipulate	survey	grade	produce
discover	indicate	Paint	advertise	measure	rearrange
duplicate	Infer	Prepare	appraise	predict	rewrite
enumerate	relate	produce	Break down	rank	role-play

(Reference: Retrieved from http://www.teachthought.com/learning/249-blooms-taxonomy-verbs-for-critical-thinking/)

School of Engineering and Technology							
Department Of Computer Science & Engineering							
B.Tech-Computer Science Engineering , Integrated B-Tech (CSE) + MBA, Integrated B-Tech (CSE) + M-Tech (SE)							
Batch: 2019 Onwards						TERM: I	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	CSE113	Programming for Problem Solving	3	0	0	3	
2	MTH142	Calculus and Abstract Algebra	3	1	0	4	
3	PHY117	Semiconductor Physics	2	1	0	3	
4	EEE112	Principles of Electrical and Electronics Engineering	2	1	0	3	
		OR					
	CHY111	Engineering Chemistry	3	0	2		
5	EVS112	Environmental Studies	3	0	0	3	
		OR					
	HMM111	Human Value & Ethics	2	0	0	2	
Practical/Viva-Voce/Jury							
6	ARP101	Communicative English-1	1	0	2	2	
7	CSP113	Programming for Problem Solving Lab	0	0	2	1	
8	CSP101	Introduction to Computer Science and Engineering	0	0	2	1	
9	MEP106	Computer Aided Design & Drafting	0	0	3	1.5	
		OR					
	MEP105	Mechanical Workshop	0	0	3		
10	EEP112	Principles of Electrical and Electronics Engineering	0	0	2	1	
		OR					
	CHY161	Engineering Chemistry Lab	0	0	2		
11	PHY161/162	Physics Lab –I / Physics Lab-II	0	0	2	1	
TOTAL CREDITS						**23.5/22.5**	

School of Engineering and Technology							
Department Of Computer Science & Engineering							
B.Tech-Computer Science Engineering , Integrated B-Tech (CSE) + MBA, Integrated B-Tech (CSE) + M-Tech (SE)							
Batch: 2019 Onwards						TERM: II	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	CSE114	Application based Programming in Python	3	0	0	3	
2	MTH145	Probability and Statistics	3	1	0	4	
3	CHY111	Engineering Chemistry	3	0	0	3	
	OR						
	EEE112	Principles of Electrical and Electronics Engineering	2	1	0		
4	HMM111	Human Value & Ethics	2	0	0	2	
	OR						
	EVS112	Environmental Studies	3	0	0	3	
5	PHY116	Engineering Physics	2	1	0	3	
Practical/Viva-Voce/Jury							
6	ARP102	Communicative English -2	1	0	2	2	
7	CSP103	Multimedia Application Lab	0	0	2	1	
8	CSP114	Application based Programming in Python	0	0	2	1	
9	MEP105	Mechanical Workshop	0	0	3	1.5	
	OR						
	MEP106	Computer Aided Design & Drafting	0	0	3		
10	CHY161	Engineering Chemistry	0	0	2	1	
	OR						
	EEP112	Principles of Electrical and Electronics Engineering	0	0	2		
11	PHY161/162	Physics Lab –I / Physics Lab-II	0	0	2	1	
TOTAL CREDITS						**22.5/23.5**	

School of Engineering and Technology							
Department Of Computer Science & Engineering							
B.Tech-Computer Science Engineering , Integrated B-Tech (CSE) + MBA, Integrated B-Tech (CSE) + M-Tech (SE)							
Batch: 2019 Onwards						TERM: III	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	BTY223	Introduction to Biology for Engineers	2	0	0	2	
2	CSE242	Data Structures	3	0	0	3	
3	CSE243	Object Oriented Programming Using Java	3	0	0	3	
4	CSE244	Principles of Operating System	3	0	0	3	
5	CSE245	Discrete Structures	3	1	0	4	
6	CSE247	Computer Organization and Architecture	3	0	0	3	
Practical/Viva-Voce/Jury							
7	ARP203	Aptitude Reasoning and Business Communication Skills - Basic	1	0	2	2	
8	CSP242	Data Structures Lab	0	0	2	1	
9	CSP243	Object Oriented Programming Using Java	0	0	2	1	
10	CSP244	Principles of Operating System Lab	0	0	2	1	
11	CSP251	Project Based Learning (PBL) -1	0	0	2	1	
12	CSP294	Summer Internship-I	-	-	-	1	
TOTAL CREDITS						**25**	

School of Engineering and Technology							
Department Of Computer Science & Engineering							
B.Tech-Computer Science Engineering , Integrated B-Tech (CSE) + MBA, Integrated B-Tech (CSE) + M-Tech (SE)							
Batch: 2019 Onwards						TERM: IV	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	CSE249	Data Base Management System	3	0	0	3	
2	CSE251	Theory of Computation	3	1	0	4	Discrete Structures
3	CSE252	Computer Networks	3	0	0	3	
4	PE-1	Program Elective-1	3	0	0	3	
	CSE011	Mathematical Techniques					
	CSE012	Introduction to Graph Theory and its Applications					
5	OE1	Open Elective – 1	2	0	0	2	
Practical/Viva-Voce/Jury							
6	CSP249	Data Base Management System Lab	0	0	2	1	
7	CSP252	Computer Networks Lab	0	0	2	1	
8	CSP298	Project Based Learning (PBL) -2	0	0	2	1	PBL-I
9	ARP204	Aptitude Reasoning and Business Communication Skills-Intermediate	1	0	2	2	
TOTAL CREDITS						**20**	

School of Engineering and Technology							
Department Of Computer Science & Engineering							
B.Tech-Computer Science Engineering , Integrated B-Tech (CSE) + MBA, Integrated B-Tech (CSE) + M-Tech (SE)							
Batch: 2019 Onwards							TERM: V
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	CSE350	Design and Analysis of Algorithm	3	1	0	4	Data Structure
2	CSE351	Software Engineering and Testing Methodologies	3	0	0	3	
3	CSE021	Introduction to Cloud Computing	3	0	0	3	Operating System
	CSE022	Android Application Development					OOP using Java
	CSE023	Quantum Computing					
	CSE024	Parallel Computing Algorithms					
	CSE025	3D Printing and Software Tools					
4	OE-2	Open Elective – 2	3	0	0	3	
Practical/Viva-Voce/Jury							
5	ECC301	Community Connect	-	-	-	2	
6	ARP301	Quantitative Aptitude Behavioral and Interpersonal Skills	1	0	2	2	
7	CSP350	Design and Analysis of Algorithm Lab	0	0	2	1	Data Structure Lab
8	CSP395	Technical Skill Enhancement Course-1 Simulation Lab	0	0	2	1	Operating system, Database Management system
9	CSP351	Project Based Learning (PBL) -3	0	0	2	1	PBL-2
10	CSP394	Summer Internship-II	-	-	-	1	Summer Internship-I
TOTAL CREDITS						**21**	

S. No.	Course Code	Course	Teaching Load L	T	P	Credits	Pre-Requisite/Co Requisite
School of Engineering and Technology							
Department Of Computer Science & Engineering							
B.Tech-Computer Science Engineering , Integrated B-Tech (CSE) + MBA, Integrated B-Tech (CSE) + M-Tech (SE)							
Batch: 2019 Onwards						TERM: VI	
THEORY SUBJECTS							
1	HMM305	Management for Engineers	3	0	0	3	
2	CSE352	Web Technologies	2	0	0	2	
3	CSE353	Compiler Design	3	0	0	3	
4	PE3	Program Elective-3	3	0	0	3	
	CSE031	Digital Image Processing					
	CSE032	Cryptography and Network Security					
5	PE4	Program Elective-4	3	0	0	3	
	CSE041	Software Project Management					
	CSE042	Software Testing					
6	OE-3	Open Elective – 3	3	0	0	3	
Practical/Viva-Voce/Jury							
7	ARP302	Higher Order Mathematics and Advanced People Skills	1	0	2	2	
8	CSP352	Web Technologies Lab	0	0	2	1	Java
9	CSP353	Compiler Design Lab	0	0	2	1	Principles of Operating system Lab
10	CSP396	Technical Skill Enhancement Course-2(Application Development Lab)	0	0	2	1	
11	CSP392	Project Based Learning (PBL) -4	0	0	2	1	PBL-3
TOTAL CREDITS						**23**	

School of Engineering and Technology							
Department Of Computer Science & Engineering							
B.Tech-Computer Science Engineering , Integrated B-Tech (CSE) + MBA, Integrated B-Tech (CSE) + M-Tech (SE)							
Batch: 2019 Onwards						TERM: VII	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
1	CSE451	Artificial Intelligence	3	0	0	3	
2		Program Elective-5	3	0	0	3	
	CSE051	Wireless Networks					
	CSE052	Risk Management					
3		Program Elective-6	3	0	0	3	
	CSE061	Introduction to Internet of Things					
	CSE062	Mobile Computing					
4		Comprehensive Examination	0	0	0	0	Audit
5	OE4	Open Elective - 4	3	0	0	3	
Practical/Viva-Voce/Jury							
6	CSP451	Artificial Intelligence Lab	0	0	2	1	
7	CSP497	Major Project- 1	-	-	-	3	PBL-4
8	CSP499	Summer Internship-III	-	-	-	1	Summer Internship-II
TOTAL CREDITS						**17**	

School of Engineering and Technology							
Department Of Computer Science & Engineering							
B.Tech-Computer Science Engineering , Integrated B-Tech (CSE) + MBA, Integrated B-Tech (CSE) + M-Tech (SE)							
Batch: 2019 Onwards						TERM: VIII	
S. No.	**Course Code**	**Course**	**Teaching Load**			**Credits**	**Pre-Requisite/Co Requisite**
			L	**T**	**P**		
THEORY SUBJECTS							
Practical/Viva-Voce/Jury							
1	CSP498	Major Project - 2	-	-	-	8	Major Project - 1
TOTAL CREDITS						**8**	
		Term	L	T	P	**Credits**	
		TERM-I.	19	3	20	23.5/22.5	
		TERM-II.	19	3	18	22.5/23.5	
		TERM-III.	18	1	10	25	
		TERM-IV.	15	1	8	20	
		TERM-V.	13	1	8	21	
		TERM-VI.	18	0	10	23	
		TERM-VII.	12	0	2	17	
		TERM-VIII.	-	-	-	8	
		TOTAL CREDITS				160	

C. Course Syllabuses

TERM-I

School: SET		Batch :		
Program: B.Tech		**Current Academic Year:**		
Branch: ALL		**Semester:1**		
1	Course Code	**CSE113**	Course Name: Programming for problem solving	
2	Course Title	Programming for problem solving		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Core		
5	Course Objective	1. Learn basic programming constructs –data types, decision structures, control structures in C 2. learning logic aptitude programming in c language 3. Developing software in c programming		
6	Course Outcomes	Students will be able to: CO1: **demonstrate** the algorithm, Pseudo-code and flow chart for the given problem. CO2**: develop** better understanding of basic concepts of C programming. CO3: **create** and implement logic using array and function. CO4: **construct** and implement the logic based on the concept of strings and pointers. CO5: **apply** user-defined data types and I/O operations in file. CO6: **design** and develop solutions to real world problems using C.		
7	Course Description	Programming for problem solving gives the Understanding of C programming and implement code from flowchart or algorithm		
8	Outline syllabus			CO Mapping
	Unit 1	**Logic Building**		
	A	Flowchart: Elements, Identifying and understanding input/ output, Branching and iteration in flowchart		CO1,
	B	Algorithm design: Problem solving approach(top down/bottom up approach)		CO1
	C	Pseudo Code : Representation of different construct, writing pseudo-code from algorithm and flowchart		CO1
	Unit 2	**Introduction to C Programming**		
	A	Introduction to C programming language, Data types, Variables, Constants, Identifiers and keywords, Storage classes		CO2, CO6
	B	Operators and expressions, Types of Statements: Assignment, Control, jumping.		CO2, CO6

	C	Control statements: Decisions, Loops, break, continue			CO2, CO6
	Unit 3	**Arrays and Functions**			
	A	Arrays: One dimensional and multi dimensional arrays: Declaration, Initialization and array manipulation (sorting, searching).			CO3, CO6
	B	Functions: Definition, Declaration/Prototyping and Calling, Types of functions, Parameter passing: Call by value, Call by reference.			CO3, CO6
	C	Passing and Returning Arrays from Functions, Recursive Functions.			CO3, CO6
	Unit 4	**Pre-processors and Pointers**			
	A	Pre-processors: Types, Directives, Pre-processors Operators (#,##,\) , Macros: Types, Use, predefined Macros			CO4, CO6
	B	Pointer: Introduction, declaration of pointer variables, Operations on pointers: Pointer arithmetic, Arrays and pointers, Dynamic memory allocation.			CO4, CO6
	C	String: Introduction, predefined string functions, Manipulation of text data, Command Line Arguments.			CO4, CO6
	Unit 5	**User Defined Data Types and File Handling**			
	A	Structure and Unions: Introduction, Declaration, Difference, Application, Nested structure, self-referential structure, Array of structures, Passing structure in function.			CO5, CO6
	B	Files: Introduction, concept of record, I/O Streaming and Buffering, Types of Files: Indexed file, sequential file and random file,			CO5, CO6
	C	Creating a data file, Opening and closing a data file, Various I/O operations on data files: Storing data or records in file, adding records, Retrieving, and updating Sequential file/random file.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Kernighan, Brian, and Dennis Ritchie. *The C Programming Language*			
	Other References	1. B.S. Gottfried - Programming With C - Schaum's Outline Series - Tata McGraw Hill 2nd Edition - 2004. 2. E. Balagurusamy - Programming in ANSI C - Second Edition - Tata McGraw Hill- 1999			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)

1.	**CO1:** demonstrate the algorithm, Pseudo-code and flow chart for the given problem.	**PO1,PO2,PO3, PO9, PSO1,PSO2**
2.	**CO2:** develop better understanding of basic concepts of C programming.	**PO1,PO3, PO4, PO5, PO9, PO11,PSO1,PSO2**
3.	**CO3:** : create and implement logic using array and function.	**PO1,PO3,PO4, PO9, PSO2**
4.	**CO4:** construct and implement the logic based on the concept of strings and pointers.	**PO1,PO3,PO4, PO9, PSO2**
5.	**CO5:** apply user-defined data types and I/O operations in file.	**PO1,PO3,PSO2**
6	**CO6:** design and develop solutions to real world problems using C.	**PO1,PO2,PO3,PO4,PO9, PO11,PSO1 PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name Programming for problem solving (Course Code CSE 113)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	1	2	2	_	_	-	_	_	2	_	_	_	1	2	_
CO2	2	_	3	2	2	-	_	_	1	_	1	_	2	2	_
CO3	3	_	2	1	_	_	_	_	3	_	_	_	_	2	_
CO4	1	_	2	1	_	_	_	_	1	_	_	_	_	3	_
CO5	1	_	1	_	_	_	_	_	_	_	_	_	_	1	_
CO6	3	3	3	2	-	-	_	_	2	_	2	_	2	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE 113	Programming for problem solving	1.83	2.50	2.17	1.50	2.00				1.80		1.50		1.67	2.17	1.00

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch : 2018- 2021**
Program: B.Tech.		**Current Academic Year: 2018-19**
Branch: CSE		**Semester: 1**
1	Course Code	**MTH 142**
2	Course Title	**Calculus and Abstract Algebra**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.
6	Course Outcomes	CO1: Explain the concept of differential calculus, illustrate thecurvature and Maxima, minima and saddle point. (K2, K3, K4) CO2: Explain the basic concepts matrices and determinate, evaluate system of linear equation by using rank and inverse method. (K2, K3, K5) CO3: Explain the basic concept of sets, relation, functions, groups Rings and Field. (K2, K4) CO4: Discuss the basic of Vector spaces. (K1, K3) CO5: Describe and use the linear transformation and evaluate nullity and kernel. (K1, K2, K3, K5) CO6:Explain the concept of Eigen values and Eigen vectors; evaluate the diagonalization of matrices,explain the basic introduction of Inner product spaces.(K2, K3, K4, K5)
7	Course Description	This course is an introduction to the fundamental of Mathematics. The primary objective of the course is to develop the basic understanding of differential and integral calculus, linear Algebra and Abstract Algebra.

8	**Outline syllabus:Calculus and Abstract Algebra**		**CO Mapping**
	Unit 1	**Calculus**	
	A	Differentiation, Taylor's and Maclaurin theorems with remainders; indeterminate forms, L' Hospital's rule.	CO1
	B	Maxima and minima, Partial derivatives, Euler's theorem.	CO1
	C	Total derivative. Evaluation of double integration. Applications of double integral (to calculate area).	CO1
	Unit 2	**Matrices**	
	A	Matrices, vectors: addition and scalar multiplication, matrix multiplication.	CO2
	B	Linear systems of equations, linear Independence, rank	CO2

		of a matrix, determinants, Cramer's Rule		
	C	Inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.		CO2
	Unit 3	**Basic Algebra**		
	A	Sets, relations and functions.		CO3
	B	Basics of groups, cyclic groups.		CO3
	C	Subgroups, basics of Rings and Field.		CO3
	Unit 4	**Vector spaces**		
	A	Vector Space, linear dependence of vectors, basis, dimension.		CO4, CO5
	B	Linear transformations (maps), range and kernel of a linear map, rank and nullity.		CO4, CO5
	C	Inverse of a linear transformation, Matrix associated with a linear map.		CO4, CO5
	Unit 5	**Vector spaces (Prerequisite Module 2 –Matrices & Module-4 Vector spaces)**		
	A	Eigenvalues, Eigenvectors		CO6
	B	Symmetric, skew-symmetric, and orthogonal Matrices, Diagonalization		CO6
	C	Basic introduction of Inner product spaces, Gram-Schmidt orthogonalization.		CO6
	Mode of examination	Theory		
	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%
	Text book/s*	1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002. 2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.		
	Other References	1. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005. 2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008. 3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010. 4. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.		

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C142.1	3	3	2	2	3	1	-	-	-	1	1	1
C142.2	3	3	3	2	2	2	-	-	-	1	1	2
C142.3	3	3	2	2	2	1	-	-	-	1	1	1
C142.4	3	3	2	2	2	1	-	-	-	1	1	1
C142.5	3	3	2	2	2	1	-	-	-	1	1	2
C142.6	3	3	2	3	2	2	-	-	-	1	1	2

PHY117 Semiconductor Physics

School: School of Basic Sciences and Research		**Batch:2019-2023**
Program: B.TECH .		**Current Academic Year: 2019-20**
Branch: CSE/EC/EEE		**Semester: I**
1	Course Code	PHY 117
2	Course Title	Semiconductor Physics
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	To make students proverbial with the fundamental concepts of Semiconductors materials and their real life applications for configuring various electronics devices.
6	Course Outcomes	After the completion of this course, CO1: Students will learn the various fundamental theory of materials and concept of solid classification. CO2: Students will learn the fundamental concepts of mobility, conductivity, electrons and holes in an intrinsic semiconductors, Donor and Acceptor impurities (n-type and p-type semiconductor), Fermi levels etc. CO3: Students will gain knowledge about the formation of depletion region, barrier potential, Zener diode, Characteristics of Zener diode etc. CO4: Students will have a clear understanding of Coherent sources, interaction of radiation with matter (spontaneous and stimulated emission), Einstein's relation, population inversion and pumping, etc. CO5: Students will learn the concept of optical sources: Light emitting diode (construction, basic working principle), semiconductor laser (construction, basic working principle), and optical detectors. CO6: Student will be familiar with the essential concepts of Semiconductors materials technology and their applications in industries.
7	Course Description	This course provides the basic foundation for understanding electronic semiconductor devices and their applications and limitations. It has introductory elements of various concept of material science. This course is essential for students who desire to specialize their engineering in Computer Sciences, Electronics, and Electronics and Electrical engineering.

8	Outline Syllabus		CO Mapping
	Unit 1	**Physics of Semiconductor**	
	A	Introduction, classical free electron theory (Lorentz-Drude theory and limitations), Quantum theory of free electron	CO1, CO6
	B	(Fermi energy, effect of temperature on Fermi-Dirac distribution) (qualitative analysis)	CO1
	C	Energy bands, Classification of Solids on the basis of energy band.	CO1

	Unit 2	**Transport phenomena in semiconductors**	
	A	Mobility, conductivity, electrons and holes in an intrinsic semiconductors, Donor and Acceptor impurities (n-type and p-type semiconductor)	CO2, CO6
	B	Fermi levels , carrier densities in semiconductor	CO2
	C	Concentration of electrons in conduction band and holes in valence band, Drift and diffusion current, Hall effect.	CO2
	Unit 3	**p-n Junction**	
	A	p-n junction, types of p-n junction (step-graded and Linearly-graded junction)	CO3
	B	formation of depletion region, barrier potential, Zener diode, Characteristics of Zener diode	CO3
	C	Avalanche and Zener breakdown, comparison of Zener diode and pn junction diode, concept of tunneling, I-V characteristics of tunnel diode.	CO3, CO6
	Unit 4	**Laser Physics**	
	A	Coherent sources, interaction of radiation with matter (spontaneous and stimulated emission), Einstein's relation	CO4
	B	population inversion and pumping, active components of laser, optical amplification or gain	CO4
	C	threshold condition for laser action, three and four level lasers, Ruby and He-Ne lasers.	CO4
	Unit 5	**Optoelectronic Devices**	
	A	optical sources: Light emitting diode (construction, basic working principle), semiconductor laser (construction, basic working principle)	CO5
	B	optical detectors: photodiode (working principle), p-i-n photodiode (working principle),	CO5, CO6
	C	Photovoltaic effect, p-n junction solar cell (basic working idea).	CO5, CO6
	Mode of Examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text books	Integrated Electronics- Millman - Halkias, Tata Mc Graw Hill	
	Other References	1. Semiconductor Devices Physics and Technology- S M Sze, John Wiley & Sons 2. Semiconductor Device Fundamentals- Robert F. Pierret Addison Wesley Longman. 3. Semiconductor Devices- Kanaan Kano, Pearson Education. 4. Basic Electronics by B.L Thareja 5. Principles of Electronics by V.K Mehta	

Instructional Plan

Academic Year: 2019-20 (Even Semester)

School: School of Basic Sciences and Research	**Subject: Physics**
Program: B.TECH	**Subject Code: PHY 118**
Branch: CSE/EC/EEE	**Instructor:**

Scheme			**Scheme of Examination**		
L 3	P 0	T 1	Internal Assessment 30%	Mid Term Examination 20%	End Term Examination 50%

Course Outline

In combination with basic knowledge of various concepts of semiconductors physics and their applications, the course discusses profound knowledge of real life applications.

Course Evaluation	
Attendance	None
Homework	5 assignments (may vary) **5 Marks**
Quizzes	5 (may vary) **15 Marks**
Presentations	Can be a presentation/Study/MOOC etc. **10 Marks**
Labs	None
Any Other	None
References:	
Text book	Integrated Electronics- Millman - Halkias, Tata Mc Graw Hill
Other References	1. Semiconductor Devices Physics and Technology- S M Sze, John Wiley & Sons 2. Semiconductor Device Fundamentals- Robert F. Pierret Addison Wesley Longman. 3. Semiconductor Devices- Kanaan Kano, Pearson Education. 4. Basic Electronics by B.L Thareja 5. Principles of Electronics by V.K Mehta
Software's	None

Session No.	Unit	Outline Syllabus	Evaluation Parameter	Pedagogy *
1	Unit 1 A	**Physics of Semiconductor**		
2	A	Introduction, classical free electron theory (Lorentz-Drude theory and limitations),		
3	A	Quantum theory of free electron		
4	B	(Fermi energy,		
5	B	effect of temperature on Fermi-Dirac distribution) (qualitative analysis)		
7	C	Energy bands,.		
8	C	Classification of Solids on the basis of energy band	I Assignment and 1 Quiz	
10	Unit 2 A	**Transport Phenomena in semiconductors**		
11	A	Mobility, conductivity, electrons and holes in an intrinsic semiconductors,		
12	A	Donor and Acceptor impurities (n-type		

		and p-type semiconductor)		
13	B	Fermi levels.		
14	B	carrier densities in semiconductor		
15	C	concentration of electrons in conduction band and holes in valence band		
16	C	Drift and diffusion current, Hall effect.	II Assignment and 2 Quiz	
17	Unit 3 A	**p-n Junction**		
18	A	p-n junction,		
19	A	Types of p-n junction (step-graded and Linearly-graded junction)		
20	B	Formation of depletion region, barrier potential,		
21	B	Zener diode, Characteristics of Zener diode		
22	C	Avalanche and Zener breakdown, comparison of Zener diode and pn junction diode,		
23	C	Concept of tunneling, I-V characteristics of tunnel diode.	III Assignment and 3 Quiz	
24	Unit 4 A	**Laser Physics**		
25	A	Coherent sources, interaction of radiation with matter (spontaneous and stimulated emission),		
	A	Einstein's relation		
26	B	Population inversion and pumping, active components of laser,		
27	B	Optical amplification or gain		
28	C	Threshold condition for laser action, three and four level lasers,		
29	C	Ruby and He-Ne lasers.		
30	Unit 5 A	**Optoelectronic Devices**		
31	A	Optical sources: Light emitting diode (construction, basic working principle),		
32	A	Semiconductor laser (construction, basic working principle)		
33	B	Optical detectors: photodiode (working principle),		
34	B	p-i-n photodiode (working principle),		
35	C	Photovoltaic effect,		
36	C	p-n junction solar cell (basic working idea).	IV Assignment and 4 Quiz	

Mapping of Course Outcomes vs. Topics

Outcome no. → Syllabus topic ↓	1	2	3	4	5	6

Unit 1 A	X					
Unit 1 B	X					X
Unit 1 C	X					
Unit 2 A		X				
Unit 2 B		X				X
Unit 2 C		X				
Unit 3 A			X			
Unit 3 B			X			X
Unit 3 C			X			
Unit 4 A				X		
Unit 4 B				X		X
Unit 4 C				X		
Unit 5 A					X	
Unit 5 B					X	X
Unit 5 C					X	

Mapping of CO Vs Pos:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
COPHY117.1	3	2	1	1	1	1	1	1	2	1	1	1
COPHY117.2	3	3	2	3	3	2	1	1	1	1	1	1
COPHY117.3	3	3	2	3	3	2	1	1	1	1	1	1
COPHY117.4	3	3	3	2	3	2	1	1	1	1	1	1
COPHY117.5	3	3	3	2	3	2	1	1	1	1	1	1
COPHY117.6	3	3	3	3	3	2	1	1	1	1	1	1

School: SET		**Batch : 2018-2022**
Program: B.Tech		**Current Academic Year: 2018-2019**
Branch:		**Semester: I/II**
1	Course Code	EEE112
2	Course Title	Principles of Electrical and Electronics Engineering
3	Credits	3
4	Contact Hours (L-T-P)	2-1-0
	Course Status	Compulsory
5	Course Objective	To provide the students with an introductory concept in the field of electrical and electronics engineering to facilitate better understanding of the devices, techniques and equipments used in engineering applications.
6	Course Outcomes	CO1: To analyze and solve basic electrical circuits CO3: To understand the working principle of transformer and identify its applications. CO3: To understand the working principle of dc and ac motors and identify the starting methods of single phase induction motor CO4: To apply the basics of diode to describe the working of rectifier circuits such as half and full wave rectifiers CO5: To apply the concepts of basic electronic devices to design various circuits CO6: Apply the basic concepts in Electrical and Electronics Engineering for multi-disciplinary tasks
7	Course Description	This initial course introduces the concepts and fundamentals of electrical and electronic circuits and devices. Topics include basic circuit analysis, diode and transistor fundamentals and applications. This course also introduces working principle and applications of dc/ac motors and transformers.

8	Outline syllabus		CO Mapping
	Unit 1	**DC & AC Circuits (6 lectures)**	
	A	Electrical circuit elements (R, L and C), series and parallel circuits, concept of equivalent resistance, Kirchhoff current and voltage laws, star-delta conversion	CO1,CO6
	B	Analysis of simple circuits with dc excitation and Superposition Theorem, Representation of sinusoidal waveforms, peak and rms values, real power, reactive power, apparent power, power factor	CO1,CO6
	C	Introduction to three phase system, relationship between phase voltages and line voltages,	CO1,CO6
	Unit 2	**Transformer(4 lectures)**	
	A	Working principle and construction of transformer, EMF equation	CO2,CO6
	B	Efficiency of transformer, Power and distribution	CO2,CO6

	transformer and difference between them	
C	Transformer applications in transmission and distribution of electrical power	CO2,CO6,
Unit 4	**Electrical Motors (6 lectures)**	
A	Construction, working principle, torque-speed characteristic and applications of dc motor.	CO3,CO6
B	Construction, working principle and applications of a three-phase induction motor, significance of torque-slip characteristic	CO3,CO6
C	Working principle starting methods and applications of single phase induction motor	CO3,CO6
Unit 4	**Semiconductor Diode and Rectifier (5 lectures)**	
A	PN junction and its biasing	CO4,CO6
B	Semiconductor diode, ideal versus practical diode , VI characteristics of diode	CO4,CO6
C	Half wave and full wave rectifiers with and without filters.	CO4,CO6
Unit 5	**Transistors (5 lectures)**	
A	Bipolar Junction Transistor (BJT) – Construction, working principle and input-output characteristics	CO5,CO6
B	BJT as CE amplifier and as a switch	CO5,CO6
C	Introduction to JFET	CO5,CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010. 2. S. K. Bhattacharya, “Basic Electrical and Electronics Engineering”, Pearson Publication. 3. Robert L Boylestad, “Electronic Devices and Circuit Theory” Pearson Education, 2009	
Other References	1. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.	

Course Articulation Matrix:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO112.1	3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO112.2	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO112.3	2	2	1	-	-	-	-	-	--	-	-	-	-	-	-
CO112.4	2	1	2	-	-	-	-	-	-	-	1	-	-	-	-
CO112.5	3	2	1	-	-	-	-	-	-	-	1	-	-	-	-
CO112.6	2	2	3	1	-	-	-	-	-	-	1	-	-	-	-

INSTRUCTIONAL PLAN

Academic Year: 2018-22 (Odd Semester)

School: SET

Subject: Principles of Electrical and Electronics Engineering

Program: B.Tech

Subject Code: EEE112

Branch: Electrical and Electronics Engineering

Instructor:

Course Evaluation					
Scheme			**Scheme of Examination**		
L	P	T	Internal Assessment	Mid Term Examination	End Term Examination
3	2	1	30%	20%	50%

Course outline

This initial course introduces the concepts and fundamentals of electrical and electronic circu and devices. Topics include basic circuit analysis, diode and transistor fundamentals a applications. This course also introduces working principle and applications of dc/ac motors a transformers.

Attendance	None
Homework	10 (Three Assignments)
Quizzes	15 (Three out of Four Quizzes)
labs	None
Presentations	5 (one)
References :	
Text book	1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. 2. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Publication. 3. Robert L Boylestad, "Electronic Devices and Circuit Theory" Pearson Education, 2009
Other References	1. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
Softwares	MATLAB MATLAB Simulink.

Session No.	**Unit**	**Outline syllabus**	**Evaluation Parameter**	**Pedagogy**
	I	**DC and AC Circuits (6)**		1. Power Point Presentations, videos through LCD Projector. 2. Use of white board
1	1a	Introduction to subject		
2	1a	Electrical circuit elements (R, L and C), series and parallel circuits, concept of equivalent resistance,		
3	1a	Kirchhoff current and voltage laws		
4	1a	star-delta conversion, Analysis of simple circuits with dc excitation, Superposition Theorem	Assignment I	
5	1b	Representation of sinusoidal waveforms, peak and rms values		
6	1c	Real power, reactive power, apparent power, power factor Introduction to three phase system, relationship between phase voltages and line	Assignment II and Quiz I	

		voltages.		
	II	**Transformer(4 lectures)**		1. Power Point Presentations, videos through LCD Projector. 2. Use of white board
7	2a	Working principle and construction of transformer		
8	2a	EMF equation of transformer		
9	2b	Efficiency of transformer, Power and distribution transformer and difference between them		
10	2c	Transformer applications in transmission and distribution of electrical power	Quiz II	
	III	**Electrical Motors (6 lectures)**		
11	3a	Construction and working principle of dc motor		1. Power Point Presentations, videos through LCD Projector. 2. Use of white board
12	3a	Torque-speed characteristic and applications of dc motor.	Mid Term Examination	
13	3b	Construction of three phase induction motor		
14	3b	working principle and applications of a three-phase induction motor		
15	3c	significance of torque-slip characteristics		
16	3c	Working principle starting methods and applications of single phase induction motor	Quiz III	
	IV	**Semiconductor Diode and Rectifier (5 lectures)**		Videos through LCD Projectors and Use of White Board
17	4a	Introduction to PN junction diode		
18	4a	Biasing of PN junction diode		
19	4b	VI characteristics of diode, ideal versus practical diode		
20	4c	Half and full wave rectifiers without filters		
21	4c	Half and full wave rectifiers wit filters	Assignment III	
	V	**Transistors (5 lectures)**		Videos through LCD Projectors and Use of White Board
22	5a	Construction of BJT		
23	5b	Working Principle of BJT	Assignment IV	
24	5b	input-output characteristics of BJT		
25	5b	BJT as CE amplifier and as a switch		
26	5c	Introduction to JFET	Quiz IV	

School: SET		Batch : 2019-2020	
Program: B. Tech		**Current Academic Year: 2019-2020**	
Branch: All		**Semester: I**	
1	Course Code	EVS-112	
2	Course Title	Environmental Science	
3	Credits	03	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Enable students to learn the concepts, principles and importance of environmental science 2. Provide knowledge of layers of atmosphere with an insight of role of climatic elements in dispersion of pollutants 3. Provide detailed knowledge of causes, effects and control of different types of environmental pollution, solid waste management and its effect on climate change, global warming and ozone layer depletion 4. Provide knowledge about ecosystem and biodiversity conservation 5. Provide and enrich the students about social issues such as R&R, water conservation and sustainability. 6. Overall understanding of environmental components and its protection and management.	
6	Course Outcomes	CO1.Understand the principles and scope of environmental science CO2.Knowledge about various types of natural resources and its conservation CO3.Study about the structure and composition of atmosphere and factors affecting weather and climate CO4.Study about pollution causes, effects and control and solid waste management and various policies to curb pollution problem CO5.About ecosystem and biodiversity and various strategies for biodiversity conservation. CO6.Overall understanding of the concepts of various elements of environment and related phenomenon.	
7	Course Description	Environmental Science emphasises on various factors as 1. Importance and scope of environmental science 2. Natural resource conservation 3. Pollution causes, effects and control methods and solid waste management 4. Social issues associated with environment	
8	Outline syllabus		CO Mapping
	Unit 1	**General Introduction**	
	A	Definition, principles and scope of environmental science	CO1/CO6
	B	Water Resources, Land Resources, Food Resources	CO1/CO6
	C	Mineral Resources, Energy Resources, Forest Resources	CO1/CO6
	Unit 2	**Atmosphere and meteorological parameters**	
	A	Structure and composition of atmosphere	CO2/CO6
	B	Meteorological parameters: Pressure, Temperature, Precipitation, Humidity,	CO2/CO6

	C	Radiation, Wind speed and direction, Wind Rose	CO2/CO6
	Unit 3	**Environmental Pollution (Cause, effects and control measures) and climate change**	
	A	Air, water, Noise and Soil pollution and Case studies	CO3/CO6
	B	Solid waste management: Causes, effects and control measures of urban and industrial wastes.	CO3/CO6
	C	Concept of Global Warming, green house effect, ozone layer depletion, Kyoto, IPCC concerns	CO3/CO6
	Unit 4	**Ecosystem and Biodiversity conservation**	
	A	Structure and Function of ecosystem, Energy flow in ecosystem, food chain, food web, and ecological succession	CO4/CO6
	B	Hot spots, Endangered and endemic species of India, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions	CO4/CO6
	C	Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.	CO4/CO6
	Unit 5	**Social Issues and the Environment**	
	A	Concept of sustainable development, Water conservation	CO5/CO6
	B	Resettlement and rehabilitation of people; its problems and concerns, Case studies	CO5/CO6
	C	Population explosion and its consequences	CO5/CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 30%; MTE: 20%; ETE: 50%	
	Text book/s*	**1.** Joseph, Benny, "Environmental Studies", Tata Mcgraw Hill. **2.** .Howard S. Peavy, Donald R. Rowe, George Tchobanoglous. Environmental engineering Mc Graw-Hill, 1985	
	Other References		

CO and PO Mapping

CO1	Understand the principles and scope of environmental science
CO2	Knowledge about various types of natural resources and its conservation
CO3	Study about the structure and composition of atmosphere and factors affecting weather and climate
CO4	Study about pollution causes, effects and control and solid waste management and various policies to curb pollution problem
CO5	About ecosystem and biodiversity and various strategies for biodiversity conservation
CO6	Overall understanding of the concepts of various elements of environment and related phenomenon

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO112.1	1	1	1	1	1	1	2	1	-	1	1	1	-	1	-
CO112.2	1	2	2	1	-	1	2	-	-	1	1	-	-	1	-
CO112.3	1	2	2	1	-	2	2	-	-	1	2	-	-	2	2
CO112.4	1	2	2	1	-	2	2	-	-	1	2	-	-	2	2
CO112.5	1	2	2	1	1	2	1	2	-	1	2	-	-	2	1
CO112.6	1	2	2	2	1	2	2	1	-	1	2	1	-	2	1

Batch : 2019-20

Schools: SET **Current Academic Year:** 2019-20

Semester: 1st

1	Course Code	**ARP101**
2	Course Title	Communicative English-1
3	Credits	2
4	Contact Hours (L-T-P)	1-0-2
5	Course Objective	To minimize the linguistic barriers that emerge in varied socio-linguistic environments through the use of English. Help students to understand different accents and standardise their existing English. Guide the students to hone the basic communication skills - listening, speaking, reading and writing while also uplifting their perception of themselves, giving them self-confidence and building positive attitude.
6	Course Outcomes	CO1 Learn to use correct sentence structure and punctuation as well as different parts of speech. Learning new words its application and usage in different contexts helpful in building meaning conversations and written drafts. Develop over all comprehension ability, interpret it and describe it in writing. Very useful in real life situations and scenarios. CO2 A recognition of one's self and abilities through language learning and personality development training leading up to greater employability chances. Learn to express oneself through writing while also developing positive perception of self. To be able to speak confidently in English CO3 To empower them to capitalise on strengths, overcome weaknesses, exploit opportunities, and counter threats. To ingrain the spirit of Positive attitude in students through a full length feature film followed by a storyboarding activity. Create a Self Brand, identity and self esteem through various interesting and engaging classroom activity CO4 Exposing students to simulataions and situations wherein students learn to describe people and situations and handle such situations effectively and with ease. Teaching students how to engage in meaningful dialogues and active conversational abilities to navigate through challenging situations in life and make effective conversations. Learn how to transform adverse beginnings into positive endings – through writing activities like story completion.
7	Course Description	The course is designed to equip students, who are at a very basic level of language comprehension, to communicate and work with ease in varied workplace environment. The course begins with basic grammar structure and pronunciation patterns, leading up to apprehension of oneself through written and verbal expression as a first step towards greater employability.
8		Outline syllabus – ARP 101

Unit A	**Sentence Structure**	**CO Mapping**
Topic 1	Subject Verb Agreement	CO1
Topic 2	Parts of speech	
Topic 3	Writing well-formed sentences	
Unit B	**Vocabulary Building & Punctuation**	
Topic 1	Homonyms/ homophones, Synonyms/Antonyms	CO1
Topic 2	Punctuation/ Spellings (Prefixes-suffixes/Unjumbled Words)	CO1, CO1

	Topic 3	Conjunctions/Compound Sentences	CO1, CO2
	Unit C	**Writing Skills**	
	Topic 1	Picture Description – Student Group Activity	CO3
	Topic 2	Positive Thinking - Dead Poets Society-Full-length feature film - Paragraph Writing inculcating the positive attitude of a learner through the movie | SWOT Analysis – Know yourself	CO3, CO2, CO3
	Topic 3	Story Completion Exercise –Building positive attitude - The Man from Earth (Watching a Full length Feature Film)	CO2, CO3 CO4
	Unit D	**Speaking Skill**	
	Topic 1	Self-introduction/Greeting/Meeting people – Self branding	CO2, CO3
	Topic 2	Describing people and situations - To Sir With Love (Watching a Full length Feature Film)	CO3, CO4
	Topic 3	Dialogues/conversations (Situation based Role Plays)	CO2, CO4 CO4
9	Evaluations	*Class Assignments/Free Speech Exercises / JAM Group Presentations/Problem Solving Scenarios/GD/Simulations (60% CA and 40% ETE*	*N/A*
10	Texts & References | Library Links	• Blum, M. Rosen. *How to Build Better Vocabulary*. London: Bloomsbury Publication • Comfort, Jeremy(et.al). *Speaking Effectively*. Cambridge University Press	

Observations:

1. A Single Consolidated Syllabus has now replaced the Previous Functional English Beginners -1 and Functional English Intermediate -1
2. Credits previously allocated to FEN 01 Lab Sessions have been dissolved
3. The Pearson Voice Labs have been completely eliminated
4. Max Students Size =80/Batch

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1										3		
CO2								1	1	2		
CO3				1				1	2			
CO4		1	1							1	2	

Syllabus: CSP 113: Programming for problem solving Lab

School: SET | **Batch: 2018**
Program: B.Tech. | **Current Academic Year: 2018-19**
Branch: CSE | **Semester: I**

1	Course Code	CSP113
2	Course Title	Programming for problem solving Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	1. Learn basic programming constructs –data types, decision structures, control structures in C 2. learning logic aptitude programming in c language 3. Developing software in c programming
6	Course Outcomes	Students will be able to: CO1: **Implement** core concept of c Programming CO2: **develop** programs using Array and String CO3: **create** Functions for any problem CO4: **Use** Union and Structure to write any program CO5: **implement** concept of Pointers CO6**: design** a real world problem with the help of c programming
7	Course Description	Programming for problem solving gives the Understanding of C programming and implement code from flowchart or algorithm

8	Outline syllabus		CO Mapping
	Unit 1	**Logic Building** Draw flowchart for finding leap year Write a c Program to Add Two Integers Write a program to create a calculator	**CO1, CO6**
	Unit 2	**Introduction to C Programming** Write a c program to convert length meter to cm Write a c program to convert temp Write a c program to swap two numbers	**CO2, CO6**
	Unit 3	**Arrays and Functions** Write a c program to calculate the average using arrays Write a c program to find the largest element of the array	**CO3, CO6**
	Unit 4	**Pre-processors and Pointers** Write a c program to swap two values using pointers Write a c program to find largest number from array using pointers	**CO4, CO6**
	Unit 5	**User Defined Data Types and File Handling** Write a c program to store information of a student using structure Write a c program to store information of a	**CO5, CO6**

	student using union
Mode of examination	Practical
Weightage Distribution	CA 60% MTE 0% ETE 40%
Text book/s*	Kernighan, Brian, and Dennis Ritchie. *The C Programming Language*
Other References	4. B.S. Gottfried - Programming With C - Schaum's Outline Series - Tata McGraw Hill 2nd Edition - 2004. 5. E. Balagurusamy - Programming in ANSI C - Second Edition - Tata McGraw Hill- 1999

Course outline

This course implements array and pointer and Recursive applications. The course talks primarily about Array, string, functions, structure & union and Pointers etc.

Course Evaluation	
Attendance	None
Any other	CA judged on the practicals conducted in the lab , weightage may be specified
References	
Text book	Kernighan, Brian, and Dennis Ritchie. *The C Programming Language*
Other References	1. B.S. Gottfried - Programming With C - Schaum's Outline Series - Tata McGraw Hill 2nd Edition - 2004. 2. E. Balagurusamy - Programming in ANSI C - Second Edition - Tata McGraw Hill- 1999
Softwares	Turbo C

PO and PSO mapping with level of strength for Course Name Programming for problem solving Lab **(Course Code CSP113)**

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSP113_ Programming for problem solving Lab	CO1	2	-	3	2	2	-	-	-	2	-	-	-	3	2	2
	CO2	3	-	3	2	2	-	-	-	3	-	-	-	3	3	1
	CO3	2	-	3	1	2	-	-	-	2	-	-	-	2	3	2
	CO4	1	-	2	1	1	-	-	-	2	-	-	-	2	2	-
	CO5	2	-	3	2	2	-	-	-	3	-	-	-	3	2	2
	CO6	3	-	3	3	1	-	-	-	2	-	-	-	2	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSP 113	Programming for problem solving Lab	2.17		2.83	1.83	1.67	-	-	-	2.33	-	-	-	2.50	2.50	1.80

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSP 101:Introduction to Computer Science and Engineering

School: SET	**Batch : 2018**	
Program:B.Tech	**Current Academic Year:**	
Branch: CSE	**Semester:I**	

1	Course Code	CSP101 Course Name	
2	Course Title	Introduction to Computer Science and Engineering	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	UG	
5	Course Objective	1. To familiarize the students about the importance of Undergraduate course on Computer Science & Engineering. 2. To discuss recent developments in hardware and software environments. 3. To focus future application areas of Computer Science and Engineering. 4. To discuss various research and development options in Computer Science and Engineering.	
6	Course Outcomes	**The student should be able to:** CO1: Understand the technical aspects of Computer Science & Engineering Course. CO2: Perceive some knowledge about programming in various applications. CO3: Acquire basic understanding about computer networking and related technology. CO4: Enhance some fundamental knowledge of DBMS including application areas. CO5: Understand the current trends in computing in discovering wisdom/knowledge and future prediction.	
7	Course Description	This course focuses application areas of Computer Science and Engineering for students admitted in undergraduate program. The purpose of B. Tech. in Computer Science & Engineering is to be given through this course to students.	
8	Outline syllabus		CO Mapping
	Unit 1	**Hardware aspect of Computer Science & Engineering**	
	A	History of Computing Systems, Computer Basics and Computer Organization.	
	B	Computer Architecture, Introduction to various connecting devices.	CO1
	C	Recent additions – IoT, Robotics and new alternate architectures.	
	Unit 2	**Programming Aspects**	
	A	Basics of Programming, Programming Paradigms, System Software versus Application Software.	
	B	Hard Computing versus Soft Computing, Data Structures and Algorithms.	CO2
	C	Computer Graphics, Multimedia, Computer	

	Vision.	
Unit 3	**Computer Networking**	
A	Introduction to Networking, Various terminologies, Client Server Technology, Web Technology.	
B	Introduction to data/network security and current trends.	CO3
C	Concept of Cloud Computing and Virtualization, Real life applications.	
Unit 4	**Database Management Systems**	
A	Introduction to DBMS, DBMS versus File System, Relational DBMS.	
B	Information Processing and Retrieval	CO4
C	Big Data Analytics & Scientific Computing	
Unit 5	**Artificial Intelligence**	
A	Basics of Artificial Intelligence	
B	Basics of Pattern Recognition	CO5
C	Basics of Machine Learning	
Mode of examination	Practical	
Weightage Distribution	CA 60% / MTE NIL / ETE 40%	
Text book/s*	1. Introduction to Computer, Peter Norton, 7/e, 2017, Tata McGraw Hill Publishing.	
Other References	2. Foundations of Computer Science, B A Forouzan& F Mosharraf, 2/e, 2008, Delmar Learning.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the technical aspects of Computer Science &Engineering Course.	PO1, PO2, PO12, PSO3
2.	**CO2:**Perceive some knowledge about programming in various applications.	PO1, PO12, PSO1, PSO3
3.	**CO3:** Acquire basic understanding about computer networking and related technology.	PO1, PO2, PO12, PSO2, PSO3
4.	**CO4:**Enhance some fundamental knowledge of DBMS including application areas.	PO1, PO12, PSO2, PSO3
5.	**CO5:** Understand the current trends in computing in discovering wisdom/knowledge and future prediction.	PO1, PO6, PO8, PO12, PSO2, PSO3

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3

CO 1	3	2	-	-	-	-	-	-	-	-	-	3	3	-	3
CO 2	3	2	-	-	-	-	-	-	-	-	-	3	-	3	2
CO 3	3	2	-	-	-	-	-	-	-	-	-	3	-	2	3
CO 4	3	-	-	-	-	-	-	-	-	-	-	3	-	3	2
CO 5	3	-	-	-	-	2	-	2	-	-	-	3	-	3	3

School: SET	**Batch : 2018-2022**
Program: B.Tech	**Current Academic Year: 2018**
Branch: ALL	**Semester: I**
1 Course Code	MEP 106
2 Course Title	Computer Aided Design & Drafting Laboratory
3 Credits	1.5
4 Contact Hours (L-T-P)	0-0-3
Course Status	Compulsory
5 Course Objective	The objective of this introductory course is to make students familiar with computer-aided drafting/ design, introduce them about the basic commands, tools and dimension techniques for creation and presentation of various engineering drawing by using AutoCAD software which helps in visualization and problem solving in engineering disciplines.
6 Course Outcomes	After successful completion of this course the student will be able to CO1: Understand the fundamental features of AutoCAD workspace and user interface. CO2: Apply the fundamental tools such as draw, edit, and view for creating two dimensional engineering drawings in AutoCAD. CO3: Choose advance features to present an engineering drawing in AutoCAD. CO4: Apply text and dimension features in the engineering drawing. CO5: Create different orthographic projections from a pictorial view. CO6: Analyze an engineering drawing and use the software packages for drafting and modeling.
7 Course Description	This introductory course is offered to students to make them proficient in design, layout, product development, and other careers that require technical drawing. Using the current version of the AutoCAD software, students will learn a variety of drawing techniques and be able to replicate specific drawings in multiple perspectives. The pinnacle of the class is to empower and enable students to create using the software provided. Career opportunities in 3D modeling, manufacturing, and engineering will also be explored. No drafting or computer experience is necessary.

8 Outline syllabus

List of Experiments		CO Mapping
Experiment 1	Introduction to AutoCAD and its interface	CO1
Experiment 2	Working with coordinates, Drawing offline, circle, arc, polygon and creating sketches	CO2
Experiment 3	Editing of drawing by using editing Tools and Power tools	CO2
Experiment 4	Creating of advanced feature like fillet, chamfer, hatch and using of block	CO3
Experiment 5	Representing text and dimensioning in AutoCAD	CO4
Experiment 6	Creating the drawings of mechanical components by using AutoCAD features.	CO2, CO3
Experiment 7	Creating the electrical circuit drawings in AutoCAD.	CO2
Experiment 8	Drawing plan and elevation of various buildings in AutoCAD.	CO2, CO4

Experiment 9	Creating the drawing of renowned constructions such as Taj Mahal in AutoCAD	CO3
Experiment 10	Creating of orthographic projections from a pictorial views	CO5

Mode of examination	Practical		
Weightage	CA	MTE	ETE
Distribution	60%	0%	40%
Text book/s*	1. Ibrahim Zaid,"CAD/CAM- Theory and Practice", McGraw Hill, International Edition.		
Software	AutoCAD		

1.3.5.1 COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PS
O106.1	2	2	2	-	3	-	-	-	-	-	-	3	3	3
O106.2	2	2	2	-	3	-	-	-	-	-	-	3	3	3
O106.3	2	2	2	-	3	-	-	-	-	-	-	3	3	3
O106.4	2	2	2	2	3	-	-	-	2	2	-	3	3	3
O106.5	2	2	2	2	3	-	-	-	2	2	-	3	3	3
O106.6	2	2	2	2	3	-	-	-	2	2	-	3	3	3

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

School: School of Engineering and Technology		**Batch: 2019-2023**	
Program: B.Tech.		**Current Academic Year: 2019-20**	
Branch: Physics		**Semester: I,II**	
1	Course Code	PHY 161	
2	Course Title	Physics Lab 1	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.	
6	Course Outcomes	On successful completion of the course the students will have: CO1: Knowledge and study of basic physics experiments based on simple harmonic motion CO2: Use the concept of stress, strain to calculate modulus of rigidity, Young's modulus. CO3: Understand how to determine moment of inertia of different bodies. CO4: Understand how to draw characteristic curves of different electronic components CO5: Understand how to calculate frequency using Melde's Experiment CO6: Apply the mathematical concepts/equations to obtain quantitative results and ability to conduct, analyze and interpret experiments	
7	Outline Syllabus		CO Mapping
	Unit 1 A B C	1. To verify the relation of time period using simple pendulum. 2. To determine the acceleration due to gravity and radius of Gyration of compound pendulum and compare with theoretical value.	CO1 CO2,CO6
	Unit 2 A B C	3. To measure the moment of inertia of a flywheel. 4. To determine the Young's modulus of a beam using cantilever beam experiment apparatus. 5. To determine vertical distance between two points using sextant.	CO2,CO6
	Unit3 A B C	6. To determine the modulus of rigidity of a material of a given wire with an inertia table (torsion pendulum) by dynamical method. 7. To calculate Moment of inertia of different irregular shapes.	CO3,CO6 CO4,CO6
	Unit 4 A B C	8. To determine the frequency of an electrically maintained tuning fork using Melde's Apparatus. (i) Transverse mode of vibration (ii) Longitudinal mode of vibration. 9. To determine the coefficient of viscosity of water by Poiseuille's method.	CO4,CO6
	Unit 5 A B C	10. To draw the characteristic curve of a PN junction diode. 11. To trace the circuit of a Half Wave Rectifier circuit and determine efficiencies and ripple factors with capacitor and inductor filters. 12. To trace the circuit of a Full Wave Rectifier circuit and	CO5,CO6 CO5,CO6

	determine efficiencies and ripple factors with capacitor and inductor filters.
Mode of Examination	Practical/Viva

Weightage Distribution	CA	MTE	ETE
	60%	0%	40%

Text books	1. B.Sc. Practical Physics- Harnam Singh, S. Chand Publishing. 2. B.Sc. Practical Physics- C L Arora, S. Chand Publishing.
Other References	1. Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co. 2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New

<u>Instructional Plan</u>

Academic Year: 2019-20 (Odd Semester)

School: School of Engineering and Technology
Program: B.Tech.
Branch: Physics

Subject: Physics Lab 1
Subject Code: PHY161
Instructor:

Scheme			**Scheme of Examination**		
L	P	T	Internal Assessment	Mid Term Examination	End Term Examination
0	0	1	60%	0%	40%

Course Outline

The list of experiments provides closure between the theoretical results and experimental readings taken in the physics laboratory. The Demonstration of each and every experiment helps the students to take up data independently and work on various research problems of physics.

Course Evaluation

Attendance	None
Any Other	CA judged on the practical conducted in the lab, weight age may be specified

References:

Text book	1. B.Sc. Practical Physics- Harnam Singh, S. Chand Publishing. 2. B.Sc. Practical Physics- C L Arora, S. Chand Publishing.
Other References	1. GeetaSanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co. 2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New
Softwares	None

Week 1	**Unit 1**	**Practical related to**	
	a, b, c	Lab expt. 1	To verify the relation of time period using simple pendulum.
Week 2	**Unit 1**	**Practical related to--**	
	a, b, c	Lab expt. 1	To verify the relation of time period using simple pendulum.
Week 3	**Unit 1**	**Practical related to—**	
	a, b, c	Lab expt. 2	To determine the acceleration due to gravity and radius of Gyration of compound pendulum and compare with theoretical value.
Week 4	**Unit 1**	**Practical related to--**	
	a, b, c	Lab expt. 2	To determine the acceleration due to gravity and radius of Gyration of compound pendulum and compare with theoretical value.
Week 5	**Unit 2**	**Practical related to--**	

	a, b, c	Lab expt. 3	To measure the moment of inertia of a flywheel.
Week 6	**Unit 2**	**Practical related to--Unit 2**	
	a, b, c	Lab expt. 4	To determine the Young's modulus of a beam using cantilever beam experiment apparatus.
Week 7	**Unit 2**	**Practical related to--Unit 2**	
	a, b, c	Lab expt. 5	To determine vertical distance between two points using sextant.
Week 8	**Unit 3**	**Practical related to--Unit 3**	
	a, b, c	Lab expt. 6	To determine the modulus of rigidity of a material of a given wire with an inertia table (torsion pendulum) by dynamical method.
Week 9	**Unit 3**	**Practical related to--Unit 3**	
	a, b, c	Lab expt. 7	To calculate Moment of inertia of different irregular shapes.
Week 10	**Unit 4**	**Practical related to--Unit 3**	
	a, b, c	Lab expt. 8	To determine the frequency of an electrically maintained tuning fork using Melde's Apparatus. (i) Transverse mode of vibration (ii) Longitudinal mode of vibration.
Week 11	**Unit 4**	**Practical related to--Unit 4**	
	a, b, c	Lab expt. 9	To determine the coefficient of viscosity of water by Poiseuille's method.
Week 12	**Unit 4**	**Practical related to--Unit 4**	
	a, b, c	Lab expt. 9	To determine the coefficient of viscosity of water by Poiseuille's method.
Week 13	**Unit 5**	**Practical related to--Unit 5**	
	a, b, c	Lab expt. 10	To draw the characteristic curve of a PN junction diode
Week 14	**Unit 5**	**Practical related to--Unit 5**	
	a, b, c	Lab expt. 11	To trace the circuit of a Half Wave Rectifier circuit and determine efficiencies and ripple factors with capacitor and inductor filters.
Week 15	**Unit 5**	**Practical related to--Unit 5**	
	a, b, c	Lab expt. 12	To trace the circuit of a Full Wave Rectifier circuit and determine efficiencies and ripple factors with capacitor and inductor filters.
Week 16	**Unit 5**	**Practical related to--Unit 5**	
	a, b, c	Lab expt. 12	To trace the circuit of a Full Wave Rectifier circuit and determine efficiencies and ripple factors with capacitor and inductor filters.

Mapping of Course Outcomes vs. Topics

Outcome no. → / Syllabus topic ↓	1	2	3	4	5	6
Unit 1 A	X					X
Unit 1 B	X					X
Unit 1 C		X				X
Unit 2 A		X				X
Unit 2 B		X				X
Unit 2 C		X				X
Unit 3 A			X			X
Unit 3 B			X			X
Unit 3 C				X		X
Unit 4 A				X		X
Unit 4 B				X		X
Unit 4 C				X		X
Unit 5 A					X	X
Unit 5 B					X	X
Unit 5 C					X	X

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO161.1	2	2	2	1	1	1	2	3	3	3	2	3
CO161.2	2	2	2	1	1	1	2	3	3	3	2	3
CO161.3	2	2	2	1	1	1	2	3	3	3	2	3
CO161.4	2	2	2	1	1	1	2	3	3	3	2	3
CO161.5	2	2	2	1	1	1	2	3	3	3	2	3
CO161.6	2	2	2	1	1	1	2	3	3	3	2	3

TERM-II

Syllabus for Application Based Programming in Python

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech.**	
Branch:		**CSE**	
1	Course Code	CSE114	
2	Course Title	Application Based Programming in Python	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	Emphasis is placed on procedural programming, algorithm design, and language constructs common to most high-level languages through Python Programming.	
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. Demonstrate program by using decision and repetition structures CO2. Construct programs by using Python lists, tuples and dictionaries CO3. Apply methods and functions to improve readability of programs. CO4. Develop logical problem using object-oriented programming methodology. CO5. Analyze and implement various tools, modules and packages for python. CO6. Design efficient logical solution for any given real life problem by using concise and efficient algorithms	
7	Course Description	Python is a language with a simple syntax, and a powerful set of libraries. It is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	CO1
	A	Python Environment, Variables, Data Types, Operators.	
	B	**Conditional Statements:** If, If- else, Nested if-else. **Looping:** For, While, Nested loops.	
	C	**Control Statements:** Break, Continue, And Pass. Comments	
	Unit 2	**List, Tuple and Dictionaries**	CO1, CO2
	A	**Lists and Nested List:** Introduction, Accessing list, Operations, Working with lists, Library Function and Methods with Lists	
	B	Strings: Introduction, Accessing items of a string, Operations, Working, Library Functions and Methods with strings. **Tuple:** Introduction, Accessing tuples, Operations, Working, Library Functions and Methods with Tuples.	
	C	Sets: Introduction, Operations, Working, functions with sets. Difference between set and lists.	

	Dictionaries : Introduction, Accessing values in dictionaries, Working with dictionaries, Library Functions	
Unit 3	**Functions and Exception Handling**	CO3
A	**Functions:** Defining a function, Calling a function, Types of functions, Function Arguments	
B	Anonymous functions, Global and local variables	
C	**Exception Handling**: Definition, Except clause, Try, finally clause, User Defined Exceptions	
Unit 4	**OOP and File Handling**	CO4
A	**OOPs concept** : Class and object, Attributes, Abstraction, Encapsulation, Polymorphism and Inheritance	
B	Static and Final Keyword, Access Modifiers and specifiers, scope of a class	
C	File Handling: Introduction, File Operations	
Unit 5	**Application based programming**	CO5,CO6
A	**Modules& packages :**Importing module, Math module, Random module, creating Modules	
B	Introduction to Numpy, pandas, Matplotlib	
C	**Applications: Searching Linear Search, Binary Search. Sorting: Bubble Sort**	
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	The Complete Reference Python, Martin C. Brown, McGraw Hill	
Other References	1. Introduction to computing in problem solving using Python, E Balahurusamy, McGraw Hill 2. Introduction to programming using Python, Y. Daniel Liang, Pearson 3. Mastering Python, Rick Van Hatten, Packet Publishing House 4. Starting out with Python, Tony Gaddis, Pearson	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. Demonstrate program by using decision and repetition structures	PO1,PO2,PO3,PO8,PO12,PSO2
2.	CO2. Apply methods and functions to improve readability of programs.	PO1,PO2,PO3,PO4,PO8,PO12,PSO2,PSO3
3.	CO3. Construct programs by using Python lists, tuples and dictionaries	PO1,PO2,PO3,PO8,PO12,PSO1, PSO2,PSO3
4.	CO4. Develop logical problem using object-oriented programming	PO1,PO2,PO3, PO4,PO5,PO6,PO8, PO12,PSO1,PSO2,PSO3

	methodology.	
5.	CO5. Analyze and implement various tools, modules and packages for python	PO1,PO2,PO3, PO4,PO5,PO6, PO8, PO12,PSO1,PSO2,PSO3
6.	CO6. Create efficient logical solution for any given real life problem by using concise and efficient algorithms.	PO1,PO2,PO3, PO4,PO5,PO6, PO8, PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Application Based Programming in Python (Course Code CSE 114)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSE114_Application Based programming in Python	CO 1	2	1	1					2				2		1	
	CO 2	2	2	2	1				2				2		2	1
	CO 3	2	2	1					2				2	1	2	1
	CO 4	2	2	2	2	1	2		2				2	1	2	2
	CO 5	2	2	2	2	3	2		2				2	2	2	1
	CO 6	3	3	2	2	2	2		2				2	2	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE114	**Application Based programming in Python**	**2.1**	**2**	**1.7**	**1.2**	**1**	**1**	**-**	**2**	**-**	**-**	**-**	**2**	**1**	**2**	**1.1**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET | Batch : 2018- 2021
Program: B.Tech. | Current Academic Year: 2018-19
Branch: CSE | Semester: II

1	Course Code	**MTH 145**
2	Course Title	**Probability and Statistics**
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	Compulsory
5	Course Objective	The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.
6	Course Outcomes	CO1: Explain the concept of probability and Random Variable. (K2,K3, K4) CO2: Explain the concept of distribution functions, densities andprobability distributions; illustrate discrete and continuous probability distributions. (K1, K2, K3, K4) CO3: Describe the concept of moments, skewness and Kurtosis; evaluate correlation and regression – Rank correlation; discuss bivariate distributions and their properties . (K1, K2, K5) CO4: Discuss the basic of Curve fitting by the method of least squares; evaluate straight lines, second degree parabolas and more general curves. (K1, K2, K5) CO5: Describe and use the concepts test of significance: Large sample test for single proportion, difference of proportions; calculate single mean, difference of means, and difference of standard deviations. (K1,K2,K3) CO6: Explain the basic concepts of tests of small samples- Student's T test, Chi-square test for goodness of fit, and evaluate the result. (K2, K4, K5)
7	Course Description	This course is an introduction to the fundamental of Mathematics. The primary objective of the course is to develop the basic understanding of statistics including measures of central tendency, correlation and regression, statistical methods of data sampling, probability and random variables and various discrete andcontinuous probability distributions and their properties.

8	**Outline syllabus :Probability and Statistics**		**CO Mapping**
	Unit 1	**Basic Probability**	
	A	Probability spaces, conditional probability, Bayes' rule.	CO1
	B	Discrete random variables, Independent random variables	CO1
	C	Expectation of Discrete Random Variables, Chebyshev's Inequality	CO1
	Unit 2	**Discrete and Continuous Probability Distributions**	
	A	Discrete Probability distributions: Binomial, Poisson.	CO2
	B	Continuous random variables and their properties,	CO2

	distribution functions and densities.	
C	Normal, exponential and gamma distribution.	CO2
Unit 3	**Statistics**	
A	Moments, skewness and Kurtosis.	CO3
B	Correlation and regression – Rank correlation.	CO3
C	Bivariate distributions and their properties.	CO3
Unit 4	**Applied Statistics**	
A	Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.	CO4, CO5
B	Test of significance: Large sample test for single proportion,	CO4, CO5
C	Difference of proportions, single mean, difference of means, and difference of standard deviations.	CO4, CO5
Unit 5	**Testing Hypothesis**	
A	Test for single mean, difference of means	CO6
B	test for ratio of variances	CO6
C	Chi-square test for goodness of fit and independence of attributes	CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. 2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint). 3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.	
Other References	1. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968. 2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C145.1	3	3	2	2	3	1	-	-	-	1	1	1
C145.2	3	2	3	2	2	2	-	-	-	1	1	2
C145.3	3	3	2	2	2	1	-	-	-	1	1	1
C145.4	3	2	2	2	2	1	-	-	-	1	1	1

C145.5	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**2**
C145.6	**3**	**3**	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**1**	**1**	**2**

ENGINEERING CHEMISTRY (CHY 111) (TERM I/II)

<table>
<tr><td colspan="2">School: SET</td><td colspan="2">Batch : 2018-2022</td></tr>
<tr><td colspan="2">Program: B.Tech.</td><td colspan="2">Current Academic Year: 2018-2019</td></tr>
<tr><td colspan="2">Branch: CS/EC/IT/EEE</td><td colspan="2">Semester:2</td></tr>
<tr><td>1</td><td>Course Code</td><td colspan="2">CHY 111</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="2">Chemistry for engineers</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="2">4</td></tr>
<tr><td>4</td><td>Contact Hours (L-T-P)</td><td colspan="2">3-1-0</td></tr>
<tr><td></td><td>Course Status</td><td colspan="2">Compulsory</td></tr>
<tr><td>5</td><td>Course Objective</td><td colspan="2">1. Make it comprehended the importance of clean water.
2. Describe to the basic concepts of spectroscopy as described in the module content and is to teach getting of valuable information from the same to apply in various engineering applications.
3. To provide an introduction to the basic concepts in Electrochemistry and apply them to understand batteries and corrosion.
4. To equip the students with the knowledge of modern technologies i.e. nanotechnology and its various engineering applications.</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td colspan="2">Students will be able to understand :
1. Realize the importance of clean and healthy water by giving knowledge about water quality parameters and cleaning measures.
2. In sighting the structural features of material by having the knowledge of spectroscopic techniques.
3. State the main cause of corrosion and prevention measures. Name the components of galvanic cell and applies these to the understand the batteries and corrosion of a metal.
4. Able to apply the basic information of engineering materials and their applications.
5. Able to have a basic knowledge of technology in modern days i.e. Nanotechnology and its various applications.
6. Have a thorough grounding in chemistry and a working knowledge of advanced chemistry.</td></tr>
<tr><td>7</td><td>Course Description</td><td colspan="2">• The course includes the fundamentals of Thermodynamics, Electrochemistry and batteries, corrosion, introduction to Chemistry of Materials, water technology and nanotechnology. This course satisfies the requirements of the Engineering program.</td></tr>
<tr><td>8</td><td colspan="2">Outline syllabus</td><td>CO Mapping</td></tr>
<tr><td></td><td>Unit 1</td><td>Water: Analysis and its treatment</td><td></td></tr>
</table>

	A	Water and water treatment: Drinking water standards, Water quality parameters and their measurement: pH (alkalinity and acidity –determination by titrimetry), Turbidity, Dissolved Oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), chloride, fluoride, oil and fats,	CO1, CO6
	B	hardness (definition and expression, estimation of hardness (EDTA method), nutrients (N, P, etc.), nitrate, dissolved metals.	CO1, CO6
	C	Municipal water treatment process - screening, sedimentation, flocculation;Coagulation, Filtration (Slow sand and rapid sand), disinfaction-chlorination.	CO1, CO6
	Unit 2	**Spectroscopic studies of materials**	
	A	Principles of spectroscopy and selection rules. Electronic spectroscopy: basic principle, 'Lamberts Beer's law,	CO2, CO6
	B	chromophore, effect of conjugation on chromophore and applications, Fluorescence and its applications in medicine.	CO2, CO6
	C	Basic principle and applications of Nuclear magnetic resonance and magnetic resonance imaging spectroscopy.	CO2, CO6
	Unit 3	**Electrochemistry, energy storage devices and corrosion**	
	A	Electrochemistry: Redox reactions, Nernst Equation, relation of e.m.f. with thermodynamic functions (ΔH, ΔF and Δ S). Electrochemical cells-	CO3, CO6
	B	Galvanic cells and Concentration cell, electrode potentials and its relevance to oxidation and reduction, measurement of EMF under standard conditions, determination of pH using Hydrogen electrode,	CO3, CO6
	C	primary battery: dry cells, secondary battery: Lead acid accumulator and Li Ion, fuel cells: H 2- O 2 . Corrosion: Types of corrosion, mechanism of Electrochemical corrosion, galvanic corrosion and protection against electrochemical corrosion.	CO3, CO6
	Unit 4	**Chemistry of materials**	
	A	:Structure, properties and application of carbon materials such as diamond, graphite, fullerenes, graphene. Liquid crystals: classification, Molecular ordering, identification, polymeric liquid crystals, and application of liquid crystals: displays and thermography.	CO4, CO6
	B	Organic and inorganic semiconductors. Basic concepts of Conducting polymer, types,p-doping, n-doping, comparison with metallic conductors, examples and applications.	CO4, CO6

	C	Biodegradable polymers: Basic information with common examples Polyglycolic acid (PGA), Polyhydroxy butyrate (PHB), Polyhydroxybutyrates-co-beta hydroxyl valerate(PHBV), Polycaprolactone(pcl).			CO4, CO6
	Unit 5	**Nano science and technology**			
	A	Introduction to nanoscience and technology, bio-nanoinformation,			CO5, CO6
	B	lithography, soft lithography, Dip pen nanolithography, CNT's			CO5, CO6
	C	Application of nanotechnology in microelectronics and in memory devices.			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	i. Puri, B.R., Sharma, L.R., and Pathania, M.S., "Principles of Physical Chemistry", Vishal publishing company. ii. Bahl Arun, Bahl B.S. and J.D Tuli, "Essentials of Physical Chemistry", S.Chand & Co. iii. University chemistry, by B. H. Mahan iv. Chemistry: Principles and Applications, by M. J. Sienko and R. A.Plane v. Fundamentals of Molecular Spectroscopy, by C. N. Banwell vi. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan vii. Physical Chemistry, by P. W. Atkins viii. Introduction to nanotechnology: C.P poole,Jr. F.J. Owens, willeyinterscience 2003. Nanotechnology, science, innovation and opportunity, LE foster, Pearson education 2007.			
	Other References	i. Collings, P.J., "Liquid Crystals", Princeton University Press. O.P. Vermani, A.K. Narula, "Industrial chemistry", Galgotia Publications.			

CO-PO MAPPING CS/IT

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	2	1	1	1	1	1	1	1	1	1	1
CO2	3	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	3	1	1	1	1	1	1	1	1	1	1	1	1	1
CO4	3	1	1	1	1	1	1	1	1	1	1	1	1	1
CO5	3	1	2	1	2	1	1	1	1	1	1	1	1	1
CO6	3	1	2	1	2	1	1	1	1	1	1	1	1	1

School: **School of Engineering and technology**
Department **Department of Computer Science and Engineering**
Program: **B.Tech**
Branch: **Computer Science**

1	Course No.	HMM111
2	Course Title	**Human** Value and Ethics
3	Credits	2
4	Contact Hours (L-T-P)	(2-0-0)2
5	Course Objective	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence
6	Course Outcomes	**On a successful completion of this course students will be able to** 1. Understand that the technical education without study of human values can generate more problems than solutions. 2. Define the principles and ideals, which help in making the judgement of what is more important. 3. See that ‘I’ and ‘Body’ are two realities, and most of their desires are related to ‘I’ and not body, while their efforts are mostly centered on the fulfilment of the needs of the body assuming that it will meet the needs of ‘I’ too. 4. Appreciate the importance of harmony in the self, family and the society for mutual fulfilment. 5. Understand the importance of harmony among human beings, other living beings and entire nature for universal equilibrium and mutual co-existence. 6. Know and practice the ethical approach in profession for continuous happiness and sustained prosperity.
7	Outline of syllabus:	
7.01	**Unit A**	**The Need and Process for Value Education**
7.02	Unit A Topic 1	The need, basic guidelines, content and process for Value Education
7.03	Unit A Topic 2	Concept of ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self exploration; Continuous Happiness and Prosperity- A look at basic Human Aspirations
7.04	Unit A Topic 3	Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority
7.05	**Unit B**	**Understanding Harmony in the Human Being - Harmony in Myself**
7.06	Unit B Topic 1	Human being as a co-existence of the sentient ‘I’ and the material ‘Body’
7.07	Unit B Topic 2	The needs of Self (‘I’) and ‘Body’ ; Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)
7.08	Unit B Topic 3	The characteristics and activities of ‘I’ and harmony in ‘I’ ; Understanding the harmony of I with the Body: Correct appraisal of Physical needs, meaning of Prosperity in detail
7.09	**Unit C**	**Harmony in the Family and Society**
7.10	Unit C Topic 1	Values in human-human relationship; Trust and Respect as the foundational values of relationship
7.11	Unit C Topic 2	Understanding the meaning of Trust; Difference between intention and competence; The meaning of Respect; Difference between respect and differentiation; the other salient values in relationship
7.12	Unit C Topic 3	Harmony in the society (society being an extension of family; Visualizing a universal harmonious order in society - from family to world family
7.13	**Unit D**	**Harmony in the Nature and Existence**
7.14	Unit D Topic 1	The harmony in the Nature
7.15	Unit D Topic 2	Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature
7.16	Unit D Topic 3	Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

7.17	**Unit E**	**Competence in professional ethics**
7.18	Unit E Topic 1	Ability to utilize the professional competence for augmenting universal human order
7.19	Unit E Topic 2	Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
7.20	Unit E Topic 3	Ability to identify and develop appropriate technologies and management patterns for above production systems.
8	Course Evaluation	
8.1	Course work: 30 marks	
8.11	Attendance	None
8.12	Homework	4 assignments, no weight
8.13	Quizzes/Class Tests	Two
8.14	Projects	None
8.15	Presentations	None
8.16	Any other	None
8.2	MTE	one, 20 marks
8.3	End-term examination: 50 marks	
9.1	Text books	1. R.R Gaur, R Sangal, G P Bagaria, "A foundation course in Human Values and professional Ethics", Excel books, New Delhi
9.2	Other references	1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. 2. A.N. Tripathy, 2003, Human Values, New Age International Publishers. 3. PL Dhar, RR Gaur, Science and Humanism, Commonwealth Purblishers.

Mapping of Outcomes vs. Topics

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
HMM 111	CO1	1	1	1	1	2	1	2			2	3	1	1	3	
	CO2	1	3	2	2	1	3	1	1	2		3	3	2	2	1
	CO3		2	2	2		2	2		1		1		1	3	2
	CO4	1		1	2	3				2	3		2			1
	CO5		3		1	2	3	2	1		2	2	1	3	1	
	CO6	2		1			1			1	1				2	3

PHY116 Engineering Physics

School: School of Science and engineering		**Batch: 2019-2023**	
Program: B.Tech		**Current Academic Year: 2019-20**	
Branch: CS		**Semester: II**	
1	Course Code	PHY116	
2	Course Title	Engineering Physics	
3	Credits	3	
4	Contact Hours (L-T-P)	2-1-0	
	Course Status	Compulsory	
5	Course Objective	1. To provide students an understanding of fundamentals of fibre optics and holography. 2. To provide knowledge of electricity and magnetism in line with phenomenon of electromagnetism and Maxwells equations. 3. To demonstrate Quantum mechanics in line with physics principles and theories.	
6	Course Outcomes	After the completion of this course, CO1: Students will show that they have learned the basics of fiber optics and its applications. CO2: Students will gain knowledge of principle of holography and its working phenomenon. CO3: Students will learn the concepts of electricity and magnetism. CO4: Students will be able to understand the significance and applications of Maxwell's equations. CO5: Students will be able to know about the short comings of classical physics and will learn various quantum mechanical principles. CO6: Students will have understanding of various concepts of physics and their applications in day to today life.	
7	Course Description	This course will help students to have deeper understanding of various fields of physics and their correlation with each other.	
8	Outline syllabus		CO Mapping
	Unit 1	**Fiber Optics and Holography**	

	A	Introduction, structure of optical fibre, Light guidance through optical fibre, Acceptance angle and Acceptance cone, Numerical aperture,	CO1, CO6
	B	Types of optical fibres, Attenuation and Dispersion in optical fibre, Applications of optical fibres.	CO1, CO6
	C	Basic principle of holography, Recording of holograms, Reconstruction process, Applications of holography.	CO2, CO6
	Unit 2	**Electrostatics and Magnetostatics**	
	A	Coulomb's law, Electric field, electric field due to a point charge, electric flux, Gauss's theorem and its applications to find field due to infinitely long straight wire,	CO3, CO6
	B	Electric potential, and potential difference, Biot-Savart law and its application to current carrying circular loop,	CO3
	C	Ampere's law and its applications to infinitely long straight wire, and solenoids.	CO3
	Unit 3	**Electromagnetism**	
	A	Electromagnetic induction; Faraday's law, induced emf and induced current; Lenz's Law, displacement current,	CO4, CO6
	B	Maxwell's Equations in differential and integral form and their physical significance,	CO4
	C	Application of Maxwell's equation in finding speed of light.	CO4
	Unit 4	**Quantum Mechanics**	
	A	Inadequacy of classical Physics, Wave particle duality, de-Broglie wavelength,	CO5, CO6
	B	Davisson-Germer experiment, Schrodinger wave equation, particle in a 1 dimensional box,	CO5
	C	Quantum Entanglement and Quantum Cryptography (qualitative).	CO5
	Mode of examination	Theory	

	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Fundamentals of Electricity and Magnetism, D. N. Vasudeva, S. Chand & Co. New Delhi 2. Fundamentals of Physics, Halliday, Resnick and Walker, John Wiley.			
	Other References	1. Electricity and Magnetism, J. Yarwood and J. H. Fewkes. University Tutorial Press (1991). 2. Lasers (Theory and Application): K.Thyagarajan & A.K.Ghatak 3. Introduction to fiber: A.K.Ghatak & K.Thyagarajan			

INSTRUCTIONAL PLAN
Academic Year: 2019-20 (Even Semester)

School: School of Science and Engineering	**Subject: Engineering Physics**
Program: B.Tech	**Subject Code: PHY116**
Branch: CS	**Instructor:**

Scheme			**Scheme of Examination**		
L 2	P 0	T 1	Internal Assessment 30%	Mid Term Examination 20%	End Term Examination 50%

Course outline

In Conjunction with basic knowledge of various phenomenon of physics, the course discusses about the applications of new research areas such as fibre optics and holography. It also involves the brief study about quantum entanglement and quantum cryptography and their relevance with the subatomic particles.

Course Evaluation	
Attendance	None
Homework	4 Assignments -5 Marks
Quizzes	4 Quizzes in Tutorial class -15 Marks
labs	None
Presentations	Presentation/Case Study/Project, 10 Marks
Any other	None

References :	
Text book	1. Fundamentals of Electricity and Magnetism, D. N. Vasudeva, S. Chand & Co. New Delhi 2. Fundamentals of Physics, Halliday, Resnick and Walker, John Wiley.
Other References	1. Electricity and Magnetism, J. Yarwood and J. H. Fewkes. University Tutorial Press (1991). 2. Lasers (Theory and Application): K.Thyagarajan & A.K.Ghatak 3. Introduction to fiber: A.K.Ghatak & K.Thyagarajan
Softwares	None

Session No.	**Unit**	**Outline syllabus**	**Evaluation Parameter**	**Pedagogy ***
1	Unit 1 A	Introduction, structure of optical fibre,		
2	A	Light guidance through optical fibre,		
3	A	Acceptance angle and Acceptance cone, Numerical aperture,		
4	B	Types of optical fibres,		
5	B	Attenuation and Dispersion in optical fibre,		
6	B	Applications of optical fibres.		
7	C	Basic principle of holography,		
8	C	Recording of holograms, Reconstruction process,		
9	C	Applications of holography.	1 Assignment and 1 Quiz	
10	Unit 2 A	Coulomb's law, Electric field,		
11	A	electric field due to a point charge, electric flux,		
12	A	Gauss's theorem and its applications to find field due to infinitely long straight wire,		
13	B	Electric potential, and potential difference,		

14	B	Biot-Savart law and its application to current carrying circular loop,		
15	C	Ampere's law and its applications to infinitely long straight wire,		
16	C	and solenoids.	1 Assignment and 1 Quiz	
17	Unit 3 A	Electromagnetic induction; Faraday's law,		
18	A	induced emf and induced current;		
19	A	Lenz's Law, displacement current,		
20	B	Maxwell's Equations in differential and integral form and their physical significance,		
21	C	Application of Maxwell's equation in finding speed of light.	1 Assignment and 1 Quiz	
22	Unit 4 A	Inadequacy of classical Physics,		
23	A	Wave particle duality, de-Broglie wavelength,		
24	B	Davisson-Germer experiment,		
25	B	Schrodinger wave equation,		
26	B	particle in a 1 dimensional box,		
27	C	Quantum Entanglement and		
28	C	Quantum Cryptography (qualitative).	1 Assignment and 1 Quiz	

*** Learning Centered, Learner Centered, Teaching Centered**
Mapping of Course Outcomes vs. Topics

Outcome no. → Syllabus topic↓	1	2	3	4	5	6
UNIT 1						
a	X					X

b	X					X
c		X				X
UNIT 2						
a			X			X
b			X			
c			X			
UNIT 3						
a				X		X
b				X		
c				X		
UNIT4						
a					X	X
b					X	
c					X	

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO116.1	3	3	3	3	3	3	3	2	3	3	1	3
CO116.2	3	3	3	3	3	3	2	2	3	2	2	2
CO116.3	3	2	2	2	2	2	1	-	2	2	1	1
CO116.4	3	2	2	3	2	2	1	-	2	2	1	1
CO116.5	3	3	3	2	1	2	2	-	2	3	2	3
CO116.6	3	3	3	2	3	3	3	1	2	2	1	3

Schools: SET

Batch : 2019-20
Current Academic Year: 2019-20
Semester: 2^{nd} (Second)

1	Course Code	**ARP102**
2	Course Title	Communicative English -2
3	Credits	2
4	Contact Hours (L-T-P)	1-0-2
5	Course Objective	To Develop LSRW skills through audio-visual language acquirement, creative writing, advanced speech et al and MTI Reduction with the aid of certain tools like texts, movies, long and short essays.
6	Course Outcomes	**CO1** Move from primary self-assessment to larger goal and vision statement realisation with the help of feature length films as enablers and multimedia as language facilitators. **CO2** To develop a positive attitude through written expression of positive thought process and outlook with the help of writing activities like story completion et al. **CO3** Learn advanced writing skills in English like full length essays et al. **CO4** Master the science of speech and correct pronunciation through the accent-neutralisation program followed by reading sessions applying the lessons learnt.
7	Course Description	The course takes the learnings from the previous semester to an advanced level of language learning and self-comprehension through the introduction of audio-visual aids as language enablers. It also leads learners to an advanced level of writing, reading, listening and speaking abilities, while also reducing the usage of L1 to minimal in order to increase the employability chances.
8		Outline syllabus – ARP 102

		CO Mapping
Unit A	**Acquiring Vision, Goals and Strategies through Audio-visual Language Texts**	
Topic 1	Pursuit of Happiness / Goal Setting & Value Proposition in life	
Topic 2	12 Angry Men / Ethics & Principles	CO1
Topic 3	The King’s Speech / Mission statement in life | strategies & Action Plans in Life	
Unit B	**Creative Writing**	
Topic 1	Story Reconstruction - Positive Thinking	
Topic 2	Theme based Story Writing - Positive attitude	CO2
Topic 3	Learning Diary Learning Log – Self-introspection	
Unit C	**Writing Skills 1**	
Topic 1	Precis	
Topic 2	Paraphrasing	CO3
Topic 3	Essays (Simple essays)	
Unit D	**MTI Reduction/Neutral Accent through Classroom Sessions & Practice**	
Topic 1	Vowel, Consonant, sound correction, speech sounds, Monothongs, Dipthongs and Tripthongs	CO4
Topic 2	Vowel Sound drills , Consonant Sound drills, Affricates and	

	Topic 3	Fricative Sounds Speech Sounds | Speech Music| Tone | Volume| Diction |Syntax |Intonation | Syllable Stress |	
	Unit E	**Gauging MTI Reduction Effectiveness through Free Speech**	
	Topic 1	Jam sessions	
	Topic 2	Extempore	*N/A*
	Topic 3	Situation-based Role Play	
9	Evaluations	*Class Assignments/Free Speech Exercises / JAM Group Presentations/Problem Solving Scenarios/GD/Simulations (60% CA and 40% ETE*	*N/A*
10	Texts & References | Library Links	• Wren, P.C.&Martin H. *High English Grammar and Composition*, S.Chand& Company Ltd, New Delhi. • Blum, M. Rosen. *How to Build Better Vocabulary*. London: Bloomsbury Publication • Comfort, Jeremy(et.al). *Speaking Effectively*. Cambridge University Press. The Luncheon by W.Somerset Maugham - http://mistera.co.nf/files/sm_luncheon.pdf	

Observations:

1. A Single Consolidated Syllabus has now replaced the Previous Functional English Beginners -2 and Functional English Intermediate -2
2. Credits previously allocated to FEN 02 the Lab Sessions have been dissolved
3. The Pearson Voice Labs have been completely eliminated
4. Max Students Size =80/Batch

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1					1	1	1	1	1			
CO2			1								1	
CO3										1		
CO4										1		

Multimedia Application Lab

School: SET		**Batch : 2019**	
Program: B.Tech/BCA		**Current Academic Year: 2020**	
Branch: CSE		**Semester:**	
1	**Course Code**	**CSP103**	**Multimedia Application Lab**
2	**Course Title**	**Multimedia Application Lab**	
3	**Credits**	**1**	
4	**Contact Hours (L-T-P)**	**0-0-2**	
	Course Status	**CORE**	
5	Course Objective	The objective of this course is to teach the principles of how different types of media can be processed and presented by computers with applications. It introduces how multimedia can be used in various application areas. It provides a solid foundation to the students so that they can identify the proper applications of multimedia, evaluate the appropriate multimedia systems and develop effective multimedia applications. In this Students will understand multimedia in respect to many applications, hardware and software needed to create projects using creativity and organization to create them, develop multimedia skills understanding the principal players of individual players in multimedia teams in developing projects, work with all aspects of images, sound, video, multimedia planning, designing, producing and present their multimedia projects.	
6	Course Outcomes	Students will be able to have thorough Understanding of: CO1-***Define:*** Fundamentals of Multimedia with software tools CO2- ***Illustrate:*** Different Graphics designing techniques with open software CO3- ***Apply:*** Software tools for web page design and animation CO4- ***Analyze:*** the Software tools of Multimedia applications CO5- ***Compare:*** various tools available for Multimedia applications CO6- ***Choose:*** The appropriate techniques for designing graphics designing and Animation of multimedia.	
7	Course Description	In this course students will learn basic introduction of Flash, Dreamweaver, and image, audio and video editing with animation techniques.	
8	Outline syllabus		CO Mapping
	1	Introduction to Flash	CO1, CO2, CO3
	2	Introduction to Corel draw and Dreamweaver	CO1, CO2, CO3
	3	Fundamentals of design & drawing	CO1, CO2, CO3
	4	Concepts of graphic & illustration	CO2, CO3,
	5	Graphic design	CO2, CO3,
	6	Image editing	CO2, CO3,
	7	Page layout	CO3, CO4,
	8	Concepts of web design	CO3, CO4,
	9	Web page designing	CO3, CO4,
	10	Interactive design	CO3, CO4, CO5
	11	Video editing	CO4, CO5, CO6
	12	Sound editing	CO4, CO5, CO6
	13	Responsive web design	CO4, CO5, CO6
	14	Animation & interactivity for web	CO4, CO5, CO6

	15	Basics of 2D animation, Digital storyboarding, Digital 2D animation			CO4, CO5, CO6
	Weightage Distribution		MTE	ETE	
			20%	50%	
	Text book/s*				
	Reference Books	Multimedia: Computing, Communications and Applications By Ralf Steinmetz			

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	***Define:*** Fundamentals of Modelling and Animation	PO1, PO2, PO3, PO10
2.	***Illustrate:*** Different techniques to create objects	PO1, PO2, PO3, PO4, PO6, PO9, PO10
3.	***Apply:*** Rendering and animation	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8
4.	***Analyze:*** the objects using modifiers in Animation	PO1, PO2, PO3, PO4, PO8, PO9, PO10
5.	***Measure:*** the objects in animation	PO1, PO2, PO3, PO8, PO9, PO10
6.	***Choose:*** The appropriate techniques for designing Animation	PO1, PO2,PO3, PO4, PO5, PO6, PO7

PO and PSO mapping with level of strength for Computer Modeling and Animation (Course Code CSP103)

Course Objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3	2	2	3	2	-	-	-	3	2	2
CO2	3	3	3	3	3	3	3	-	2	3	2	2
CO3	2	2	3	3	-	3	3	3	-	3	1	2
CO4	2	2	3	3	-	-	-	3	3	3	2	3
CO5	2	2	3	-	-	-	-	3	3	3	1	1
CO6	2	3	2	3	3	3	3	-	-	-	2	1
	2.4	2.5	2.6	2.3	1.5	1.8	1.5	1.5	1.3	2.5	1.6	1.8

- **Note: Software Required CorelDRAW, Adobe Illustrator, HTML & HTML5, Dreamweaver, Animate CC, CSS, Muse, Layar, Wordpress, Storyboard Pro Harmony**

Syllabus: CSP 114: Application based programming in Python Lab

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech.**	
Branch:		**CSE**	
1	Course Code	CSP114	
2	Course Title	Application Based Programming in Python Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	Emphasis is placed on procedural programming, algorithm design, and language constructs common to most high level languages through Python Programming.	
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1: Develop program based on procedural statements like assignments, conditional statements and loops. CO2: Compare and implement different data types of python. CO3: Create programs by using function and function call. CO4: Formulate clear and accurate logical solution by using OOPS CO5: Apply different modules, packages available in python. CO6: Design real life situational problems and think creatively about solutions of them.	
7	Course Description	Python is a language with a simple syntax, and a powerful set of libraries. It is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on conditional statements and control structures**	
		1. Program to implement all conditional statements 2. Program to implement different control structures	CO1,C06
	Unit 2	**Practical related to List, Tuples and dictionaries**	
		1. Program to implement operations on lists 2. Program to implement operations on Dictionary **3.** Program to implement operations on Tuple	CO2,CO6
	Unit 3	**Practical related to Functions and Exception Handling**	
		1. Program to implement Exception Handling **2.** Program to use different functions	CO3,CO6
	Unit 4	**Practical related to Object Oriented Programming**	
		1. Program to use object oriented concepts like inheritance, overloading polymorphism etc. 2.Program for file handling	CO4,CO6

	Unit 5	**Practical related to Modules and Applications**			
		1.Program to use modules and package 2.Program to implement searching and sorting			CO5,CO6
	Mode of examination	Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	2. The Complete Reference Python, Martin C. Brown, McGraw Hill			
	Other References	5. Introduction to computing in problem solving using Python, E Balagurusamy, McGraw Hill 6. Introduction to programming using Python, Y. Daniel Liang, Pearson 7. Mastering Python, Rick Van Hatten, Packet Publishing House Starting out with Python, Tony Gaddis, Pearson			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Develop program based on procedural statements like assignments, conditional statements and loops.	PO1,PO2,PO3,PO4,PO8,PO12,PSO2
2.	CO2: Compare and implement different data types of python.	PO1,PO2,PO3,PO4,PO5,PO8,PO12,PSO2,PSO3
3.	CO3: Create programs by using function and function call.	PO1,PO2,PO3,PO4,PO5,PO6,PO8,PO12, PSO1,PSO2,PSO3
4.	CO4: Formulate clear and accurate logical solution by using OOPS	PO1,PO2,PO3,PO4,PO5,PO6,PO8,PO12, PSO1,PSO2,PSO3
5.	CO5: Apply different modules, packages available in python.	PO1,PO2,PO3,PO4,PO5,PO6,PO8,PO12, PSO1,PSO2,PSO3
6.	CO6: Design real life situational problems and think creatively about solutions of them.	PO1,PO2,PO3,PO4,PO5,PO6,PO8,PO12, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name-Application Based Programming in Python Lab **(Course Code CSP 114)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSP114_Application Based programming in Python Lab	CO1	1	1	1	1				2				2		1	
	CO2	2	2	1	1	2			2				2		1	1
	CO3	2	2	1	1	1	1		2				2	1	2	1
	CO4	2	2	2	2	1	1		2				2	2	2	1
	CO5	2	2	2	2	2	2		2				2	2	2	2
	CO6	3	3	2	2	2	3		2				2	2	2	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO3
CSP114	Application Based programming in Python Lab	2	2	1.5	1.5	1.3	1.2	-	2	-	-	-	2	1.2	1.7	1.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch : 2018-2022**
Program: B.Tech		**Current Academic Year: 2018**
Branch: Mechanical Engineering		**Semester: II**
1	Course Code	MEP 105
2	Course Title	**Mechanical Workshop**
3	Credits	1.5
4	Contact Hours (L-T-P)	0-0-3
	Course Status	Compulsory
5	Course Objective	The objective of this course is to make the students, familiar with the modern day manufacturing processes, introduce them to various hand tools and equipment, acclimatize with the measuring devices, and perform basic machine tool operations in various machine tools.
6	Course Outcomes	After successful completion of this course, students will be able to CO1: Apply 5S (Seiri, Seiton, Seiso, Seiketsu and Shitsuke) methodology at workplace. CO2: Select the various hand tools used in the basic mechanical engineering workshop sections-smithy, carpentry, assembling, welding etc. CO3: Choose different measuring devices according to the job CO4: Differentiate between various machine tools and their operation CO5: Classify and select suitable tools for machining processes including turning, facing, thread cutting and tapping, milling, drilling and shaping. CO6: Apply the knowledge for advance manufacturing experiments.
7	Course Description	**Black Smithy Shop:** Simple exercises based on black smithy operations such as upsetting, practice of S -Hook from circular bar using hand forging operations. **Carpentry Shop :** Study of different types of wood , Carpentry Tools, Equipment and different joints, Practice of T joint, cross lap joint, Mortise and Tenon T joint, Bridle T joint **Fitting Shop:** Preparation of Square joint, V joint, half round joint, dovetail jointas per the given specifications, which contains: Sawing, Filing, Grinding, and Practice marking operations. **Sheet Metal Shop:** Study of galvanized Iron (G.I.) Sheet material properties, hand tools and sheet metal machines, and projective geometry, demonstration of different sheet metal operations and practice of development of Tray, cylinder, hopper, funnel etc. **Welding Shop:** Introduction, Study of Tools and welding Equipment (Gas and Arc welding), Selection of welding electrode and current, Bead practice and Practice of Butt Joint, Lap Joint. **Machine Shop:** Study of machine tools in particular Lathe machine (different parts, different operations, study of cutting tools), Demonstration of different operations on Lathe machine, Practice of Facing, Plane Turning, step turning, taper turning, knurling and parting and Study of Quick return mechanism of Shaper. **Foundry Shop:** Introduction to foundry, Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes, Demo of mould preparation and Practice – Preparation of mould by using split pattern.

8	Outline syllabus		CO Mapping
	List of Experiments		
	Experiment 1	To make a S shaped hook from a given circular rod using hand forging technique.	CO4
	Experiment 2	To make a dovetail lap joint in Carpentry shop.	CO2,CO3

	Experiment 3	To make a cross-half lap joint in Carpentry shop.			CO2,CO3
	Experiment 4	To make a square fit from the given mild steel pieces in fitting shop.			CO3,CO5
	Experiment 5	To prepare a V-Fit from the given mild steel pieces in fitting shop.			CO3, CO5
	Experiment 6	To make a rectangular tray of specified dimensions in sheet metal shop.			CO2, CO5
	Experiment 7	To make a Lap joint, using the given mild steel pieces using arc welding.			CO3, CO5
	Experiment 8	To perform step turning and taper turning operations on the given work piece			CO5
	Experiment 9	To prepare a sand mold, using the given single piece pattern			CO2
	Experiment 10	To prepare a sand mold, using the given Split-piece pattern.			CO2
	Mode of examination	Practical			
	Weight- age Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	1. Raghuwanshi B.S., Workshop Technology Vol. I & II, DhanpathRai& Sons. 2. Kannaiah P. and Narayana K.L., Workshop Manual, 2nd Edn, Scitech publishers. 3. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010. 4. JeyapoovanT.andPranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008.			

Program Outcome Vs Courses Mapping Table:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO105.1	1	-	-	-	-	2	-	-	-	-	-	2	-	-	-
CO105.2	1	-	-	-	1	2	-	-	-	-	-	1	1	-	1
CO105.3	2	-	1	-	1	2	-	-	-	-	-	2	1	-	1
CO105.4	2	-	1	-	2	2	-	-	-	-	-	2	1	-	1
CO105.5	2	-	1	-	2	2	-	-	-	-	-	2	2	-	1
CO105.6	2	-	1	-	2	2	-	-	-	-	-	2	2	-	1
CO105	**2**	**-**	**1**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**1**

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

Engineering Chemistry Lab (CHY-161)

School: SET		**Batch: 2018 – 22**	
Program: BTech		**Current Academic Year: 2018 – 19**	
Branch: All		**Semester: I**	
1	Course Code	CHY-161 Course Name: Engineering Chemistry Lab	
2	Course Title	Engineering Chemistry Lab	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Basic Engineering	
5	Course Objective	1. To learn methods for preparation of solution of different concentration, their standardization 2. To learn quantitative estimation of different chemical species by various volumetric methods. 3. To understand the practical concepts of reaction kinetics 4. To understand the procedure for testing of COD of water samples.	
6	Course Outcomes	CO1.Prepare solutions of different strength and standardize them. CO2.Estimate water alkalinity and hardness and hence water quality, the chloride ion/residual chlorine after disinfection CO3.Understand the different order of reactions like Zero, First and Second order. CO4.Prepare simple thermosetting polymers at small scale in laboratory. CO5.Understand the importance of microbial free water by testing for COD. CO6.Understand the basics of analytical chemistry which may be helpful to perform major engineering applications.	
7	Course Description	This course include various titration methods like acid-base titration, complexometric titration, precipitation titration etc. It also describe various calculations and units frequently used in analytical chemistry.	
8	Outline syllabus		CO Mapping
	Unit 1	**Preparation of standard solution**	**06**
	A	To prepare N/10 normality solution of sodium carbonate and use it to standardize the given hydrochloric acid solution.	
	B	To prepare N/30 normality solution of potassium dichromate and use it to standardize the given hypo solution.	CO1, CO6
	C	To determine the strength of given HCl solution by titrating with standard NaOH solution by (a)Indicator method (b) pH metrically	
	Unit 2	**Analysis of water**	**08**
	A	To determine the amount and constituents of alkalinity of given water sample.	CO2, CO6
	B	To determine the hardness of water by EDTA method.	

C	To determine the chloride content in water by Mohr's Method.	
D	To determine the residual chlorine in the given water sample.	
Unit 3	**Synthesis of polymer**	**02**
A	Preparation of Bakelite and Urea formaldehyde resin.	CO3, CO6
Unit-4	**Determination of kinetic parameters**	**04**
	To determine the rate constant and order of the reaction of hydrolysis of an ester catalyzed by an acid.	
	To determine the rate constant of hydrolysis of ethyl acetate with NaOH and show that the reaction is of second order.	CO4, CO6
Unit-5	**Determination of COD**	**02**
	To determine the chemical oxygen demand (COD) in the given water sample.	CO5,CO6
	Total Hours	**22**
Mode of examination	Practical	

Weightage	CA	MTE	ETE
Distribution	60%	None	40%
Text book/s*	Text book		
Other References	Other References		

CO and PO Mapping

CO1	Prepare solutions of different strength and standardize them.
CO2	the chloride ion/residual chlorine after disinfection
CO3	Understand the different order of reactions like Zero, First and Second order.
CO4	Prepare simple thermosetting polymers at small scale in laboratory.
CO5	Understand the importance of microbial free water by testing for COD.
CO6	Understand the basics of analytical chemistry which may be helpful to perform major engineering applications.

Note: Up to Unit 2C to be covered in the MTE.

Mapping with Pos and PSOs of CS and IT

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	-	2	1	2	-	3	3	2	2	-	-
CO2	2	3	1	-	2	1	2	-	3	3	2	2	-	-
CO3	2	3	1	-	2	1	2	-	3	3	2	2	-	-
CO4	2	3	1	-	2	1	2	-	3	3	2	2	-	-
CO5	2	2	2	-	2	1	1	-	3	3	1	2	-	-
CO6	2	2	2	-	2	1	1	-	3	3	1	2	-	-

School: School of Engineering and Technology **Batch: 2019-2023**
Program: B.Tech. **Current Academic Year: 2019-20**
Branch: Physics **Semester: I, II**

1	Course Code	PHY 162
2	Course Title	Physics Lab 2
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
6	Course Outcomes	On successful completion of the course the students will have: CO1: Knowledge and study of basic physics experiments based on Semiconductors, energy band gap, planck constant etc. CO2: Use the concept of electricity and magnetism to find out variation of magnetic field through a current carrying coil and hall effect CO3: Understand and learn how to determine specific resistance CO4: Understand and perform laser-based experiments. CO5: Knowledge and study of various optical experiments. CO6: Apply the mathematical concepts/equations to obtain quantitative results and ability to conduct, analyze and interpret experiments

7	Outline Syllabus		CO Mapping
	Unit 1 A B C	13. To determine Energy band gap of a semiconductor using Four Probe method. 14. To determine the variation of magnetic field along the axis of a current carrying coil and estimate the radius of the coil. 15. To study Hall effect and determine the Hall coefficient, carrier density and the mobility of a semiconductor material	CO1 CO2,CO6
	Unit 2 A B C	16. To draw hysteresis curve (B-H curve) of a specimen in the form of a transformer on a C.R.O. And to determine its hysteresis loss 17. To determine the Planck's constant by measuring radiation in a fixed spectral range. 18. To determine the specific resistance of the material of a given wire using Carey Foster's bridge.	CO2,CO6
	Unit3 A B C	19. To determine the diameter of thin wire by diffraction using laser. 20. To determine the wavelength of laser light by diffraction at a single slit. 21. To determine slit width of single and double slit by using Laser.	CO3,CO6 CO4,CO6
	Unit 4 A	22. To determine the wavelength of prominent lines of	

B C	mercury by plane diffraction grating. 23. To determine the wavelength of monochromatic light by Newton's Ring method.	CO4,CO6
Unit 5 A B C	24. To determine the focal length of the combination of two lenses separated by a distance with the help of a nodal slide and to verify the formula. 25. To verify Stefan's Law.	CO5,CO6 CO5,CO6

Mode of Examination	Practical/Viva		
Weightage Distribution	CA	MTE	ETE
	60%	0%	40%
Text books	3. B.Sc. Practical Physics- Harnam Singh, S. Chand Publishing. 4. B.Sc. Practical Physics- C L Arora, S. Chand Publishing.		
Other References	3. Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co. 4. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New		

Instructional Plan

Academic Year: 2019-20 (Odd Semester)

School: School of Engineering and Technology **Subject: Physics Lab 2**
Program: B.Tech. **Subject Code: PHY162**
Branch: Physics **Instructor:**

Scheme **Scheme of Examination**

L	P	T	Internal Assessment	Mid Term Examination	End Term Examination
0	0	1	60%	0%	40%

Course Outline

The list of experiments provides closure between the theoretical results and experimental readings taken in the physics laboratory. The Demonstration of each and every experiment helps the students to take up data independently and work on various research problems of physics.

Course Evaluation

Attendance	None
Any Other	CA judged on the practical conducted in the lab, weight age may be specified

References:

Text book	3. B.Sc. Practical Physics- Harnam Singh, S. Chand Publishing. 4. B.Sc. Practical Physics- C L Arora, S. Chand Publishing.
Other References	3. GeetaSanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co. 4. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New
Softwares	None

Week 1	**Unit 1**	**Practical related to**	
	a, b, c	Lab expt. 1	To determine Energy band gap of a semiconductor using Four Probe method.
Week 2	**Unit 1**	**Practical related to--**	
	a, b, c	Lab expt. 1	To determine Energy band gap of a semiconductor using Four Probe method.
Week 3	**Unit 1**	**Practical related to—**	

	a, b, c	Lab expt. 2	To determine the variation of magnetic field along the axis of a current carrying coil and estimate the radius of the coil.
Week 4	**Unit 1**	**Practical related to--**	
	a, b, c	Lab expt. 3	To study Hall effect and determine the Hall coefficient, carrier density and the mobility of a semiconductor material.
Week 5	**Unit 2**	**Practical related to--**	
	a, b, c	Lab expt. 4	To draw hysteresis curve (B-H curve) of a specimen in the form of a transformer on a C.R.O. And to determine its hysteresis loss.
Week 6	**Unit 2**	**Practical related to-- Unit 2**	
	a, b, c	Lab expt. 5	To determine the Planck's constant by measuring radiation in a fixed spectral range.
Week 7	**Unit 2**	**Practical related to-- Unit 2**	
	a, b, c	Lab expt. 6	To determine the specific resistance of the material of a given wire using Carey Foster's bridge.
Week 8	**Unit 3**	**Practical related to-- Unit 3**	
	a, b, c	Lab expt. 7	To determine the diameter of thin wire by diffraction using laser
Week 9	**Unit 3**	**Practical related to-- Unit 3**	
	a, b, c	Lab expt. 8	To determine the wavelength of laser light by diffraction at a single slit.
Week 10	**Unit 3**	**Practical related to-- Unit 3**	
	a, b, c	Lab expt. 9	To determine slit width of single and double slit by using Laser.
Week 11	**Unit 4**	**Practical related to-- Unit 4**	
	a, b, c	Lab expt. 10	To determine the wavelength of prominent lines of mercury by plane diffraction grating.
Week 12	**Unit 4**	**Practical related to-- Unit 4**	
	a, b, c	Lab expt. 11	To determine the wavelength of monochromatic light by Newton's Ring method.
Week 13	**Unit 4**	**Practical related to-- Unit 4**	
	a, b, c	Lab expt. 11	To determine the wavelength of monochromatic light by Newton's Ring method.
Week 14	**Unit 5**	**Practical related to-- Unit 5**	
	a, b, c	Lab expt. 12	To determine the focal length of the combination of two lenses separated by a distance with the help of a nodal slide and to verify the formula.
Week 15	**Unit 5**	**Practical related to-- Unit 5**	
	a, b, c	Lab expt. 12	To determine the focal length of the combination of two lenses separated by a distance with the help of a nodal slide and to verify the formula.
Week 16	**Unit 5**	**Practical related to--**	

	Unit 5	
a, b, c	Lab expt. 13	To verify Stefan's Law.

Mapping of Course Outcomes vs. Topics

Outcome no. → / Syllabus topic ↓	1	2	3	4	5	6
Unit 1 A	X					X
Unit 1 B	X					X
Unit 1 C		X				X
Unit 2 A		X				X
Unit 2 B		X				X
Unit 2 C		X				X
Unit 3 A			X			X
Unit 3 B			X			X
Unit 3 C				X		X
Unit 4 A				X		X
Unit 4 B				X		X
Unit 4 C				X		X
Unit 5 A					X	X
Unit 5 B					X	X
Unit 5 C					X	X

Cos	PO 1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1
CO162.1	2	2	2	1	1	1	2	3	3	3	2	3	2
CO162.2	2	2	2	1	1	1	2	3	3	3	2	3	2
CO162.3	2	2	2	1	1	1	2	3	3	3	2	3	2
CO162.4	2	2	2	1	1	1	2	3	3	3	2	3	2
CO162.5	2	2	2	1	1	1	2	3	3	3	2	3	2
CO162.6	2	2	2	1	1	1	2	3	3	3	2	3	2

TERM-III

BTY 223 INTRODUCTIONS TO BIOLOGY FOR ENGINEERS

1	Course number	**BTY 223**	
2	Course Title	**Introduction to Biology for Engineers**	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
5	Course Objective	Students will be introduced to the functions and interactions of biological systems from a quantitative perspective. To provide a foundation in biology with engineering of living systems and to apply various tools of traditional engineering fields. To harness potential of living systems for the benefit of human mankind.	
6	Course Outcomes	After successfully completion of this course students will be able to: 1. To understand the fundamentals of living things, their classification, cell structure and biochemical constituents. 2. To apply the concept of plant, animal and microbial systems and growth in real life situations. 3. To comprehend genetics and the immune system. 4. To know the cause, symptoms, diagnosis and treatment of common diseases. 5. To give a basic knowledge of the applications of biological systems in relevant industries. 6. Understand importance of biological components in everyday life	
7	Outline syllabus:		
7.01	XXXNNN.A	**Unit A**	**UNIT I: INTRODUCTION TO LIFE**
7.02	XXXNNN.A1	Unit A Topic 1	Characteristics of living organisms
7.03	XXXNNN.A2	Unit A Topic 2	Cell theory
7.04	XXXNNN.A3	Unit A Topic 3	Structure of prokaryotic and eukaryotic cell
7.05	XXXNNN.B	**Unit B**	**UNIT II: Biomolecules**
7.06	XXXNNN.B1	Unit B Topic 1	General classification and important functions of carbohydrates and lipids
7.07	XXXNNN.B2	Unit B Topic 2	General classification and important functions of proteins
7.08	XXXNNN.B3	Unit B Topic 3	General classification and important functions of DNA and RNA
7.09	XXXNNN.C	**Unit C**	**UNIT III: Genetics and Immune system**
7.10	XXXNNN.C1	Unit C Topic 1	Theories of Evolution
7.11	XXXNNN.C2	Unit C Topic 2	Mendel's laws of inheritance
7.12	XXXNNN.C3	Unit C Topic 3	Immune system and Immunity
7.13	XXXNNN.D	**Unit D**	**UNIT IV: Human Diseases**
7.14	XXXNNN.D1	Unit D Topic 1	Genetic diseases and Infectious diseases
7.15	XXXNNN.D2	Unit D Topic 2	AIDS and Diabetes
7.16	XXXNNN.D3	Unit D Topic 3	Cancer and its causes
7.17	XXXNNN.E	**Unit E**	**UNIT V: Biology and its industrial application**
7.18	XXXNNN.E1	Unit E Topic 1	Vaccines and their types
7.19	XXXNNN.E2	Unit E Topic 2	Bioremediation and biofertilizers
7.20	XXXNNN.E3	Unit E Topic 3	Bioreactors
8	Course Evaluation		
8.1	Course work: 30% marks		
8.11	Attendance	None	
8.12	Assignments	5 marks	
8.13	Quizzes	20 marks	
8.14	Presentations	5 marks	
8.15	Any other	None	
8.16	MTE	20 marks	
8.18	End-term examination: 50 marks		
8.19	References		
8.20	Text book	1. Karp, G. *Cell and Molecular Biology*, *5th ed.*, John Wiley and Sons, Inc.	
8.21	Other References	1. Alberts, B. et al. *Essential Cell Biology*, Garland Publishing, Inc. (ISBN: 081533480X) 4. 2. Berger, S. et al. *Introduction to Bioengineering*, Oxford University Press (ISBN: 978-0-19-856515-4)	

Mapping of Outcomes vs. Topics

CSE mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	1	3	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	2	-	-	-	-	-	3	-	-	-
CO3	3	3	3	1	1	3	3	2	1	3	-	3	1	1	-
CO4	3	2	-	-	-	2	2	3	1	2	-	3	1	-	-
CO5	3	1	1	1	3	1	3	2	1	2	1	3	1	1	-
CO6	3	3	1	1	2	3	5	1	1	1	-	3	1	-	-

Syllabus: CSE242, Data Structures

School: SET		**Batch :**2019-23	
Program: B.Tech.		**Current Academic Year:** 2019-20	
Branch:CSE/IT		**Semester:**III	
1	Course Code	CSE242	
2	Course Title	Data Structures	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	1. Learn the basic concepts of Data Structures and algorithms. 2. Design and Implementation of Various Basic and Advanced Data Structures. 3. Learn the concepts of various searching, Sorting and Hashing Techniques. 4. Choose the appropriate data structures and algorithm design method for a specified application.	
6	Course Outcomes	CO1: **Select** appropriate data structures as applied to specified problem definition. CO2: **Choose** the suitable data structures like arrays, linked list, stacks and queues to solve real world problems efficiently. CO3 **Represent** and manipulate data using nonlinear data structures like trees and graphs to design algorithms for various applications. CO4: **Compare** various techniques for searching and sorting. CO5: **Design** and implement an appropriate hashing function for an application CO6: **Formulate** new solutions for programing problems or improve existing code using learned algorithms and data structures	
7	Course Description	This course starts with an introduction to data structures with its classification, efficiency of different algorithms, array and pointer based implementations and Recursive applications. As the course progresses the study of Linear and Non-Linear data structures are studied in details. The course talks primarily about Linked list, stacks, queue, Tree structure, Graphs etc. This Course also deals with the concept of searching, sorting and hashing methods.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Data Structure – Definition, Operations and Applications, Abstract Data Types, Algorithm – Definition, Introduction to Complexity, Big OH notation, Time and Space tradeoffs.	CO1
	B	Dynamic Memory Allocation(Malloc, calloc, realloc, free), Recursion – Definition, Examples- Tower of Hanoi problem, Tail Recursion	CO1
	C	Arrays: Implementation of One Dimensional Arrays, Multidimensional Arrays, Applications of Arrays, Address Calculation, Matrix Operations, Sparse martices	CO1

	Unit 2	**Linked List**			
	A	Concept of Linked List, Garbage Collection, Overflow and Underflow, Array Implementation and Dynamic Implementation of Singly Linked Lists			CO2
	B	Array Implementation and Dynamic Implementation of Doubly Linked List, Circularly Linked List			CO3
	C	Operations on a Linked List- Insertion, Deletion, Traversal, Polynomial Representation and Addition			CO2
	Unit 3	**Stack and Queue**			
	A	Stacks: Definitions, Primitive operations, Application of stacks – Conversion of Infix Expression to Postfix form, Evaluation of Postfix Expressions			CO3
	B	Queues: Definition, Primitive Operations, Implementation of Circular Queues, Priority Queues			CO3
	C	Deques, Application of Queues. Implementation - Linked Stacks, Linked Queues.			CO3
	Unit 4	**Tree and Graphs**			
	A	Trees: Terminologies, Binary tree, Representation, Applications, Binary search Tree – Operations on Binary Search Trees (Traversing, Insertion, deletion etc.), Binary Search Algorithm, AVL Tree			CO4, CO6
	B	Graph: Terminology, Representation, Traversals- Depth First Search, Breadth First Search.			CO4, CO6
	C	Graph Applications – Minimum Spanning Trees – Prim's and Kruskal's Algorithms			CO4, CO6
	Unit 5	**Searching, Sorting and Hashing**			
	A	Implementation and Analysis - Linear search, Binary Search			CO5, CO6
	B	Implementation and Analysis- Bubble Sort, Insertion Sort, Selection Sort, Tree sort			CO5, CO6
	C	Hashing: Concepts and Applications, Hash Functions, Collisions, Methods of Resolving Collisions			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Lipschutz, "Data Structures" Schaum's Outline Series, TMH			
	Other References	1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI 2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication 3. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill 4. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education 5. G A V Pai, "Data Structures and Algorithms", TMH			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Select** appropriate data structures as applied to specified problem definition.	PO1, PO3, PO9, PSO1, PSO2
2.	**Choose** the suitable data structures like arrays, linked list, stacks and queues to solve real world problems efficiently.	PO1, PO2, PO3, PO9, PSO1, PSO2, PSO3
3.	**Represent** and manipulate data using nonlinear data structures like trees and graphs to design algorithms for various applications.	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2
4.	**Compare** various techniques for searching and sorting.	PO3, PO9, PO12, PSO1, PSO2
5.	**Design** and implement an appropriate hashing function for an application	PO1, PO2, PO3, PO4, PO5, PO9, PSO1, PSO2, PSO3
6.	**Formulate** new solutions for programing problems or improve existing code using learned algorithms and data structures	PO1, PO3, PO4, PO5, PO9, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Data Structures (Course Code CSE 242)

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	2	-	2	-	-	-	-	-	2	-	-	-	2	2	-
CO 2	1	2	3	-	-	-	-	-	1	-	-	-	3	1	2
CO 3	2	3	3	2	-	-	-	-	2	-	-	-	2	3	-
CO 4	-	-	2	-	-	-	-	-	3	-	-	1	2	2	-
CO 5	3	2	3	2	1	-	-	-	2	-	--	-	3	2	2
CO 6	2	-	3	3	2	-	-	-	1	-	-	-	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CSE 242	Data structures	2	2.33	2.67	2.33	1.5	-	-	-	1.83	-	-	1	2.33	2.17	2.33

2.1 Template A1: Syllabus for Theory Courses

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B-Tech**	
Branch:		**Computer Science and Engineering**	
1	Course Code	CSE 243	
2	Course Title	Object Oriented Programming Using Java	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-2	
	Course Status	Core /Elective/Open Elective	
5	Course Objective	To learn Java language syntax and semantics and concepts such as classes, objects, inheritance, polymorphism, packages and multithreading.	
6	Course Outcomes	CO1. Define Object oriented programming concepts by identifying classes, objects, members of a class and relationships among them needed for a specific problem. CO2: Illustrate different features of java. CO3: Develop Java programs to solve problems of applications using OOP principles such as abstraction, polymorphism and inheritance. CO4:Categorize runtime errors thrown in the application software or generated runtime by applying the methods of exception handling and File I/O CO5. Explain the concept of multithreading. CO6. Design real life application using Java	
7	Course Description	Basic Object Oriented Programming (OOP) concepts including objects, classes, methods, parameter passing, information hiding, inheritance and polymorphism are discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Object Oriented Paradigm**	
	A	Introduction to OOP, Characteristics of OOP, Difference between OOP and procedural languages	CO1, CO2
	B	Byte Code, Architecture of JVM, Class Loader Execution Engine.	CO1, CO2
	C	Java development Kit (JDK), Introduction to IDE for java development, Setting java environment (steps for path and CLASS PATH setting), Garbage collection.	CO1, CO2
	Unit 2	**Introduction to Java**	
	A	Features of Java, Constants, Variables, Data Types, Operators, Expressions.	CO1,CO2
	B	Classes, Objects ,Constructors, Methods ,Input from user	CO1, CO2
	C	Decision Making Branching, Loops, command line argument and static keyword	CO1, CO2
	Unit 3	**Polymorphism**	
	A	Arrays ,Strings and String handling,	CO1,CO2
	B	Polymorphism, method overloading	CO1,CO2,CO3
	C	Constructors overloading , Wrapper class ,Type conversion & casting,	CO2

Unit 4	**Inheritance, package and Interface Inheritance Implementation**	
A	Types of inheritance, Overriding methods, use of this and super, Constructor call in inheritance, Abstract class and method overriding.	CO2,CO3,CO6
B	Final class, method and variable, Concept of multiple inheritance in Java, Implementing Interface, Access Modifiers,	CO2,CO3,CO6
C	Packages: User defined packages, built-in packages (java.langpackage).	CO2,CO3,CO6
Unit 5	**Exception and Multithreading**	
A	Input/output: Exploring java.io, File, Stream Classes Byte Stream Classes and Character stream Classes, Reading and writing in file	CO4,CO6
B	Introduction to Exception Handling, Introduction to try, catch, Finally , throw and throws, Checked and Unchecked exceptions, User define exception	CO4,CO6
C	Introduction to Multithreading: multithreading advantages and issues, Creating thread using Runnable interface and Thread class, Thread life cycle, Thread priorities, sleep method.	CO5,CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1.Schildt H, "The Complete Reference JAVA2", TMH	
Other References	1. Balagurusamy E, "Programming in JAVA", TMH 2. Professional Java Programming: BrettSpell, WROX Publication	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define Object oriented programming concepts by identifying classes, objects, members of a class and relationships among them needed for a specific problem.	PO5,PO12
2.	Illustrate different features of java.	PO5
3.	Develop Java programs to solve problems of applications using OOP principles such as abstraction, polymorphism and inheritance.	PO1,PO2,PO3,PO5,PO9, PO12,PSO1,PSO2
4.	Categorize runtime errors thrown in the application software or generated runtime by applying the methods of exception handling and File I/O	PO5
5.	Explain the concept of multithreading.	PO5
6.	Design real life application using Java.	PO1,PO2,PO3,PO5,PO6, PO7,PO9,PO11,PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Object Oriented Programming Using Java **(Course Code CSE243)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
MCA164_ Object Oriented Programming Using Java	**CO1**					**2**							**2**			
	CO2					**2**										
	CO3	**2**	**3**	**3**		**2**				**3**			**2**	**2**	**3**	
	CO4					**2**										
	CO5					**2**										
	CO6	**3**	**3**	**3**		**2**	**3**	**2**		**3**		**2**	**3**	**3**	**3**	**2**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE 243	Object Oriented Programming Using Java	2.5	3	3	0	2	3	2	0	3	0	2	2.3	2.5	3	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSE 244, Principles of Operating System

School: SET		**Batch : 2018-2022**	
Program: B.Tech		**Current Academic Year: 2018-19**	
Branch: CSE		**Semester: IV**	
1	Course Code	**CSE 244**	Course Name: Principles of Operating System
2	Course Title	Principles of Operating System	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-2	
	Course Status	Core	
5	Course Objective	1. This course introduces the challenges for designing the operating systems. 2. Includes different design principles and algorithms. 3. Evaluation of algorithms proposed. 4. Implementation of algorithms and utilities.	
6	Course Outcomes	Students will be able : **CO1:**To Understand the basic concept of Operating system. **CO2:**Explore process management concepts including scheduling, synchronization, deadlocks **CO3:** To understand and implement algorithms in resource allocation and utilization. **CO4:** To integrate and interpret effectiveness, efficiency of algorithms used for resource management of operating systems. **CO5:** Analyze various memory management and virtual memory techniques **CO6:** To Understand file and disk management and analyzing them	
7	Course Description	This course introduces the design principles of operating systems, resource management, identifying challenges and applying respective algorithms.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Operating System Concepts and functions, Comparison of different Operating system	CO1
	B	Types of Operating Systems (Batch, Multiprogramming ,Multi Tasking , Multiprocessing, Distributed and Real Time Operating System)	CO1
	C	Operating System Structure(Monolithic, Layered and Microkernel), Operating System Services	CO1
	Unit 2	**Process Synchronization**	
	A	Process Concepts (PCB, Process States , Process Operations, Inter process communication)	CO1, CO2
	B	Critical Section problem & their solutions, Introduction to Semaphores	CO1, CO2
	C	Classical Problems of Synchronization(Producer Consumer Problem, Readers Writer Problem, Dining philosophers problem)	CO1, CO2
	Unit 3	**CPU Scheduling**	
	A	Concept , Types of schedulers(Short term, Long term, Middle term), Dispatcher, Performance Criteria	CO1,CO2
	B	CPU Scheduling Algorithms(FCFS, SJF, Priority,	CO1,CO2,CO3,CO4

		Round Robin, Multilevel Queue, Multilevel feedback Queue)	
	C	Deadlock concepts & Handling Techniques(Avoidance, Prevention and Detection & Recovery)	CO1,CO2,CO3,CO4
	Unit 4	**Memory Management**	
	A	Memory Hierarchy, Memory Management Unit	CO1,CO2,CO3,CO5
	B	Paging, Segmentation	CO1,CO2,CO3,CO5
	C	Virtual memory concept, demand paging, Page replacement algorithms(FCFS, Optimal, LRU)	CO1,CO2,CO3,CO5
	Unit 5	**INPUT-OUTPUT Management**	
	A	Input –Output interface, Modes of data transfer(Programmed, interrupt and DMA)	CO1,CO2,CO3,CO6
	B	Disk structure , Disk scheduling(FCFS,SSTF, SCAN, LOOK,C-SCAN, C-LOOK)	CO1,CO2,CO3,CO4,CO6
	C	File Concept ,File operations, File Directories, Case study of Windows Operating System	CO1,CO2,CO3,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	6. Silberschatz G, *Operating System Concepts*, Wiley	
	Other References	1. W. Stalling, "Operating System", Maxwell Macmillan 2. Tannenbaum A S, *Operating System Design and Implementation*, Prentice Hall India 3. Milenkovic M, *Operating System Concepts*, McGraw Hill	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** To identify the challenges and apply suitable algorithms for them.	PO1,PO2,PO3,PO4,PSO1
2.	**CO2:** To assess the strengths and weaknesses of the algorithms.	PO1, PO3, PO4, PSO2
3.	**CO3:** To understand and implement algorithms in resource allocation and utilization.	PO1,PO2,PO3,PO4
4.	**CO4:** To integrate and interpret effectiveness, efficiency of algorithms used for resource management of operating systems.	PO9, PO10,PO11, PSO3
5.	**CO5:** Analyze various memory management and virtual memory techniques.	PO1,PO2,PO8,PO9,PO10,PSO1
6.	**CO6:** To Understand file and disk management and analyzing them.	PO1,PO2,PO10,PO11,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Principles of Operating System (Course Code CSE 244)

CSE244	Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
	CO 1	3	3	3	3	--	--	--	2	2	1	2	1	3	2	2
	CO 2	3	2	3	3	--	--	--	2	2	2	1	1	2	3	2
	CO 3	3	3	3	3	--	--	--	1	1	1	3	2	3	2	1
	CO 4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
	Co5	2	2	3	-	-	-	-	3	3	1	2	-	3	-	-
	CO 6	3	2	-	-	-	-	-	-	-	2	3	-	2	2	-

CSE245: Discrete Structures

School:SET		Batch:2019-20		
Program: B.Tech		**Current Academic Year:2019-20**		
Branch:CSE		**Semester:**		
1	Course Code	CSE245	Course Name: Discrete Structures	
2	Course Title	Discrete Structures		
3	Credits	4		
4	Contact Hours(L-T-P)	3-1-0		
	Course Status			
5	Course Objective	This course provides a mathematical foundation for subsequent study in Computer Science, as well as developing the skills necessary to solve practical problems.		
6	Course Outcomes (CO)	After the completion of this course, students will be able to: CO-1. ***Apply the*** basic principles of sets and operations in sets**.** CO-2. ***Classify*** logical notation and determine if the argument is or is not valid. CO-3. ***Construct*** and prove models by using algebraic structures. CO-4. ***Analyze*** basic principles of Boolean algebra with mathematical description. CO-5. ***Construct*** Permutations and combinations in counting techniques and applications of Graph Theory. CO-6. ***Compose*** computer programs in a formal mathematical manner.		
7	**Prerequisite**	Concepts of algebra		
8	**Course Contents**			CO-Mapping
	Unit 1	**Introduction to Set Theory, Relations and Functions.**		
	A	Set Theory: Introduction, Combination of sets, Multi sets, ordered pairs, Set Identities.		CO1
	B	Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Order of relations.		CO1
	C	Functions: Definition, Classification of functions, Operations on functions, Recursively defined functions.		CO1
	Unit 2	**Logics and Mathematical Induction**		
	A	Propositional Logic: Proposition, well formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Theory of Inference, Natural Deduction.		CO1,CO2
	B	Predicate Logic: First order predicate, well formed formula of predicate, quantifiers, Inference theory of predicate logic.		CO1,CO2
	C	Natural Numbers: Introduction, Mathematical Induction, Variants of Induction, Induction with Nonzero Base cases.		CO1,CO2
	Unit 3	**Algebraic Structures**		
	A	Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups,		CO3
	B	Homomorphism's, Definition and elementary properties of Rings and Fields, Integers Modulo n.		CO3
	C	Partial order sets: Definition, Partial order sets, Combination of partial order sets, Hasse diagram.		CO3
	Unit 4	**Lattices and Applications**		
	A	Definition, Properties of lattices – Bounded, Complemented,		CO4

		Modular and Complete Lattice, Morphisms of lattices.	
	B	Boolean Algebra: Introduction, Axioms and Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions. Simplification of Boolean Functions, Karnaugh maps, Logic gates, Digital circuits and Boolean algebra. Combinational and sequential Circuits.	CO4
	C	Recurrence Relation & Generating function: Recursive definition of functions, Recursive algorithms, Method of solving recurrences.	CO4
	Unit 5	**Graph Theory and Applications.**	
	A	Trees: Definition, Binary tree, Binary tree traversal, Binary search tree.	CO4,CO5
	B	Graphs: Definition and terminology, Representation of graphs, Multi graphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph colouring.	CO4,CO5
	C	Combinatory: Introduction, Counting Techniques, Pigeonhole Principle	CO4,CO5
	Mode of examination	Theory	

	Weightage Distribution	CA	MTE	ETE
		30%	20%	50%

	Text book*	1) *1. C. L. Liu, Elements of Discrete Mathematics, second edition 1985, McGraw-Hill Book Company. Reprinted 2000.* 2) Jean Paul Trembley, R Manohar, "Discrete Mathematical Structures with Application to Computer Science", McGraw-Hill. 3) *K. H. Rosen, Discrete Mathematics and applications, fifth edition 2003, Tata McGraw Hill Publishing Company.*
	other references	1) *J .L. Mott, A. Kandel, T.P .Baker, Discrete Mathematics for Computer Scientists and Mathematicians, second edition 1986, Prentice Hall of India.* 2) *W.K. Grassmann and J.P.Trembnlay, Logic and Discrete Mathematics, A Computer Science*

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** ***Apply the*** basic principles of sets and operations in sets**.**	**PO1,PO2,PO3,PO4,PO6,PO12, PSO1,PSO2**
2.	**CO2:** ***Classify*** logical notation and determine if the argument is or is not valid.	**PO1,PO2,PO3,PO6,PO9,PO12 PSO1,PSO2**
3.	**CO3:** ***Construct*** and prove models by using algebraic structures.	**PO1,PO2,PO3,PO4,PO5,PO9,PSO 2,PSO3**
4.	**CO4:** ***Analyze*** basic principles of Boolean algebra with mathematical description.	**PO1,PO2,PO3,PO4,PO5,PO11,PO 12 PSO1, PSO3**
5.	**CO5:** ***Construct*** Permutations and combinations in counting techniques and applications of Graph Theory.	**PO1,PO2,PO3,PO4,PO6,PO9,PO1 1,PO12, PSO2,PSO3**
6	**CO6:** ***Compose*** computer programs in a formal	**PO1,PO2,PO3, PO4, PO5,PO9,**

	mathematical manner.	**PO11, PSO1,PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name Discrete Structures (Course Code CSE245)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	_	3	_	_	3	_	_	3	3	3	_
CO2	2	2	3	_	_	2	_	_	_	_	_	3	3	2	_
CO3	3	2	3	3	3	_	_	_	2	_	_	_	_	3	2
CO4	2	2	3	3	3	_	_	_	_	_	3	3	3	_	3
CO5	2	2	2	3	_	3	_	_	3	_	3	3	_	2	3
CO6	1	2	1	2	3	_	_	_	3	_	3	_	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE245	DS	2	2.1	2.5	2	1.5	1.3	0	0	1.8	0	1.8	2	2	2.1	1.6

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSE 247, Computer organization and architecture

School: SET		**Batch: 2019-2023**	
Program: B.Tech		**Current Academic Year: 2019-2020**	
Branch: CSE/IT		**Semester: III**	
1	Course Code	CSE247 | Course Name	
2	Course Title	Computer Organization and Architecture	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	To impart an understanding of the internal organization and operations of a computer and to introduce the concepts of processor logic design and control logic design.	
6	Course Outcomes	Upon successful completion of this course, the student will be able to: **CO1:** Identify the basic structure and functional units of a digital computer CO2:Study the architecture of Bus and registers . **CO3:**Study the design of arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations **CO4:**Understand basic processing unit and organization of simple processor including instruction sets, instruction formats and various addressing modes **CO5:**Study the two types of control unit techniques **CO6:** Describe hierarchical memory systems including cache memories and select appropriate interfacing standards for I/O devices.	
7	Course Description	This course discusses the basic structure of a digital computer and used for understanding the organization of various units such as control unit, Arithmetic and Logical unit and Memory unit and I/O unit in a digital computer.	
8	Outline syllabus		CO Mapping
	Unit 1	**Computer Organization and Design**	
	A	Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register bus and memory transfer	CO1
	B	Register transfer Language, Registertransfer, Bus & memory transfer, Logic micro operations, Shift micro operation.	CO1
	C	Adder-Subtractor- Incrementor, Arithmetic unit, Logic unit.	CO1
	Unit 2	**Computer Arithmetic**	
	A	Representation of numbers in 1’s and 2’s complement, Addition and subtractionofsigned numbers.	CO1, CO2
	B	Binary Multiplier, Multiplication: Signed operand multiplication, Booth algorithm	CO1, CO2
	C	Floating point arithmetic representation: addition and subtraction.	CO1, CO2
	Unit 3	**Processor Organization**	
	A	General register organization, stack organization	CO3
	B	Instruction set architecture of a CPU - registers, Instruction types, formats, instruction execution cycle	CO3
	C	Addressing modes, RISC/CISC	CO3
	Unit 4	**Control Unit**	
	A	Introduction to CPU design, Instruction interpretation and	CO3, CO4

		execution, Micro-operation and their register transfer language (RTL) specification		
	B	Hardwired control CPU design		CO3, CO4
	C	Microprogrammed control CPU design		CO3, CO4
	Unit 5	**Memory and I/O**		
	A	RAM/ROM/Flash memory, Designing Memory System using RAM and ROM chips		CO1, CO5
	B	Cache memory: Memory hierarchy, performance Considerations, mapping techniques		CO1, CO5
	C	Input Output: Isolated vs. Memory mapped I/O, Programmed I/O, Interrupt driven I/O, Direct Memory Access		CO1, CO5
	Mode of examination	Theory		
	Weightage Distribution	CA / 30%	MTE / 20%	ETE / 50%
	Text book/s*	1. M. Morris Mano, Computer System Architecture, Pearson		
	Other References	1. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization", McGrawHill, 2002. 2. W. Stallings, "Computer Organization and Architecture - Designing for Performance", Prentice Hall of India, 2002. 3. D. A. Patterson and J. L. Hennessy, "Computer Organization and Design - The Hardware/Software Interface", Morgan Kaufmann,1998. 4. J.P. Hayes, "Computer Architecture and Organization", McGraw-Hill, 1998.		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. Identify the basic structure and functional units of a digital computer.	PO1, PO2, PO3, PO6, PO12, PSO3
2.	CO2:Study the architecture of Bus and registers	PO1, PO2, PO3, PO6, PO12, PSO3
3.	CO3. Study the design of arithmetic and logic unit and implementation of fixedpoint and floating-point arithmetic operations	PO1, PO2, PO3, PO6, PO12, PSO3
4.	CO4. Understand basic processing unit and organization of simple processor including instruction sets, instruction formats and various addressing modes	PO1, PO2, PO3, PO6, PO12, PSO3
5.	CO5. Study the two types of control unit techniques	PO1, PO2, PO3, PO4, PO6, PO12, PSO2, PSO3
6.	CO6. Describe hierarchical memory systems including cache memories and select appropriate interfacing standards for I/O devices	PO1, PO2, PO3, PO6, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Computer Organization and Architecture **(Course Code CSE 247)**

CSE 247	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1	3	1	1	-	-	2	-	-	-	-	-	2	-	1	3
	CO2	3	3	3	-	-	3	-	-	-	-	-	3	-	2	3
	CO3	3	2	3	-	-	2	-	-	-	-	-	3	-	2	3
	CO4	3	2	2	-	-	1	-	-	-	-	-	3	-	3	2
	CO5	3	3	3	-	-	2	-	-	-	-	-	3	-	2	2
	CO6	3	3	3	-	-	2	-	-	-	-	-	3	-	1	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

School: SET
Program:
Branch: CSE

Batch : 2018-19
Current Academic Year: 2018-19
Semester: III

1	Course Code	**ARP203** Course Name : **Aptitude Reasoning and Business Communication Skills-Basic**
2	Course Title	: **Aptitude Reasoning and Business Communication Skills-Basic**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	
5	Course Objective	To enhance holistic development of students and improve their employability skills. To provide a 360 degree exposure to learning elements of Business English readiness program, behavioural traits, achieve softer communication levels and a positive self-branding along with augmenting numerical and altitudinal abilities. To step up skill and upgrade students' across varied industry needs to enhance employability skills. By the end of this semester, a student will have entered the threshold of his/her 1st phase of employability enhancement and skill building activity exercise.
6	Course Outcomes	CO1: *At the end of the session this activity will help to ascertain a student's skill and competency level which will lead to effective mapping of his skills and competencies and an an effective training need identification and training need analysis model can be drawn* CO2: *At the end of the session a student will have a heightened sense of self awareness, raised levels of self-esteem & self-effectiveness, will have developed a positive mental frame of mind helping a student become more evolved in his/her life .* CO3: *At the end of the session the program would have instilled positive thinking and professional ethics in students and reinforce positive attitude building* CO4: *At the end of the session a student would have learned how to build positive emotional competence in self and learn GOAL Setting and SMART Goals technique* CO5: *At the end of the session a student would have enhanced LSRWG and P (Listening Speaking Reading Writing Grammar and Pronunciation) | Verbal Abilities - 1* CO6: *At the end of the session a student would have Understanding of AMCAT + ELITMUS Study patterns for Quantitative aptitude and Logical | Analytical Reasoning*
7	Course Description	This Level 1 blended training approach equips the students for Industry employment readiness and combines elements of soft skills and numerical abilities to achieve this purpose.
8		Outline syllabus – ARP 203

Unit 1	**BELLS (Building Essential Language and Life Skills)**	**CO Mapping**
A	*Know Yourself*: Core Competence. A very unique and interactive approach through an engaging questionnaire to ascertain a student's current skill level to design, architect and expose a student to the right syllabus as also to identify the correct TNI/TNA levels of the student.	*CO1*
B	Techniques of Self Awareness | Self Esteem & Effectiveness| Building Positive Attitude | Building Emotional Competence	*CO2*
C	Positive Thinking & Attitude Building | Goal Setting and SMART Goals – Milestone Mapping | Enhancing L S R W G and P (Listening Speaking Reading Writing Grammar and Pronunciation) | Verbal Abilities - 1	*CO3,CO4,CO5*
Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	
A	Syllogism | Letter Series | Coding, Decoding , Ranking & Their Comparison Level-1	*CO6*
B	Number Puzzles	*CO6*
C	Selection Based On Given Conditions	*CO6*
Unit 3	**Quantitative Aptitude**	*CO6*

A	Number Systems Level 1 | Vedic Maths Level-1	*CO6*
B	Percentage ,Ratio & Proportion | Mensuration - Area & Volume |Algebra	*CO6*
Weightage Distribution	*Class Assignment/Free Speech Exercises / JAM – 60% | Group Presentations/Mock Interviews/GD/ Reasoning, Quant & Aptitude – 40%*	
Text book/s*	*Wiley's Quantitative Aptitude-P Anand | **Quantum CAT – Arihant Publications | Quicker Maths- M. Tyra |** Power of Positive Action (English, Paperback, Napoleon Hill) | Streets of Attitude (English, Paperback, Cary Fagan, Elizabeth Wilson) The 6 Pillars of self-esteem and awareness – Nathaniel Brandon | Goal Setting (English, Paperback, Wilson Dobson*	

Syllabus: CSP 242, Data Structure Lab

School: SET		**Batch: 2019-2023**	
Program: B.Tech.		**Current Academic Year: 2019-2020**	
Branch: CSE/IT		**Semester: III**	
1	Course Code	CSP242	
2	Course Title	Data Structure Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	1. Learn the basic concepts of Data Structures and algorithms. 2. Design and Implementation of Various Basic and Advanced Data Structures. 3. Learn the concepts of various searching, Sorting and Hashing Techniques. 4. Choose the appropriate data structures and algorithm design method for a specified application.	
6	Course Outcomes	CO1: **Implement** operation like traversing, insertion, deletion, searching etc. on various data structures. CO2 **apply** linear data structure(s) to solve various problems CO3: **develop** the solution of any problem using non linear data structure(s) CO4: **create** a solution of any problem using searching and sorting techniques CO5: **Design** a hash function using any programming language CO6: **Choose** the most appropriate data structure(s) for a given problem	
7	Course Description	This course starts with an introduction to data structures with its classification, efficiency of different algorithms, array and pointer based implementations and Recursive applications. As the course progresses the study of Linear and Non-Linear data structures are studied in details. The course talks primarily about Linked list, stacks, queue, Tree structure, Graphs etc. This Course also deals with the concept of searching, sorting and hashing methods.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	**CO1**
		Program to implement Operation on Array such as Traversing, Insertion & Deletion operation	**CO1**
		Program based on Recursion such as Towers of Hanoi, Fibonacci series etc.	CO1
	Unit 2	**Linked List**	**CO2**
		Program to implement different operation on the following linked list: Singly, Doubly and circular linked list.	CO2
	Unit 3	**Stack & Queue**	**CO3**
		Program to Implement Stack operation using Array and	**CO3**

		Linked list			
		Program to convert infix expression to post fix expression			**CO3**
		Program on Evaluation of Post fix expression			**CO3**
		Program to implement queue operation using array and linked list			**CO3**
		Program to implement circular queue and deque.			**CO3**
	Unit 4	**Tree & Graph**			**CO4, CO6**
		Program to implement binary tree and BST.			**CO4, CO6**
		Program to implement MST and shortest path algorithm.			CO4, CO6
	Unit 5	**Searching, Sorting & Hashing**			**CO5**
		Program on Searching and Hashing			**CO5**
		Program on Sorting.			CO5
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	1. Lipschutz, "Data Structures" Schaum's Outline Series, TMH			
	Other References	1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI 2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication 3. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill 4. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education 5. G A V Pai, "Data Structures and Algorithms", TMH			

PO and PSO mapping with level of strength for Course Name Data Structures (Course Code CSE 242)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	2	3	_	_	-	_	_	3	_	_	2	3	2	2
CO2	3	2	2	2	2	-	_	_	2	_	-	_	2	3	3
CO3	3	1	3	3	_	_	_	_	3	_	_	1	3	2	2
CO4	3	2	3	2	_	_	_	_	2	_	_	2	2	3	2
CO5	2	2	2	_	_	_	_	_	_	_	_	_	1	2	2
CO6	3	3	2	3	-	-	_	_	3	_	-	_	2	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSP 242	**Data structures Lab**	2.67	2	2.5	2.5	2	-	-	-	2.6	-	-	1.7	2.17	2.5	2.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE**	

1	Course Code	CSP243	
2	Course Title	Object Oriented Programming Using Java Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory/Elective	
5	Course Objective	To learn Java language syntax and semantics and concepts such as classes, objects, inheritance, polymorphism, packages and multithreading.	
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1. Define Object oriented programming concepts by identifying classes, objects, members of a class and relationships among them needed for a specific problem. CO2: Illustrate different features of java. CO3: Develop Java programs to solve problems of applications using OOP principles such as abstraction, polymorphism and inheritance. CO4:Categorize runtime errors thrown in the application software or generated runtime by applying the methods of exception handling and File I/O CO5. Explain the concept of multithreading. CO6. Design real life application using Java	
7	Course Description	Basic Object Oriented Programming (OOP) concepts including objects, classes, methods, parameter passing, information hiding, inheritance and polymorphism are discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Object Oriented Paradigm**	
		Program related to garbage collection and OOPS	CO1,CO2
	Unit 2	**Introduction to Java**	
		Program to take input from user, decision making and branching	CO1,CO2
	Unit 3	**Polymorphism**	
		Program related to string handling and polymorphism	CO1,CO2
	Unit 4	**Inheritance, package and Interface Inheritance Implementation**	
		Program related to inheritance and interfaces	CO2,CO3,CO6
	Unit 5	**Exception and Multithreading**	
		Program related to exception handling	CO4,CO6
	Mode of examination	Jury/Practical/Viva	
	Weightage Distribution	CA 60% / MTE 0% / ETE 40%	
	Text book/s*	1.Schildt H, "The Complete Reference JAVA2", TMH	

Other References	3. Balagurusamy E, "Programming in JAVA", TMH Professional Java Programming: BrettSpell, WROX Publication

PO and PSO mapping with level of strength for Course Name Object Oriented Programming Using Java **(Course Code CSP243)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
CSP243_ Object Oriented Programming Using Java Lab	CO1					2							2			
	CO2					2										
	CO3	2	3	3		2				3			2	2	3	
	CO4					2										
	CO5					2										
	CO6	3	3	3		2	3	2		3		2	3	3	3	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

List of Experiments

Unit No	S.No	Name of the Practical
1	1.1	Write a Java program to print 'Hello' on screen and then print your name on a separate line
	1.2	Write a Java program to print the sum (addition), multiply, subtract, divide and remainder of two numbers.
2	2.1	Write a Java program to accept a number and check the number is even or not. Prints 1 if the number is even or 0 if the number is odd.
	2.2	Write a Java program that accepts three integers from the user and return true if the second number is greater than first number and third number is greater than second number. If "abc" is true second number does not need to be greater than first number.
3	3.1	Write a Java program to find the maximum occurring character in a string
	3.2	Write a Java program to find first non repeating character in a string.
	3.3	Write a program in java to demonstrate method overloading
4	4.1	Write a program in java to demonstrate multilevel inheritance in java.
	4.2	Write a java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
5	5.1	Write a program that creates a user interface to perform integer division. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 and Num2 were not integers, the program would throw a Number Format Exception. If Num2 were zero, the program would throw an

Arithmetic Exception Display the exception in a message dialog box.

5.2 Write a java program that implements a multi-thread application that has three threads. First hread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number

Syllabus: CSP 244, Principles of Operating System Lab

School: SET		**Batch: 2018**	
Program: B.Tech		**Current Academic Year: 2018-19**	
Branch: CSE		**Semester: IV**	
1	Course Code	**CSP 244**	
2	Course Title	Principles of operating System Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status		
5	Course Objective	Introduces different type operating systems, functions of operating systems, working in a Unix/Linux and Windows system, writing programs on Process management and file management.	
6	Course Outcomes	CO1: Working with single user multi task and multi-user multi-tasking environment. CO2: Identify and use utilities of Windows & Unix operating systems CO3: Use the resources of operating system i.e. process management and file management CO4: Writing programs on Process creation, multiple process creation, process synchronization, CO5: Writing program on basic file operations CO6: Writing program on file buffering.	
7	Course Description	The course is designed to make the students research/industry ready as operating systems are indispensable for the systems used in industries/research organizations. New operating systems for different gadgets are launched in last few years. So the students will get the design principles operating system in this course.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
		Illustration of Different types of operating system: Single user Multi task, Multi user Multi task	CO1
		Basic Windows features & Unix commands.	CO2
	Unit 2	**Processes**	
		Process basics: Creating processes using fork( ), the parent-child processes PID, PPID, process states: creating orphan, zombie processes.	CO2, CO3, CO4
	Unit 3	**Process Synchronization**	
		Creating multiple processes, Process table, use the command ps with –el, Synchronization of processes by using sleep( ) & wait( ), background process,	CO3, CO4
	Unit 4	**Files**	
		Basic file operations, Programs for File operations, sharing data between processes using files.	CO3, CO4,CO5

	Unit 5	**File Buffering**			
		File descriptor table, system file table, file pointer, buffer accessing block wise, use the functions: fopen( ), fread( ), ftell( ), lseek( ), fflush( ) etc.			CO3, CO4,CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	1. Sumitabha Das, "Unix Concepts and Applications", Tata McGraw Hill.			
	Other References	1. Unix: The complete Reference, Kenneth Rosen et.al., TMH 2. Unix 'C' Odessey, Meeta Gandhi et.al. BPB			

Course outline	
This course introduces the features of GUI i.e. Windows operating system as well as the CUI i.e. the commands used in Unix, so that the students will be familiar with both GUI & CUI environment of operating systems. As the course progresses the students will learn to write programs for process management and file operations. Further the students can implement the algorithms studied in theory by writing programs using the above principles and skills.	
Course Evaluation	
Attendance	None
Any other	CA judged on the practical conducted in the lab , weightage may be specified
References	
Text book	1. Sumitabha Das, "Unix Concepts and Applications", Tata McGraw Hill.
Other References	1. Unix: The complete Reference, Kenneth Rosen et.al., TMH 2. Unix 'C' Odessey, Meeta Gandhi et.al. BPB
Software	Windows, Unix / Any Unix family OS i.e. Linux

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Working with single user multi task and multi-user multi-tasking environment.	PO1,PO2,PO3,PO4,PSO1
2.	CO2: Identify and use utilities of Windows & Unix operating systems	PO1, PO3, PO4, PSO2
3.	CO3: Use the resources of operating system i.e. process management and file management	PO1,PO2,PO3,PO4
4.	CO4: Writing programs on Process creation, multiple process creation, process synchronization,	PO9, PO10,PO11, PSO3

5.	CO5: Writing program on basic file operations	PO1,PO2,PO8,PO9,PO10,PSO1
6.	CO6: Writing program on file buffering.	PO1,PO2,PO10,PO11,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Principles of Operating System (Course Code CSP 244)

CSE244	Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
	CO 1	3	3	3	3	--	--	--	2	2	1	2	1	3	2	2
	CO 2	3	2	3	3	--	--	--	2	2	2	1	1	2	3	2
	CO 3	3	3	3	3	--	--	--	1	1	1	3	2	3	2	1
	CO 4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
	CO 5	2	2	3					3	3	1	2		3		
	CO 6	3	2								2	3		2	2	

School: SET	**Batch : 2018 - 2022**
Program: B.tech	**Current Academic Year: 2019-2020**
Branch: CSE / IT	**Semester: 3rd**

1	Course Code	**CSP251** Course Name: Project Based Learning -1
2	Course Title	Project Based Learning -1
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	4. To align student's skill and interests with a realistic problem or project 5. To understand the significance of problem and its scope 6. Students will make decisions within a framework
6	Course Outcomes	Students will be able to: CO1: Identify and formulate problem statement with systematic approach. CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others. CO3: Design the problem solution as per the problem statement framed. CO4: Classify and understand techniques for software verification and validation of project successfully. CO5: Fabricate and implement the solution by using different aspects of programming language. CO6: Develop a glory of the need to engage in life-long learning.
7	Course Description	In PBL-1, the students will learn how to define the problem for developing projects, identifying the skills required for developing the project based on given a set of specifications and all subjects of that Semester.
8	Outline syllabus	

		CO Mapping
Unit 1	Problem Definition, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1, CO2
Unit 2	Develop a work flow or block diagram for the proposed system / software.	CO2,CO3
Unit 3	Design algorithms for the proposed problem.	CO3
Unit 4	Implementation of work under the guidance of a faculty member and obtain the appropriate results.	CO3, CO4
Unit 5	Demonstrate and execute Project with the team. Validate and verify the project modules. Report should include Abstract, Hardware / Software Requirement, Problem Statement, Design/Algorithm, Implementation Detail. Validation Reports. References if any. The presentation, report, work done during the term supported by the documentation, forms the basis of assessment.	CO4, CO5, CO6

Mode of examination	Practical /Viva

Weight age Distribution	CA	MTE	ETE
	60%	NA	40%

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify and formulate problem statement with systematic approach.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others.	PO1, PO2, PO4, PO7, PO9, PO10, PO11, PO12 ,PSO3
3.	CO3: Design the problem solution as per the problem statement framed.	PO1, PO2, PO5, PO9, PO10, PO11, PO12, PSO1,PSO2
4.	CO4: Classify and understand techniques for software verification and validation of project successfully.	PO1, PO2, PO6, PO9, PO10, PO11, PO12,PSO2
5.	CO5: Fabricate and implement the solution by using different aspects of programming language.	PO1, PO2, PO3, PO4,PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12 PSO1,PSO2, PSO3
6.	CO6: Develop a glory of the need to engage in life-long learning.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO3

PO and PSO mapping with level of strength for Course Name Project Based Learning -1 (Course Code CSP251)

CO/PO Mapping

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low

Cos	Programme Outcomes(POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
CO2	3	2	-	3	-	-	2	-	3	3	2	3			1
CO3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	
CO4	3	3	-	-	-	2	-	-	3	3	2	3		2	
CO5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
CO6	3	3	-	3	-	-	-	-	3	3	2	3			1
AvgPO attained	3	2.7	0.34	1.84	0.67	0.67	0.84	0.5	3	3	2	3	1	1.4	0.5

School: SET	**Batch : 2018 - 2022**	
Program: B.tech	**Current Academic Year: 2019-2020**	
Branch: CSE / IT	**Semester: 3rd**	
1	Course Code	**CSP294** Course Name: Summer Internship-I
2	Course Title	Summer Internship-I
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	This course will expose students to apply theories learned in the classroom and provides current technological developments relevant to the subject area of training. Students will be able to identify the career preferences and professional goals.
6	Course Outcomes	Students will be able to: CO1: Get familiarize with industry principles and practices. CO2: Identify and analyze an appropriate problem. CO3: Develop teamwork and apply prior acquired knowledge in problem solving. CO4: Demonstrate effective verbal and written communication skills. CO5: Practice engineer's responsibilities, self-understanding, self-discipline and ethical standards. CO6: Identify the career preferences and professional goals.
7	Course Description	The Internship aims to offer students the opportunity to apply their prior acquired knowledge in problem solving. Students will acquire skills important for time management, discipline, self learning, and effective communication and so on.

8 Outline syllabus		CO Mapping
Unit 1	Define objectives and conditions for the internship, ensuring students that it is related to the study path carried out at the University	CO1,CO6
Unit 2	Problem Definition and identification, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO2,CO6,
Unit 3	The internship work plan is drawn up by developing team work and applies prior acquired knowledge in problem solving.	CO3,CO6,
Unit 4	Demonstrate and execute Project with the team. Submission of evaluation form and final report completed by the intern.	CO4,CO6
Unit 5	Final evaluation form completed by the supervisor at the Host Organization and final presentation before departmental committee.	CO5,CO6
Mode of examination	Theory	
Weight age Distribution	CA	MTE

60% NA

Text book/s* ETE 40%

Other References

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Get familiarize with industry principles and practices.	PO1
2.	CO2: Identify and analyze an appropriate problem.	PO2,PO3,PO5,PSO1,PSO2
3.	CO3: Develop teamwork and apply prior acquired knowledge in problem solving.	PO1,PO2, PO3,PO9,PSO1
4.	CO4: Demonstrate effective verbal and written communication skills.	PO10
5.	CO5: Practice engineer's responsibilities, self-understanding, self-discipline and ethical standards.	PO6,PO8
6.	CO6: Identify the career preferences and professional goals.	PO12,PSO1

PO and PSO mapping with level of strength for Course Name Summer Internship-I

CO/PO Mapping

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low

Cos	Programme Outcomes(POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	2	-	2	-	-	-	-	-	-	-	2	2	-
CO3	2	2	3	-	-	-	-	-	3	-	-	-	1	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO5	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-
Avg PO attained	1	0.84	0.84	0	0.34	0.34	0	0.5	0.5	0.5	0	0.34	0.64	0.34	0

TERM-IV

Syllabus: CSP 249, Database management System

School: SET		**Batch: 2019-2023**	
Program: B.Tech		**Current Academic Year: 2019-2020**	
Branch: CSE		**Semester: IV**	
1	Course Code	CSE249	Course Name
2	Course Title	**Database Management System**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	1.Develop the ability to design, 2. Implement and manipulate databases. 3. Introduce students to build data base management systems. 4. Apply DBMS concepts to various examples and real life applications.	
6	Course Outcomes	Students will be able to: **CO1:** Explain the basics concepts of data base. **CO2:** Demonstrate the knowledge of databases to E-R modelling. **CO3:** Ability to design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respective data. **CO4:** Apply normalization techniques to reduce redundancy from the database. **CO5:** To appraise the basic issues of Transaction processing, Serializability& concurrency control **CO6:** Design & develop database for real life problems	
7	Course Description	This course introduces database design and creation using a DBMS product. Emphasis is on, normalization, data integrity, data modeling, and creation of simple tables, queries, reports, and forms. Upon completion, students should be able to design and implement normalized database structures by creating simple database tables, queries, reports, and forms.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Databases:**	
	A	Introduction ofof DBMS, Characteristic of DBMS, Data Models, Database languages, Database Administrator, Database Users.	CO1,CO2,CO6
	B	Three Schema architecture of DBMS, Data Models,Hierarchical, Network ,Data independence and database language, DDL, DML, Data Modeling using Entity Relationship Model	
	C	Strong Entity, Weak entity, Specialization and generalization, converting ER Model to relational tables.	
	Unit 2	**Relational Database Language and Interfaces:**	
	A	Relational data model concepts ,Concept of keys, Mapping Constraints	CO3
	B	Null Values, Domain Constraints, Referential Integrity Constraints	
	C	Unary Relational Operations: SELECT and PROJECT Relational Algebra Operations from Set Theory ,Binary	

		Relational Operations: JOIN and DIVISION ,SQL.			
	Unit 3	**Normalization in Design of Databases:**			
	A	Functional Dependency, Different anomalies in designing a Database, loss less join decompositions			CO1, CO4, CO6
	B	Normalization : first second and third normal forms, BoyceCodd normal form, dependency preservation,			
	C	multi-valued dependencies , fourth normal forms, Inclusion dependencies,			
	Unit 4	**Transaction Management:**			
	A	Transaction processing system, schedule and recoverability, Testing of serializability,			CO5
	B	Serializability of schedules, conflict & view serializable schedule			
	C	Recovery from transaction failures, deadlock handling.			
	Unit 5	**Concurrency Control**			
	A	Two-Phase Locking Techniques for Concurrency Control , Concurrency Control Based on Timestamp Ordering			CO5
	B	Multiversion Concurrency Control Techniques ,Validation (Optimistic) Concurrency Control Techniques			
	C	Granularity of Data Items and Multiple Granularity Locking			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Korth , Silberschatz&Sudarshan, Data base Concepts, Tata McGraw-Hill, Latest Edition			
	Other References	1.Elmasri, Navathe, Fundamentals of Database Systems, Pearson Education Inc. 2.Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to design, Implementation and Management, Pearson Education, Third Edition.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Understand the basics concepts of data base.	PO1, PO6, PO12, PSO1,PSO2
2.	Acquire the knowledge of databases to E-R modelling.	PO1 , PO5 , PO6 ,PO9, PO12, PSO1 PSO2
3.	Ability to design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respective data.	PO1, PO2, PO3, PO5, PO6, PO12 PSO1, PSO2
4	Learn the basic concept of normalization & apply them to reduce redundancy from the database .	PO1, PO2, PO3, PO4, PO6 ,PO8 PO9 ,PO12 , PSO3
5	To appraise the basic issues of Transaction processing ,Serializability& concurrency control	PO1, PO2, PO3, PO5, PO6, PO8 PO12 ,PSO2

6	Design & develop database for real life problems	PO1, PO2, PO3, PO4, PO5, PO6 PO8 ,PO9 ,PO10 ,PO11, PO12 PSO3

PO and PSO mapping with level of strength for Course Name Database Management System(Course Code CSE 249)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication:	Project management and finance	Life-long learning	Familiarity and practical proficiency	Understand, analyse and develop	Apply standard Software
CO1	3	-	-	-	-	2	-	-	-	-	-	3	3	3	-
CO2	2	-	-	-	3	2	-	-	2	-	-	3	3	3	-
CO3	3	3	3	-	3	2	-	-	-	-	-	2	2	3	-
CO4	3	3	3	3	-	2	-	2	3	-	-	2	-	-	3
CO5	2	3	2	-	2	2	-	2	-	-	-	1	-	3	-
CO6	3	3	3	3	3	3	-	3	3	3	2	3	-	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code/ Name	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSE 249/ DBMS	2.6 7	3	2.7 5	3	2.7 5	2.2	-	2.3	2.7	3	2	2.3	2.6	3	3

Strength of Correlation:1. Addressed to ***Slight (Low=1) extent 2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch: 2019-2020**	
Program: B.Tech		**Current Academic Year: 2019-2020**	
Branch:CSE		**Semester:**	
1	Course Code	**CSE250** Course Name: Theory of Computation and Compiler Design	
2	Course Title	Theory of Computation and Compiler Design	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status		
5	Course Objective	The objective of this course is to provide fundamental knowledge of Finite automata Learning about automata, grammar, language, and their relationships. Also, Introduces the major phases of Compiler construction and also its theoretical aspects including regular expressions, context-free grammars, Finite Automata	
6	Course Outcomes	After completing this course, students will be able to: **CO1: Design** DFA and NDFA and conversion from NDFA to DFA. Construct finite automata without output and with output. **CO2:Implement** regular expression and grammar corresponding to DFA and vice-versa. Explain the concepts and different phases of compilation with compile time error handling. **CO3: Design** Push down Automata from Context Free Language or Grammar and vice-versa. **CO 4:Compare** top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input **CO 5: Design** syntax directed translation schemes for a given context free grammar. **CO 6:Generate** intermediate code for statements in high level language, Benefits and limitations of automatic memory management. optimization techniques to intermediate code and generate machine code for high level language program	
7	Course Description	To provide students with an overview of the issues that arise in Compiler construction as well as to throw light upon the significant theoretical developments and tools that are deep rooted into computer science.	
8	Outline syllabus		CO Mapping
	Unit 1	**Finite Automata and Regular Expression**	
	A	Introduction to languages, Kleene closures, Finite Automata (FA), Transition graph, Nondeterministic finite Automata (NFA), Deterministic finite Automata (DFA).	CO1
	B	Regular Expression, Finite Automata with null move, Regular Expression to Finite Automata.,Arden Theorem	CO1,CO2
	C	FA with output: Moore machine, Mealy machine and Equivalence.	CO1
	Unit 2	**REGULAR & CONTEXT FREE LANGUAGE**	
	A	Defining grammar, Chomsky hierarchy of Languages and Grammar. Ambiguous to Unambiguous CFG.	CO1,CO2
	B	Simplification of CFGs, Normal forms for CFGs, Derivation and parse trees.	CO1,CO2
	C	Introduction to Compiler, Phases and passes, Bootstrapping, Cross-Compiler	CO1,CO2,CO4
	Unit 3	**PUSH DOWN AUTOMATA**	
	A	Description and definition of PDA and Non-Deterministic	CO3

		PDA	
	B	Working of PDA,Acceptance of a string by PDA with final state and with Null store. Two stack PDA.	CO3
	C	Two stack PDA and PDA applications	CO3
	Unit 4	**Introduction to Lexical and Syntax Analysis & Parsing techniques**	
	A	Lexical analysis: Role of lexical analyser, Tokens, patterns & Lexemes	CO4,CO5
	B	Basic Parsing Techniques: Role of Parsers, Top Down Parsers, Algorithm to calculate FIRST and Follow, predictive parsers, LL(1) grammars, operator precedence parsing,	CO4,CO5
	C	Bottom up Parsing: Reductions, Handle Pruning, Conflicts during shift reduce parsing, Introduction to LR parsers, Items, Viable Prefixes, the canonical Collection of LR(0) items, SLR(1),CLR(1) and LALR(1) parsers.	CO4,CO5
	Unit 5	**Semantic Analysis and Three Address Code**	
	A	Syntax directed definition: Inherited and Synthesized attributes, Evaluation order for SDD's, Syntax directed translation scheme	CO5,CO6
	B	Intermediate code generation: Three address Code and its variants	CO5,CO6
	C	Code Optimization : Machine Dependent and Machine independent optimization techniques.	CO5,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 30%	MTE: 20%	ETE: 50%	
	Text book/s*	•Introduction to Automata theory, Languages and Computation, John E. Hopcroft, Rajeev Motwani, Jeffery D. Ullman, Third Edition Pearson education. 2007 •Aho, Sethi, Ulman, compilers Principles, Techniques, and Tools, Pearson Education, 20	
	Other References	1. Lauden, Principles of Compiler Construction. 2. Fundamentals of the Theory of computation, Principles and Practice, Raymond Greenlaw, H. James Hoover, Morgan Kaufmann,1998 3. Peter Linz, “Formal Languages and Auomata”, Narosa Publishing House	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1: Design** DFA and NDFA and conversion from NDFA to DFA. Construct finite automata without output and with output.	PO1,PO2,PO3,PO4,PO5,PO8, PO9,PO12,PSO1
2.	**CO2:Implement** regular expression and grammar corresponding to DFA and vice-versa. Explain the concepts and different phases of compilation with compile time error handling.	PO1,PO2, PO3, PO4,PO5, PO8, PSO2,PSO3

3.	**CO3: Design** Push down Automata from Context Free Language or Grammar and vice-versa.	PO1,PO2,PO3,PO4, PO9, PO12,PSO1,PSO2
4.	**CO 4:Compare** Top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input	PO1,PO2,PO3,PO5 PO8,,PO9, PO12, PSO1,PSO2,PSO2
5.	**CO 5: Design** syntax directed translation schemes for a given context free grammar.	PO1,PO2,PO3, PO4,PO5, PSO1,PSO2,PSO3
6.	**CO 6:Generate** intermediate code for statements in high level language, Benefits and limitations of automatic memory management. optimization techniques to intermediate code and generate machine code for high level language program	PO1, PO3,PO4, PO5, PO8,PO9, PO12, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Theory of Computation and Compiler Design **(Course Code CSE 250)**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	--	--	2	2	--	--	2	3	--	--
CO2	2	3	3	1	2	--	--	3	--	--	--	--	--	3	2
CO3	3	3	3	2	--	--	--	--	2	--	--	2	2	2	--
CO4	1	2	3	--	2	--	--	3	3	--	--	3	3	3	2
CO5	1	2	2	2	2	--	--	1	2	--	--	--	1	2	2
CO6	2	--	3	2	1	--	--	2	3	--	--	3	3	2	3

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE250	TOC& CD	2	2	2.6	1.5	1.6	0	0	1.8	2	0	0	1.6	2	2	1.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSE 251, Theory of Computation

School: SET		**Batch : 2019-20**	
Program: B.Tech		**Current Academic Year:2019-20**	
Branch:CSE		**Semester:IV**	
1	Course Code	CSE-251 Course Name: Theory of Computation	
2	Course Title	Theory of Computation	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status		
5	Course Objective	The goal of this course is to provide students with an understanding of basic concepts in the theory of computation.	
6	Course Outcomes	Students will be able to: **CO1: Formulate** the concept of Automata and related terminology. **CO2: Design** DFA and NDFA and conversion from NDFA to DFA. **CO3: Construct** finite automata without output and with output. **CO4:Implement** regular expression and grammar corresponding to DFA and vice-versa **CO5: Design** Push down Automata from Context Free Language or Grammar and vice-versa. **CO6: Design** Turing Machine for computational problems, Develop a clear understanding of un-decidability.	
7	Course Description	The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples.	
8	Outline syllabus		CO Mapping
	Unit 1	**Finite Automata**	
	A	Introduction to languages, Kleene closures, Finite Automata (FA), Transition graph, Nondeterministic finite Automata (NFA), Deterministic finite Automata (DFA).	CO1, CO2
	B	Equivalence of NDFA and DFA, Construction of DFA from NFA and optimization of Finite Automata.	CO1, CO2
	C	Applications and Limitation of FA. (FAT tool).	CO1, CO2
	Unit 2	**Regular Expression and Finite Automata**	
	A	Regular Expression, Finite Automata with null move, Regular Expression to Finite Automata.	CO1, CO2,CO4
	B	Arden Theorem, Pumping Lemma for regular expressions.	CO1, CO2,CO4
	C	FA with output: Moore machine, Mealy machine and Equivalence.	CO1, CO2,CO3
	Unit 3	**REGULAR & CONTEXT FREE LANGUAGE**	
	A	Defining grammar, Chomsky hierarchy of Languages and Grammar. Ambiguous to Unambiguous CFG.	CO4
	B	Simplification of CFGs.	CO4
	C	Normal forms for CFGs, Pumping lemma for CFLs.	CO4
	Unit 4	**PUSH DOWN AUTOMATA**	
	A	Description and definition of PDA and Non-	CO5

	Deterministic PDA, Working of PDA.	
B	Acceptance of a string by PDA with final state and with Null store. Two stack PDA.	CO5
C	Conversion of PDA into CFG, Conversion of CFG into PDA.	CO5
Unit 5	**TURING MACHINE**	
A	Turing machines (TM): Basic model, definition and representation, Language acceptance by TM.	CO6
B	Turing machine as a computational machine, Halting problem of TM, Universal TM (Visual Turing machine).	CO6
C	Modifications in TM, Undecidability of Post correspondence problem, Church's Thesis, Godel Numbering.	CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science(Automata, Languages and Computation)", PHI	
Other References	1.Peter Linz, "Formal Languages and Auomata", Narosa Publishing House 2.Hopcroft, Ullman, "Introduction to Automata Theory, Language and Computation", Narosa Publishing House	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Formulate the concept of Automata and related terminology.	PO1,PO2,PO3,PO4,PO5, PO9,PO12,PSO1,PSO2
2.	**CO2:** Design DFA and NDFA and conversion from NDFA to DFA.	PO1, PO3, PO4, PO5, PO9, PO12 PSO2, PSO3
3.	**CO3:** Construct finite automata without output and with output.	PO1,PO2,PO3,PO4, PO9,PSO1,PSO2
4.	**CO4:** Implement regular expression and grammar corresponding to DFA and vice-versa	PO1,PO2,PO3, PO5,PO9, PO12 PSO3
5	**CO5:** Design Push down Automata from Context Free Language or Grammar and vice-versa .	PO1,PO2,PO3,PO4, PO5, PO9, PO12,PSO1,PSO2,PSO3
6	**CO6:** Design Turing Machine for computational problems, Develop a clear understanding of un-decidability.	PO1,PO2,PO3,PO4,PO5PO9, PO12, PSO1, PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Theory of Computation **(Course Code CSE251)**

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	2	--	--	--	3	--	--	3	3	2	--
CO 2	3	--	3	3	2	--	--	--	2	--	--	2	--	3	2
CO 3	3	3	3	3	--	--	--	--	2	--	--	--	3	2	--
CO 4	2	2	2	--	2	--	--	--	3	--	--	2	--	--	3
CO 5	3	3	3	3	3	--	--	--	--	--	--	3	3	2	2
CO 6	3	2	3	3	3	--	--	--	2	--	--	3	3	3	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE251	TOC	2.8	2.1	2.8	2.5	2	0	0	0	2	0	0	2.1	2	2	1.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSE 252, Computer Networks

School: SET		**Batch: 2019 onwards**	
Program: B.Tech		**Current Academic Year: 2020-2021**	
Branch:CSE		**Semester: 4**	
1	Course Code	CSE252 Course Name: B. Tech	
2	Course Title	**Computer Networks**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	Provide students with an overview of networking, insight into the issues, challenges and working at all level of reference models. Also practice on applying protocols in network design.	
6	Course Outcomes	Students will be able to: **CO1:**Demonstrate and differentiate working of all layers of the OSI Reference Model and TCP/IP model. **CO2:**Investigate and explore fundamental issues driving network design including error control. **CO3:** Understand and building the skills of IP addressing, subnetting and routing protocols. **CO4:** Discuss the flow control, elements and protocols of transport layer **CO5:** Describe the connection management and application layer protocols. **CO6:** Outline the basic knowledge of the use of cryptography and network security.	
7	Course Description	To familiarize with the basic taxonomy and terminology of computer networking area.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to computer networks, applications and uses, classification of Networks based on topologies, geographical distribution and communication techniques	CO1, CO2
	B	**Reference models:** OSI model, TCP/IP model , Overview of Connecting devices (Hub, Repeaters, Switches, Bridges, Routers, Gateways)	CO1, CO2
	C	**Transmission Media:**wired , wireless, Multiplexing techniques-FDM, TDM	CO1, CO2
	Unit 2	**Data Link Layer**	
	A	Functions, Framing, Error Control-Error correction codes(Hamming code),Error Detection codes(Parity Bit, CRC)	CO1, CO2
	B	Flow Control- Stop and Wait Protocol, Sliding window –Goback N and Selective repeat(ARQ)	CO1, CO2
	C	MAC- Sub-layer Protocols: ALOHA, CSMA, CSMA/CD protocols, IEEE Standards 802.3, 802.4,802.5	CO1, CO2
	Unit 3	**Network Layer**	
	A	Design issues , IPV4addressing basics and Header format, CIDR, sub-netting and sub-masking	CO1,CO3
	B	Routing, optimality Principle Routing protocols-, Shortest path, flooding, distance vector routing , link state routing	CO1,CO3
	C	Congestion control-Leaky bucket , Token Bucket, jitter control	CO1,CO3,CO4
	Unit 4	**Transport Layer**	
	A	Need of transport layer with its services, Quality of service,	CO1,CO4

	connection oriented and connection less	
B	Transmission Control Protocol: Segment structure and header format, TCP Connection Management, Flow Control	CO1,CO4,CO5
C	TCP congestion control, Internet Congestion Control Algorithm, Overview of User Datagram Protocol (UDP)	CO1,CO4,CO5
Unit 5	**Application Layer**	
A	Domain Name System (DNS), HTTP, FTP, SMTP	CO1,CO5
B	Network Security services, cryptography, Symmetric versus Asymmetric cryptographic algorithms- DES, and RSA	CO1,CO5,CO6
C	Application of Security in Networks: Digital signature	CO1,CO5,CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Tanenbaum, A.S." Computer Networks", 4th Edition, PHI	
Other References	1. Forouzan, B.., "Communication Networks", TMH, Latest Edition 2. W. Stallings, "Data and Computer Communication" Macmillan Press	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:**Demonstrate and differentiate working of all layers of the OSI Reference Model and TCP/IP model.	PO2,PO11,PO12,PSO2
2.	**CO2:**Investigate and explore fundamental issues driving network design including error control.	PO1,PO3,PO4,PO5,PO11PO12,PSO2
3.	**CO3:** Understand and building the skills of IP addressing, subnetting and routing protocols.	PO1,PO2,PO4,PO6,PSO1,PSO3
4.	**CO4:** Discuss the flow control, elements and protocols of transport layer	PO2,PO3,PSO2,PSO3
5.	**CO5:** Describe the connection management and application layer protocols.	PO1, PO2,PO3, PO4, PSO2
6.	**CO6:** Outline the basic knowledge of the use of cryptography and network security.	PO1, PO2, PO4,PO8 PO11, PSO2

PO and PSO mapping with level of strength for Course Name Computer Networks (Course Code CSE 252)

COs	PO1 Engineering knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4 Conduct investigations of complex problems	PO5 Modern tool usage	PO6 The engineer and society	PO7 Environment and sustainability	PO8 Ethics	PO9 Individual and team work	PO10 Communication:	PO11 Project management and finance	PO12 Life-long learning	PSO1 Familiarity and practical proficiency	PSO2 Understand, analyse and develop	PSO3 Apply standard Software
CO1		2	-	-	-	-	-	-	-	-	2	3	-	3	-
CO2	2	-	2	2	3	-	-	-	-	-	2	3		3	-
CO3	3	2	-	2	-	2	-	-	-	-	-	-	2	-	2
CO4	-	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO6	2	-	-	2	-	-	-	2	-	-	2	-	-	2	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code/ Name	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
Computer Networks	1.5	1.33	1	1.33	0.5	0.33	-	0.33	-	-	1	1	0.33	2	0.67

Strength of Correlation:1. Addressed to ***Slight (Low=1) extent 2.*** Addressed to ***Moderate (Medium=2) extent 3.*** Addressed to ***Substantial (High=3) extent***

Syllabus: CSE 011, Mathematical Techniques (Program Elective-1)

School: SET		**Batch: 2019-2023**	
Department		**Department of Computer Science and Engineering**	
Program: B.Tech		**Current Academic Year: 2019-2020**	
Branch:CSE		**Semester:V**	
1	Course Code	CSE 011	
2	Course Title	Mathematical Techniques	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Program Elective-I	
5	Course Objective	The objective of the course is to teach students the mathematical & statistical techniques that provide sound basis for research and application development in Computer Science.	
6	Course Outcomes	By the end of the course, students will be able to: CO1: Identify and analyze computational errors in numerical computation and series approximation. CO2: Make use of various Numerical techniques for interpolation. CO3: Recall probability concepts and statistical terms to apply in various random situations CO4: Identify various distributions for suitable scenario CO5: Make use of various techniques for hypothesis testing CO6: Apply mathematical and statistical methods in their research and application development	
7	Course Description	In this subject, the fundamental concepts and principles of Mathematical & Statistical Techniques together with the challenging issues in Computer Science software development will be introduced. Discussion on various topics related to mathematics and Computer Science will also be conducted.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction, Computational Errors and their Analysis**	
	A	Accuracy of numbers, Errors and a general error formula, Errors in Numerical Computations.	CO1, CO6
	B	Errors in a Series Approximation.	CO1, CO6
	C	Precisions	CO1, CO6
	Unit 2	**Numerical Techniques**	
	A	LU decomposition for systems of linear equations;	CO2, CO6
	B	numerical solutions of non-linear algebraic equations by Secant, Bisection and Newton-Raphson Methods;	CO2, CO6
	C	Numerical integration by trapezoidal and Simpson's rules.	CO2, CO6
	Unit 3	**Probability**	
	A	Probability: Conditional Probability;	CO3,CO6
	B	Mean, Median, Mode and Standard Deviation;.	CO3,CO6
	C	Random Variables; Distributions;	CO3,CO6
	Unit 4	**Permutation**	
	A	uniform, normal, exponential	CO4,CO6
	B	Poisson, Binomial distribution	CO4,CO6
	C	Permutations; Combinations; Counting; Summation;	CO4,CO6
	Unit 5	**Hypothesis testing**	
	A	Generating functions; recurrence relations;	CO5,CO6

	B	Techniques for statistical quality control,			CO5,CO6
	C	Testing of hypothesis.			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	M. Goyal, "Computer Based Numerical & Statistical Techniques", Infinity Science Press, LLC, MA, USA.			
	Other References	1. Matheus Grasselli and Dimitry Pelinovsky, "Numerical Mathematics", Jones and Bartlet Publishers, USA. 2. Lars Elden, "Mattrix Methods in Data Mining and Pattern Recognition", SIAM (Society for Industrial and Applied Mathematics), USA. 3. Internet as a resource for references.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Identify and analyze computational errors in numerical computation and series approximation.	PO1, PO2, PSO1
2.	CO2: Make use of various Numerical techniques for interpolation.	PO1, PO2, PO3, PO7, PO10, PO11, PO12, PSO1, PSO2
3.	CO3: Recall probability concepts and statistical terms to apply in various random situations	PO1, PO2, PO3, PO4, PO7, PO10, PO11, PO12, PSO1,PSO2
4.	CO4: Identify various distributions for suitable scenario	PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11, PO12, PSO1, PSO2
5.	CO5: Make use of various techniques for hypothesis testing	PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11, PO12, PSO1, PSO2
6.	CO6: Apply mathematical and statistical methods in their research and application development	PO1, PO2, PO3, PO4, PO5, PO7, PO10, PO11, PO12, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Mathematical techniques (Course Code CSE011)

Course	Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Mathematical techniques (CSE011)	CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
	CO2	2	3	1	1	1	-	1	-	-	1	2	1	1	1	-
	CO3	3	1	1	1	-	-	1	-	-	2	1	1	3	1	-
	CO4	2	3	2	1	1	-	1	-	-	1	1	1	2	1	-
	CO5	1	1	1	2	2	-	1	-	-	1	2	1	2	1	-
	CO6	3	1	3	1	2	-	2	-	-	2	2	3	3	1	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE011	Mathematical techniques	2.3	1.8	1.3	1	1	0	1	0	0	1.1	1.3	1.1	2.1	.8	0

School: SET		**Batch :2018**		
Program: B.Tech		**Current Academic Year: 2018-19**		
Branch:CS/IT		**Semester:5**		
1	Course Code	CSE012	Course Name: Introduction to Graph Theory and its Application	
2	Course Title	Introduction to Graph Theory and its Application		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Program Elective-I		
5	Course Objective	The objective of the course is to teach students the basic graph theory concepts and their applications in computer science.		
6	Course Outcomes	After successful completion of the course students will be able to CO1: demonstrate some of the most important notions and types of graph theory and develop their skill in solving basic applications understanding societal needs. CO2: interpret the fundamentals of graphs and trees and to apply these as computer science applications such as to find a minimal spanning tree for a given weighted graph etc. CO3: Discover the advanced properties and concepts of graphs such as cut-sets and circuits in graph, planarity of graphs etc in addition to their application in real-world. CO4: Examine a graph using matrices to communicate their application in real world. CO5: Develop efficient graph-theoretic algorithms (mathematically) to explore the applications of coloring problem of graph theory. **CO6: Relating the concepts to prepare grounds for project work and research interests.**		
7	Course Description	This course is to teach students the basic graph theory concepts and their applications in computer science.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction**		
	A	Basic terminologies and concepts of Graph Theory, Fundamental types of graphs, Applications in various areas		CO1
	B	Properties of graphs, theorems based on different types of graph and various operations on graphs		CO1,CO2
	C	Special types of graphs (Hamiltonian, Euler), Travelling salesman problem		CO1, CO6
	Unit 2	**TREES**		
	A	Fundamentals of trees and their types, Binary trees and their properties, importance of binary trees in data structure (searching algorithms)		CO2
	B	fundamental circuits, spanning trees, algorithms to find spanning trees in a weighted graph (Kruskal& Prim)		CO2
	C	Applications: Representation of the algebraic expressions as ordered binary trees, Huffman procedure for construction of an optimal tree for a given set of weights.		CO2, CO6
	Unit 3	**CUT SETS**		
	A	a cut-set of a connected graph, the fundamental circuit		CO1, CO3

		,Properties of circuits & cut–sets, Concept of connectivity and separability	
	B	Concept of Planar graphs with introduction to Kuratowski's non-planar graphs, Proof of Euler's formula	CO3
	C	Detection of planarity , geometric duals of graph, thickness & Crossings, network flow	CO3, CO6
	Unit 4	**Coloring and Covering**	
	A	Concept of proper coloring of vertices of a graph, chromatic number , Chromatic partitioning	CO5, CO6
	B	Chromatic polynomial, finding chromatic polynomial of a given graph	CO5, CO6
	C	Matching, Covering, Five color problem and its proof	CO5, CO6
	Unit 5	**Matrix Representation of Graphs& Applications**	
	A	Incidence matrix, sub matrices of A(G), circuit matrix, fundamental circuit matrix and Rank of B	CO3, CO4
	B	Cut set matrix , fundamental cut set matrix, path matrix, Adjacency matrix	CO4
	C	Finding Rank of different matrices, Relationship among A_f, B_f, andC_f	CO3, CO4
	Mode of examination	Theory	
	Weightage Distribution	CA / MTE / ETE 30% / 20% / 50%	
	Text book/s*	1. Deo, N, *Graphtheory with applications to Engineering and Computer Science*, Prentice Hall India	
	Other References	1. Wilson R J, *Introduction to Graph Theory*, PearsonEducation 2. Harary, F, *Graph Theory*, Narosa 3. Bondy& Murthy, *Graph theory and application*. Addison Wesley	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: : demonstrate some of the most important notions and types of graph theory and develop their skill in solving basic applications understanding societal needs.	PO1, PO2, PO6, PO7, PO10, PO11, PO12, PSO1
2.	CO2: interpret the fundamentals of graphs and trees and to apply these as computer science applications such as to find a minimal spanning tree for a given weighted graph etc.	PO1, PO2, PO3, PO4, PO6, PO7, PO10, PO12, PSO1
3.	CO3: Discover the advanced properties and concepts of graphs such as cut-sets and circuits in graph, planarity of graphs etc in addition to their application in real-world.	PO2, PO4, PO5,PO6, PO10, PO12, PSO2
4.	CO4: Examine a graph using matrices to communicate their application in real world.	PO2, PO4, PO10,PSO1, PSO2,
5.	CO5: Develop efficient graph-theoretic algorithms (mathematically) to explore the applications of coloring problem of graph theory.	PO1, PO2, PO4, PO5, PO6, PO10, PO12, PSO2
6	**CO6: Relating the concepts to prepare grounds for project work and research interests.**	PO4, PO6,PO12,PO10, PSO2, PSO3.

PO and PSO mapping with level of strength for Course Name: Introduction to Graph Theory and its Application (CSE 012)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	2	-	-	2	1	2	3	1	-
CO2	3	3	3	2	-	1	1	-	-	1	-	2	3	1	-
CO3	1	3	1	3	2	2	-	-	-	1	-	2	2	2	-
CO4	1	3	1	3	1	1	-	-	-	2	-	1	3	2	-
CO5	2	2	2	3	2	1	-	-	-	1	-	2	1	2	-
Co6	1	1	2	3	1	2	-	-	-	2	-	2	1	2	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE012	**Introduction to Graph Theory and its Application**	**1.83**	**2.83**	**1.83**	**2.67**	**1.17**	**1.5**	**0.5**	**-**	**-**	**1.5**	**0.17**	**1.83**	**2.17**	**1.67**	**0.33**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSP 249, Database management System Lab

School: SET		**Batch: 2019-2023**
Program: B.Tech		**Current Academic Year: 2019-2020**
Branch:CSE		**Semester: IV**
1	Course Code	CSP249
2	Course Title	Database Management System Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	• To Develop efficient SQL programs to access Oracle databases • Build database using Data Definition Language Statements • Perform operations using Data Manipulation Language statements like Insert, Update and Delete
6	Course Outcomes	By the end of this course you will be able to: CO1: Understand the concept of SQL commands in DBMS CO2: Create SQL SELECT statements that retrieve any required data CO3: Perform operations using Data Manipulation Language statements like Insert, Update and Delete CO4: Manipulate your data to modify and summaries your results for reporting CO5: Apply Grouping Clauses on various tuples & relations of database CO6: Develop project based on various SQL commands.
7	Course Description	An introduction to the design and creation of relational databases. Create database-level applications and tuning robust business applications. Lab sessions reinforce the learning objectives and provide participants the opportunity to gain practical hands-on experience.

8	Outline syllabus		CO Mapping
	Unit 1	**Practical based Data types**	
		Classification SQL, Data types of SQL/Oracle	CO1,CO2
	Unit 2	**Practical based on DDL commands**	
		Create table, Alter table and drop table	CO2,CO3
	Unit 3	**DML commands and Aggregate functions**	
		Introduction about the INSERT, SELECT, UPDATE & DELETE commands.	CO3,CO4
	Unit 4	**Practical based on Grouping Clauses GROUP BY ORDER BY & GROUP BY HAVING**	
		Briefly explain Group by, order by ,having clauses with examples. Aggregate function: sum, avg, count, max, min	CO5
	Unit 5	**Practical based on Sub- queries, JOINS**	
		Related example of Sub- queries, Joins and related examples,Views,Trigger	CO5,CO6

	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	1. Korth ,Silberschatz& Sudarshan, Data base Concepts, Tata McGraw-Hill			
	Other References	1. Elmasri, Navathe, Fundamentals of Database Systems, Pearson Education Inc. 2. *Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to design, Implementation and Management, Pearson Education, Latest Edition.* 3. *Jeffrey D. Ullman, Jennifer Windon, A first course in Database Systems, Pearson Education.*			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the concept of SQL commands in DBMS.	PO1,PO5, PSO1 ,PSO2
2.	CO2: Create SQL SELECT statements that retrieve any required data.	PO2, PO3, PO4, PO5, PO9,PSO1, ,PSO3
3.	CO3: Perform operations using Data Manipulation Language statements like Insert, Update and Delete.	PO2, PO3, PO4, PO5, PO9,PSO1, ,PSO3
4.	CO4: Manipulate your data to modify and summaries your results for reporting.	PO2, PO3, PO4, PO5, PO9,PSO1, ,PSO3
5	CO5: Apply Grouping Clauses on various tuples & relations of database	PO2, PO3, PO4, PO5, PO9,PSO1, ,PSO3
6	CO6: Develop project based on various SQL commands.	PO2, PO3, PO4, PO5, PO9, PO12,PSO1, PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Principles of Database Management System lab (Course Code CSP 249)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication:	Project management and finance	Life-long learning	Familiarity and practical proficiency	Understand, analyse and develop	Apply standard Software
CO1	3	-	-	-	2	-	-	-	-	-	-	-	2	3	2
CO2	-	3	3	3	2	-	-	-	3	-	-	-	2	3	3
CO3	-	2	2	2	2	-	-	-	3	-	-	-	2	2	3
CO4	-	2	2	2	2	-	-	-	3	-	-	-	2	2	3
CO5	-	2	2	2	2	-	-	-	3	-	-	-	2	2	3
CO6	-	2	3	2	3	-	-	-	3	-	-	2	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code/ Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
CSP249 / DBMS lab	3	2.2	2.4	2.2	2.2	-	-	-	3	-	-	2	2.2	2.5	2.8

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: Theory of Computation & Compiler Design Lab

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:CSE		**Semester:**	
1	Course Code	CSP250	
2	Course Title	Theory of Computation & Compiler Design Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status		
5	Course Objective	This laboratory course is intended to make the students experiment on the basic techniques of automata theory, regular expression, formal language, pushdown automaton and compiler construction that can used to perform syntax-directed translation of a high-level programming language into an executable code. Students will design and implement language processors in C by using tools to automate parts of the implementation process. This will provide deeper insights into the more advanced semantics aspects of programming languages, code generation, machine independent optimizations.	
6	Course Outcomes	CO1 **Apply** different compiler writing tools to implement the different Phases CO2: **Implement** regular expression and grammar corresponding to DFA and vice-versa CO3: **Construct** Push Down Automata. CO4: **Implement** a parser for different context free grammars. CO5: **Construct** the intermediate representation CO6: **Compare** various code optimization techniques	
7	Course Description	This self-paced course will discuss the major ideas used today in the implementation of programming language compilers, including lexical analysis, parsing, syntax-directed translation, abstract syntax trees, types and type checking, intermediate languages, dataflow analysis, program optimization, code generation, and runtime systems. As a result, you will learn how a program written in a high-level language designed for humans is systematically translated into a program written in low-level assembly more suited to machines	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on Designing of Finite Automata and Regular expression**	
		1. Design a DFA which will accept all the strings containing even number of 0's and even number of 1’s over an alphabet {0, 1} and write a program to implement the DFA. 2. Design a DFA which will accept all the strings containing mod 3 of 0’s over an alphabet {0, 1} and write a program to implement the DFA. 3. Construct a regular expressions. And	CO1,CO2

Converting FA to Regular Expressions.

Unit 2	**Practical related to – Context free grammar & Lexical Analyzer**	
	1. Write a code to convert Ambiguous to Unambiguous CFG. 2. Write a code for simplification of Grammar. 3. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines	CO1,CO2
Unit 3	**Practical related to-- PUSH DOWN AUTOMATA**	
	1. Implement Push Down Automata 2. Converting PDA to CFG 3. Converting CFG to PDA	CO3
Unit 4	**Practical related to--- Parsing techniques**	
	1. Write an algorithm and program on Recursive Descent parser. 2. Write an algorithm and program to compute FIRST and FOLLOW function. 3. Develop an operator precedence parser for a given language. 4. Implementation of shift reduce parsing algorithm and LR parser	CO4
Unit 5	**Practical related to--- Syntax Directed Translations And Intermediate Code Generation**	
	1. Write code to generate abstract syntax tree. 2. Implement Three Address codes 3. Implementation of Code Generation	CO5,CO6
Mode of examination	Jury/Practical/Viva	
Weightage Distribution	CA 60% MTE 0% ETE 40%	
Text book/s*	1. Aho, Sethi, Ulman, compilers Principles, Techniques, and Tools, Pearson Education, 2003 2. Peter Linz, "Formal Languages and Auomata", Narosa Publishing House	
Other References	Lauden, Principles of Compiler Construction. 1. D. M. *Dhamdhere Compiler* Construction--Principles and Practice, Macmillan India,	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1 **Apply** different compiler writing tools to implement the different Phases	PO1,PO5,PO6,PO9,PO12,PSO1,PSO2

2.	CO2: **Implement** regular expression and grammar corresponding to DFA and vice-versa	PO1,PO2,PO3, PO4,PO5, PO12, PSO1, PSO2
3.	CO3: **Construct** Push Down Automata.	PO1,PO2,PO3,PSO1,PSO2
4.	CO4: **Implement** a parser for different context free grammars.	PO1,PO2,PO3, PO4,PO5,PO9, PSO2,PSO3
5.	CO5: **Construct** the intermediate representation	PO1,PO2,PO3, PO4,PO5,PO9,PO12,PSO1,PSO2,PSO3
6.	CO6: **Compare** various code optimization techniques	PO1, PO3,PO4, PO4,PO5,PO9,PO12 PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Theory of Computation and compiler Design Lab (Course Code CSP250)

Cos	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO 11	PO1 2	PS O1	PSO2	PSO3
CO1	3	--	--	--	3	--	--	--	2	--	--	3	2	1	--
CO2	2	2	3	3	2	--	--	--	--	--	--	2	3	2	--
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	2	--
CO4	1	2	3	3	3	--	--	--	3	--	--	--	--	3	2
CO5	1	1	2	3	2	--	--	--	3	--	--	3	1	2	2
CO6	2	--	3	3	2	--	--	--	3	--	--	3	3	2	3

1-Slight (Low)   2-Moderate (Medium)   3-Substantial (High)

Average of non-zeros entry in following table (should be auto calculated).

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSP250	**TOC&CD**	**2**	**1.3**	**2.3**	**2**	**2**	**0**	**0**	**0**	**1.8**	**0**	**0**	**2**	**2**	**2**	**1.2**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent***   ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

.

School:		School of Engineering and technology
Department		Department of Computer Science and Engineering
Program:		B.Tech
Branch:		
1	Course Code	CSP-252
2	Course Title	Computer Networks Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory/Elective
5	Course Objective	The students will be introduced to the basic concepts and fundamentals of computer networks along with the study of individual layers of reference model.
6	Course Outcomes	Students will be able to: CO1: Explain the basic concepts of computer network. CO2: Illustrate and differentiate working of all layers of the OSI Reference Model and TCP/IP model CO3: Analyze fundamental issues driving network design including error control, IP addressing, access control, flow and congestion control CO4: Compare working of various routing algorithms CO5: Test various network security algorithms CO6: Examine various cryptographic Algorithms
7	Course Description	To familiarize with the basic taxonomy and terminology of computer networking area.

8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Study of Data Communication and Networking. Identify five components of Data communication system.	CO1, CO2
	B	Study of computer network topology and OSI model layered architecture.	CO1, CO2
	C	Study of basic networking commands: IPCONFIG, PING / Tracer and Net stat utilities to debug the network issues.	CO1, CO2
	Unit 2	Data Link Layer	
	A	To connect the computers in Local Area Network	CO1, CO2
	B	Write a C program to implement Character Stuffing and Destuffing	CO1, CO2
	C	Write a C program to Error Detection using Cyclic Redundancy Check Algorithms.	CO1, CO2
	Unit 3	Network Layer	

A	Write a program to generate Hamming code.	CO1,CO3
B	Write a C program to determine if the IP address is in Class A, B, C, D, or E.	CO1,CO3
C	Write a C program to translate dotted decimal IP address into 32 bit address.	CO1,CO3,CO4
Unit 4	Transport Layer	
A	Write a program for congestion control using Leaky bucket algorithm.	CO1,CO4
B	Write a Program to simulate Distance vector routing.	CO1,CO4,CO5
C	Creating a Network topology using CISCO packet tracer software	CO1,CO4,CO5
Unit 5	Application Layer	
A	Write a program to implement DES for encryption.	CO1,CO5
B	Using RSA algorithm encrypts a text data and decrypts the same.	CO1,CO5,CO6
C	Open Ended Project	CO1,CO5,CO6
Mode of examination	Jury/Practical/Viva	
Weightage Distribution	CA 60% MTE 0% ETE 40%	
Text book/s*	Tanenbaum, A.S." Computer Networks", 4th Edition, PHI	
Other References	1. Forouzan, B.., "Communication Networks", TMH, Latest Edition 2. W. Stallings, "Data and Computer Communication" Macmillan Press	

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Explain the basic concepts of computer network.	PO2,PO11,PO12,PSO2
2.	CO2: Illustrate and differentiate working of all layers of the OSI Reference Model and TCP/IP model	PO1,PO3,PO4,PO5,PO11PO12,PSO2
3.	CO3: Analyze fundamental issues driving network design including error control, IP addressing, access control, flow and congestion control	PO1,PO2,PO4,PO6,PSO1,PSO3
4.	CO4: Compare working of various routing algorithms	PO2,PO3,PSO2,PSO3
5.	CO5: Test various network security algorithms	PO1, PO2,PO3, PO4, PSO2
6.	CO6: Examine various cryptographic Algorithms	PO1, PO2, PO4,PO8 PO11, PSO2

PO and PSO mapping with level of strength for Course Name Computer Networks Lab (Course Code CSP252)

Computer Networks Lab (Course Code CSP252)		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1		2	-	-	-	-	-	-	-	-	2	3	-	3	-
	CO2	2	-	2	2	3	-	-	-	-	-	2	3		3	-
	CO3	3	2	-	2	-	2	-	-	-	-	-	-	2	-	2
	CO4	-	2	2	-	-	-	-	-	-	-	-	-	-	2	2
	CO5	2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
	CO6	2	-	-	2	-	-	-	2	-	-	2	-	-	2	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code/ Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Computer Networks (CSP 252)	1.5	1.33	1	1.33	0.5	0.33	-	0.33	-	-	1	1	0.33	2	0.67

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School: SET **Batch : 2018 - 2022**
Program: B.tech **Current Academic Year: 2019-2020**
Branch: CSE / IT **Semester: 4th**

1	Course Code	**CSP298** Course Name: Project Based Learning -2
2	Course Title	Project Based Learning -2
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	7.To align student's skill and interests with a realistic problem or project 8.To understand the significance of problem and its scope 9.Students will make decisions within a framework
6	Course Outcomes	Students will be able to: CO1: Identify and formulate problem statement with systematic approach. CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others. CO3: Design the problem solution as per the problem statement framed. CO4: Explain the characteristics, architecture of database approach, describe the components of the project. CO5: Fabricate and implement the solution by using different object oriented concepts like encapsulation, polymorphism etc. CO6: Develop a glory of the need to engage in life-long learning.
7	Course Description	In PBL-1, the students will learn how to define the problem for developing projects, identifying the skills required for developing the project based on given a set of specifications and all subjects of that Semester.

8 Outline syllabus

		CO Mapping
Unit 1	Problem Definition, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1, CO2
Unit 2	Develop a work flow or block diagram for the proposed system / software.	CO2,CO3
Unit 3	Design algorithms for the proposed problem.	CO3
Unit 4	Implementation of work under the guidance of a faculty member and obtain the appropriate results.	CO3, CO4
Unit 5	Demonstrate and execute Project with the team. Validate and verify the project modules. Report should include Abstract, Hardware / Software Requirement, Problem Statement, Design/Algorithm, Implementation Detail. Validation Reports. References if any. The presentation, report, work done during the term	CO4, CO5, CO6

	supported by the documentation, forms the basis of assessment.			
Mode of examination	Practical /Viva			
Weight age	CA		MTE	ETE
Distribution	60%		NA	40%

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify and formulate problem statement with systematic approach.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Develop teamwork and problem-solving skills, along with the ability to communicate effectively with others.	PO1, PO2, PO4, PO7, PO9, PO10, PO11, PO12 ,PSO3
3.	CO3: Design the problem solution as per the problem statement framed.	PO1, PO2, PO5, PO9, PO10, PO11, PO12, PSO1,PSO2
4.	CO4: Explain the characteristics, architecture of database approach, describe the components of the project.	PO1, PO2, PO6, PO9, PO10, PO11, PO12,PSO2
5.	CO5: Fabricate and implement the solution by using different object oriented concepts like encapsulation, polymorphism etc.	PO1, PO2, PO3, PO4,PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12 PSO1,PSO2, PSO3
6.	CO6: Develop a glory of the need to engage in life-long learning.	PO1, PO2, PO4, PO9, PO10, PO11, PO12,PSO3

PO and PSO mapping with level of strength for Course Name Project Based Learning -1 (Course Code CSP251)

CO/PO Mapping

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low

Cos	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	-	3	3	2	3	2	2	1
CO2	3	2	-	3	-	-	2	-	3	3	2	3			1
CO3	3	2	-	-	2	-	-	-	3	3	2	3	2	2	
CO4	3	3	-	-	-	2	-	-	3	3	2	3		2	
CO5	3	3	2	2	2	2	3	3	3	3	2	3	2	2	
CO6	3	3	-	3	-	-	-	-	3	3	2	3			1
Avg PO attainted	3	2.7	0.3	1.8	0.7	0.7	0.8	0.5	3	3	2	3	1	1.3	0.5

School: SET
Program:
Branch: CSE

Batch : 2018-19
Current Academic Year: 2018-19
Semester: IV

1	Course Code	**ARP204** Course Name : **Aptitude Reasoning and Business Communication Skills-Intermediate**	
2	Course Title	**Aptitude Reasoning and Business Communication Skills-Intermediate**	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status		
5	Course Objective	To enhance holistic development of students and improve their employability skills. Provide a 360 degree exposure to learning elements of Business English readiness program, behavioural traits, achieve softer communication levels and a positive self-branding along with augmenting numerical and altitudinal abilities. To up skill and upgrade students' across varied industry needs to enhance employability skills. By the end of this semester, a will have entered the threshold of his/her 2nd phase of employability enhancement and skill building activity exercise.	
6	Course Outcomes	CO1: *At the end of the session a student would have learned what is VMOSA (Vision, Mission, Values and Ethics) and Communication Process. This would help students understand and interpret the deeper meaning of life.* CO2: *At the end of the session a student would have learned Communication Styles and flexing and 4 social styles of communication which will lead to effective and meaningful communication process along with Listening Styles & Listening Skills* CO3: *At the end of the session a student would have learned the Art of giving feedback and probing skills that will help in improving peer to peer and business communication by giving meaningful feedbacks and probing skills to understand, assess and evaluate real life situations better* CO4: *At the end of the session a student would have learned business writing skills and non-verbal communication process to make an impression in written communication process in office or otherwise coupled with positive body language and non-verbal communication* CO5: *At the end of the session a student would have learned MTI (Mother Tongue Influence) Reduction attributes that will help to eliminate the influence of mother tongue in one's speech leading to meaningful communication levels and proficiencies.* CO6: *At the end of the 2nd Level proficiency program in Quant & Aptitude Reasoning abilities a student will be able to coherently reason real life situations, will have more pronounced aptitudinal abilities that will help a student deal with real life situations more effectively*	
7	Course Description	This course bundle allows students to build vision, mission and strategy statements while exposing them to various models of communication along with MTI reduction and the 2nd level of quant, aptitude and reasoning abilities	
8		Outline syllabus – ARP204	CO MAPPING
	Unit 1	**Communicate to Conquer**	
	A	VMOSA (Vision, Mission, Values and Ethics)| Business Communication - Verbal Communication Skills | Barriers in communication | Basics of effective communication – PRIDE Model	CO1
	B	Different styles of communication & style flexing (Based on the 4 social styles-Analytical, Driving, Expressive, Amiable) | Importance of Listening & practice of Active Listening | The Art of Giving Feedbacks| Feedback Skills | Asking fact finding questions- Probing Skills	CO3,CO2

C	Email Etiquette | Business Writing Skills| Telephone Etiquette Skills (Telephone Handling Skills) | Non Verbal Communication-Kinesics, Proxemics, Paralanguage | MTI Reduction Program | Verbal Abilities - 2	CO4, CO5
Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	
A	Coding Decoding , Ranking & Their Comparison Level-2	CO6
B	Series, Blood Relations & Number Puzzle	CO6
Unit 3	**Quantitative Aptitude**	
A	Number System Level 2	CO6
B	Vedic Maths Level-2 | Probability | Permutation & Combination	CO6
C	Percentage, Profit & Loss ,Partnership, Simple Interest & Compound Interest	CO6
Weightage Distribution	*(CA)Class Assignment/Free Speech Exercises / JAM – 60% | (ETE) Group Presentations/Mock Interviews/GD/ Reasoning, Quant & Aptitude – 40%*	
Text book/s*	*Wiley's Quantitative Aptitude-P Anand | **Quantum CAT – Arihant Publications | Quicker Maths- M. Tyra |** Power of Positive Action (English, Paperback, Napoleon Hill) | Streets of Attitude (English, Paperback, Cary Fagan, Elizabeth Wilson) The 6 Pillars of self-esteem and awareness – Nathaniel Brandon | Goal Setting (English, Paperback, Wilson Dobson*	

SHARDA UNIVERSITY
Beyond Boundaries

TERM-V

Syllabus: CSE350, Design and Analysis of Algorithms

School: SET **Batch :2018**
Program:B.Tech **Current Academic Year:**
Branch:CSE **Semester:V**

1	Course Code	CSE350 Course Name: Design and Analysis of Algorithms
2	Course Title	Design and Analysis of Algorithms
3	Credits	4
4	Contact Hours (L-T-P)	3-1-0
	Course Status	UG
5	Course Objective	Objective of this course is to 1. Reinforce basic design concepts (e.g., pseudocode, specifications, top-down design) 2. Knowledge of algorithm design strategies 3. Familiarity with an assortment of important algorithms. 4. Enable students to analyze time and space complexity
6	Course Outcomes	Students will be able to: **CO1: Analyze** the asymptotic performance of algorithms **CO2**: **Describe** the dynamic-programming and Greedy paradigm and explain when an algorithmic design situation calls for it. **CO3: Demonstrate** a familiarity with major algorithms and data structures **CO4: Apply** important algorithmic design paradigms and methods of analysis **CO5: Discuss** NP-complete problems and develop algorithms to solve the problems. **CO6: Choose** appropriate algorithm design techniques for solving problems.
7	Course Description	This course introduces concepts related to the design and analysis of algorithms. Specifically, it discusses recurrence relations, and illustrates their role in asymptotic and probabilistic analysis of algorithms. It covers in detail greedy strategies divide and conquer techniques, dynamic programming and max flow - min cut theory for designing algorithms, and illustrates them using a number of well-known problems and applications.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction : Algorithms, Analyzing algorithms, Complexity of algorithms, Growth of functions, Performance measurements	CO1, CO3
	B	Asymptotic Notations and their properties – Mathematical analysis for Recursive and Non-recursive algorithms, Recurrences relations, Master Method	CO1, CO2, CO3
	C	Divide-and-conquer: Analysis and Structure of divide-and-conquer algorithms, Divide-and-conquer examples-Quick sort, Merge	CO1, CO2, CO4

	sort, Sorting in Linear Time, Heap Sort	
Unit 2	**Dynamic Programming**	
A	Overview, Difference between dynamic programming and divide and conquer, All pair shortest path problems: Floyd-Warshall Algorithm	CO1,CO2,CO3, CO4
B	Applications and analysis: Matrix Chain Multiplication, 0/1 Knapsack Problem	CO1, CO2, CO3, CO4
C	Applications and analysis: Longest Common sub-sequence, Optimal Binary Search tree	
Unit 3	**Greedy Method**	CO1,CO2,CO3
A	Overview of the Greedy paradigm, Analysis and example: task scheduling,	CO1,CO2,CO3
B	Fractional Knapsack problem, Single source shortest paths problem: Dijkastra's Algorithm, Bellman-ford Algorithm,	CO1,CO2,CO3
C	Overview and analysis of Backtracking & Branch and Bound: N-Queens problem and Sum of subsets	
Unit 4	**Selected Topics**	CO1,CO2,CO3,
A	Introduction to NP Complete and NP Hard Problems, Examples, Amortized Analysis	CO1,CO2,CO3,
B	Approximation Algorithms – Travelling Sales Person Problem and Vertex Cover Problem, Randomized Algorithms, Randomized Quick Sort Algorithm	CO1,CO2,CO3
C	String Matching Algorithms – Naive String Matching Algorithm, Rabin Karp Algorithm.	CO1,CO2,CO3, CO4
Unit 5	**Advanced Data Structures**	
A	Red-Black Trees - Definition, Applications, Insertion and deletion of elements in RB-Tree	CO1, CO2, CO3, CO4
B	B-Trees - Definitions, Applications, Insertion and Deletion in B-Trees	CO1, CO2, CO4
C	Data Structure for Disjoint Sets – Definition, Binomial Heaps, Fibonacci Heaps.	CO1, CO2, CO3, CO4
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	2. Cormen et al., "Introduction of Computer Algorithms", Prentice Hall India	
Other References	4. Sahni et al., "Fundamentals of Computer Algorithms", Galgotia Publications. 5. Hopcroft A, The Design And Analysis Computer Algorithms, Addison Wesley	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1: Analyze** the asymptotic performance of algorithms	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2, PSO3
2.	**CO2**: **Describe** the dynamic-programming and Greedy paradigm and explain when an algorithmic design situation calls for it.	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2, PSO3
3.	**CO3: Demonstrate** a familiarity with major algorithms and data structures	PO1, PO2, PO3, PO9, PSO1, PSO2
4.	**CO4: Apply** important algorithmic design paradigms and methods of analysis	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2, PSO3
5.	**CO5: Discuss** NP-complete problems and develop algorithms to solve the problems.	PO1, PO2, PO3, PO4, PO9, PSO1, PSO2, PSO3
6.	**CO6: Choose** appropriate algorithm design techniques for solving problems.	PO1, PO2, PO3, PO4, PO5, PO9, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Design and Analysis of Algorithms Course Code CSE 350)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	2	-	--	--	-	2	-	-	-	3	2	2
CO2	2	2	2	2	-	--	--	-	3	-	-	-	2	3	2
CO3	2	1	2	-	-	--	--	-	1	-	-	-	3	2	-
CO4	1	2	2	3	-	--	--	-	2	-	-	-	2	2	2
CO5	3	3	1	3	-	-	-	-	3	-	-	-	2	1	3
CO6	2	2	3	2	2	-	-	--	2	-	-	-	3	2	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSP 350	**Design and Analysis of Algorithms Lab**	2	2.17	1.83	2.4	2	-	-	-	2.2	-	-	-	2.5	2	2.3

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		Computer Science and Engineering	
1	Course Code	CSE351 Course Name: Software Engineering and Testing Methodologies	
2	Course Title	Software Engineering and Testing Methodologies	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core /Elective/Open Elective	
5	Course Objective	The objective of this course is to provide 1. Fundamental knowledge of software engineering 2. To make student aware of best software engineering practices 3. Inculcate ability in students to work as an effective member or leader of software engineering teams 4. To help students to develop skills that will enable them to construct software of high quality	
6	Course Outcomes	CO1: Illustrate and compare an effective software engineering process, based on knowledge of widely used development lifecycle model CO2: Apply effective requirement elicitation techniques to develop SRS for a project. CO3: Construct design documents with the help of designing tools CO4: Analyze testing strategies for a software system CO5: Develop and deliver quality software as an individual or as part of a multidisciplinary team. CO6: Adapt techniques and tools necessary for software engineering practices.	
7	Course Description	This course provides knowledge of software engineering. It introduces concepts such as software processes and agile methods and essential software development activities, from initial specification to system maintenance. Formalisms and tools to assist in software development are also presented, including common design patterns and UML notation. Course focuses on all levels of testing.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Software Engineering and Process Models**	
	A	Significance challenges and Software Myths in software engineering, Software Components, Software Characteristics, Software Crisis, software applications	CO1
	B	Software Development Methodologies: Waterfall model, prototyping model, Incremental model, Spiral model, V model, component based, RAD model	CO1
	C	Agility, Agile Process models: Extreme Programming (XP), Adaptive Software Development (ASD), Scrum	CO1
	Unit 2	**Software Requirement Engineering**	
	A	Requirement Engineering process, Elicitation techniques, Review and Management of User Needs, Types of Requirements	CO2
	B	Feasibility study, DFD, data dictionary ,decision tables	CO2

C	Requirement Documentation: Characteristics of SRS, Document SRS according to IEEE standards, SRS case study	CO2
Unit 3	**Software Design**	
A	Design Concepts, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design	CO3, CO6
B	Effective modular design: Functional independence, Cohesion, Coupling, Design documentation	CO3, CO6
C	UML Diagrams and Tools: Introduction to UML Diagrams, Use Case , Object and Class, Interaction diagram: Sequence & Collaboration , Introduction to Rational Rose tool	CO3, CO6
Unit 4	**Software Implementation and Testing**	
A	Fundamental of testing: Objectives, principles, myths and facts, Error, Mistake, Bug, Fault and Failure, limitations of testing	CO4
B	Levels of testing: Unit Testing, Integration Testing, System Testing, Acceptance Testing: Alpha & Beta Testing, Integration techniques	CO4, CO6
C	White Box Testing, Black Box Testing, Verification and Validation, Test case designing, Guidelines for Coding, Debugging	CO4, CO6
Unit 5	**Maintenance & Quality Management**	
A	Introduction to Maintenance , Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance	CO5, CO6
B	Quality Concepts: Quality, Quality Control, Cost of Quality, Software Quality Assurance , SQA Plan , Software Reliability: Measures of Reliability and Availability, Software Safety	CO5, CO6
C	Statistical Software Quality Assurance: Six Sigma, The ISO 9000 Quality Standards, Capability Maturity Model	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Pressman R S, Software Engineering: A Practitioners Approach, McGraw Hill.	
Other References	1.Datta S, Software Engineering: Concepts and Applications, Oxford University Press, 2010. 2. K.K. Aggrawal and Yogesh Singh, “Software Engineering”, New Age International Publication 3 .Sommerville, Ian. “Software Engineering”, Pearson(Latest Ed).	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Illustrate and compare an effective software engineering process, based on knowledge of widely used development lifecycle model	PO1,PO3,PO8,PO9,PO10,PO12,PSO1, PSO3
2.	CO2: Apply effective requirement elicitation techniques to develop SRS for a project	PO1,PO2,PO3,PO4,PO5,PO8,PO9,PO10, PO11,PO12,PSO1,PSO3
3.	CO3: Construct design documents with the help of designing tools	PO1,PO2,PO3,PO4,PO5, PO8,PO9,PO10, PO11,PO12,PSO1,PSO3
4.	CO4:Analyze testing strategies for a software system	PO1,PO2,PO4,PO5,PO6,PO7,PO8,PO9,PO10, PO11,PO12,PSO1,PSO3
5.	CO5: Develop and deliver quality software as an individual or as part of a multidisciplinary team.	PO1,PO2,PO3,PO4,PO5, PO6,PO7, PO8,PO9,PO10,PO11,PO12,PSO1,PSO3
6.	CO6: Adapt techniques and tools necessary for software engineering practices .	PO1,PO4,PO5,PO8,PO9,PO10,PO11,PSO3

PO and PSO mapping with level of strength for Course Name Software Engineering and Testing Methodologies (Course Code CSE351)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1	3	-	2	-	-	-	-	1	2	3	-	3	1	-	2
	CO2	3	3	2	3	3	-	-	1	2	3	2	3	2	-	3
	CO3	3	2	3	3	3	-	-	1	2	3	1	2	2	-	3
	CO4	3	1	-	1	3	2	2	2	3	3	2	3	1	-	3
	CO5	3	1	3	3	3	3	3	2	3	3	1	3	1	-	3
CSE351_ Software Engineering and Testing Methodologies	CO6	2	-	-	1	3	-	-	1	2	2	2	-	-	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO2	PSO3
CSE351	Software Engineering and Testing Methodologies	2.8	1.75	2.5	2.2	3	2.5	2.5	1.3	2.3	2.8	1.6	2.8	1.4	0	2.8

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B. Tech.**		
Branch:		**Computer Science and Enginering**		
1	Course Code	CSE021		
2	Course Title	Introduction to Cloud Computing		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		
5	Course Objective	This introductory course on Cloud computing will teach both the fundamental concepts of how and why Cloud systems works, as well as Cloud technologies that manifest these concepts.		
6	Course Outcomes	At the end of the course, students will have achieved the following learning objectives. CO1. Define the basics of cloud and recall the computer Science concepts which are helpful in understanding on demand service architecture. CO2. Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing. CO3. Apply the PAAS and SAAS to manage the workflow and use of cloud in scientific application. CO4. Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing. Examine the design of task and data parallel distributed algorithms for Clouds and use them to construct Cloud applications. CO5. Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances. CO6. Elaborate the design concept and formulate to build the solution		

		using cloud service providers as AWS, MS Azure, Google Cloud. Demonstrate the use of Map-Reduce, Vertex-Centric and Continuous Dataflow programming models.	
7	Course Description	This course is an introductory course for cloud computing concepts and helps in understanding the core functionalities, algorithms, models and workflows in cloud environment. In this course Students will get demonstrations of real-time cloud services for better exposure and research understanding.	
8	Outline syllabus		CO Mapping
	Unit 1	**FOUNDATIONS**	
	A	**Introduction to compute** Types of Computing, Grid computing, distributed computing, Client-server computing, Three Tier Architecture, use of Sockets and Remote Procedure Call, working of RMI and CORBA, Web services, Web Sockets, Message Queues and Message Brokers.	CO1
	B	**Introduction to Cloud Computing** Cloud Computing definition, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks	CO1
	C	**Migrating and Integrating into Cloud** Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Enriching the 'Integration as a Service' Paradigm for the Cloud Era, Evolution and Challenges of SaaS Paradigm, Integration Scenarios, The Integration Methodologies	CO1
	Unit 2	**ENTERPRISE CLOUD COMPUTING AND IAAS**	
	A	**The Enterprise Cloud Computing Paradigm** Issues for Enterprise Applications on the Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers Toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain	CO1,CO2
	B	**Virtual Machines Provisioning and Migration Services** Introduction to Virtual Machines,The Anatomy of Cloud	CO1,CO2

		Infrastructures, VM Provisioning and Manageability, Virtual Machine Migration Services, Management of Virtual Machines for Cloud Infrastructures,, Distributed Management of Virtual Infrastructures, Scheduling Techniques	
	C	**Enhancing Cloud Computing Environments Using a Cluster as a Service** Introduction and Related Work, RVWS Design, Cluster as a Service: The Logical Design, Secure Distributed Data Storage in Cloud Computing, Cloud Storage, Technologies for Data Security in Cloud Computing	CO1,CO2
	Unit 3	**PLATFORM AND SOFTWARE AS A SERVICE**	
	A	**Aneka and CometCloud** Aneka—Integration of Private and Public Clouds, Technologies and Tools for Cloud Computing, Aneka Cloud Platform, CometCloud: An Autonomic Cloud Engine, Introduction of CometCloud (Architecture, Autonomic Behavior, Applications overview)	CO1,CO3
	B	**Business Solutions and WorkFlow** Cloud-Based Solutions for Business Applications (Introduction of Enterprises Demand and Cloud Computing, Dynamic ICT Services), Workflow Engine for Clouds, Workflow Management Systems, Architecture of Workflow Management Systems	CO1,CO3, CO6
	C	**Scientific Applications and MapReduce Model** Scientific Application for Cloud Environments, Classification of Scientific Applications and Services in the Cloud, SAGA-based Scientific Applications, MapReduce Programming Model, MapReduce Impacts and Research Directions	CO1,CO3, CO6
	Unit 4	**MONITORING, MANAGEMENT & GOVERNANCE**	
	A	**SLA Management in Cloud Computing** Introduction of typical Use Cases, Model for Federated Cloud Computing, Security Considerations, SLA Management in Cloud Computing: A Service Provider's Perspective, Types of SLA, Life Cycle of SLA, Automated Policy-based Management	CO1,CO4

	B	**Performance Predictions for HPC on Clouds** Introduction and Background of Grid and Cloud, HPC in the Cloud: Performance-related Issues, Game Hosting on Cloud Resources, Building Content Delivery Networks Using Clouds, Resource Cloud Mashups					CO1,CO4
	C	**Security and Governance** Basic Concept of Organizational Readiness, Drivers for Changes: Common Change Management Models, Security and Risk in the Cloud, Cloud Computing and Identity, Content Level Security—Pros and Cons, Legal Issues in Cloud Computing(PCI DSS), Data Privacy and Security Issues					CO1,CO4
	Unit 5	**AWS, MS AZURE AND GOOGLE CLOUD**					
	A	AWS Services:EC2, IAM, S3, Lambda, EBS, CDN, CloudWatch,					CO1,CO5, CO6
	B	MS Azure Services:Azure VM , SQL Server on Virtual Machines, Azure SQL Database,Azure Active Directory, Azure Backup					CO1,CO5, Co6
	C	Google Cloud: Compute Engine,Migrate for Compute Engine, Cloud Functions, Gsuite Admin,Cloud Lab Balancing ,Cloud Storage					CO1,CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva					
	Weightage Distribution	CA		MTE		ETE	
		30%		20%		50%	
	Text book/s*	CLOUD COMPUTING Principles and Paradigms, Edited by Rajkumar Buyya, Jam Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter					
	Other References						

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define the basics of cloud and recall the computer Science concepts which are helpful in understanding on demand service architecture. Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing.	PO1,PO2,PO3,PO4
2.	Define the basics of cloud and recall the computer	PO1,PO2,PO3,PO4
3.	Apply the PAAS and SAAS to manage the workflow and use of cloud in scientific application.	PO1,PO2,PO3,PO4,PSO2,PSO3
4.	Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing. Examine the design of task and data parallel distributed algorithms for Clouds and use them to construct Cloud applications.	PO1,PO2,PO3,PO4,PSO2,PSO3
5.	Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances	PO1,PO2,PO3,PO4,PSO2,PSO3
6.	Elaborate the design concept and formulate to build the solution using cloud service providers as AWS, MS Azure, Google Cloud. Demonstrate the use of Map-Reduce, Vertex-Centric and Continuous Dataflow programming models.	PO1,PO2,PO3,PO4,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name xxxx (Course Code yyyy)

Course Code_ Course Name	**CO's**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
	CO1	2	3	1	2											
	CO2	2	2	2	3											
Yyyy_xxxx	**CO3**	1	3	1	2										2	3

	CO4	3	1	2	2										3	2
	CO5	2	2	3	1										2	2
	CO6	1	3	1	2									2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
		1.83	2.33	1.66	2									.33	1.66	1.67

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:			
Branch:			
1	Course Code	CSE022	
2	Course Title	Android Application Development	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core /Elective/Open Elective	
5	Course Objective	1. Basics of Android OS 2. Develop Basic and advance Android Apps 3. Publishing and Monetizing the app	
6	Course Outcomes	CO1: Demonstrate and understanding anatomy of an android application. CO2: Develop various android applications related to layouts and rich uses interactive interfaces. CO3:Apply essential android programming concept CO4: Distinguish and compare different components of Android CO5: Access and work with databases under an android operating system. CO6: Develop Basic and advance android app development for android devices.	
7	Course Description	This android development course will help students to Understand the basis of Android Platform and its lifecycle. This will help them to implement simple GUI applications, use built-in components and work with database to store the data.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and Architecture of Android**	
	A	History of Android, Features of Android, Android Devices, Open Handset Alliance (OHA) , Advantages of Android, Comparing Android with other platform	CO1
	B	Android Directory Structure, Android Development Tools, Architecture of Android.	CO1
	C	Structure of Manifest files, Activities, Activity life cycle	CO1
	Unit 2	**User Interfaces**	
	A	Layouts-Linear layout, Relative layout, Constraint layout	CO1,CO2
	B	Input Controls – Text input, Checkboxes, Radio buttons, Spinner, Toggle buttons and switches	CO1,CO2
	C	Menus- Popup, Dialog, Context, date picker, style	CO1,CO2
	Unit 3	**Components of Android**	
	A	Intents, types of intents, Intent Filter	CO3
	B	Starting a new activity, Sending and Receiving of data, Notifications	CO3
	C	Services, service life cycle, Broadcast receivers	CO3

Unit 4	**Working with SQL Lite**	
A	Introduction to SQLite database, Steps for connecting application with database.	CO4,CO5
B	Fetch and update data in database from application,	CO4,CO5
C	Cursor and content value, opening and closing database	CO4,CO5
Unit 5	**Sensors and Animation**	
A	Sensor Manager, Sensor Framework, Types of Sensors Accelerometer, Gyroscope, Proximity Sensor, Orientation, Light Sensor	CO6
B	Detect availability of sensor, Fetch data from sensors on frequent basis, Development of compass application with help of gyroscope sensor	CO6
C	SMS , Graphics and Animation	CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% / MTE 20% / ETE 50%	
Text book/s*	1. Anubhav Pradhan and Anil V. Deshpande , Composing Mobile Apps: Learn, Explore, Apply Using Android , 1st Edition,Wiley India.	
Other References	1. Wei-Meng Lee , Beginning Android 4 Application Development. 2. Neil Smyth ,Android Studio Development essentials-Android 6	

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Demonstrate and understanding anatomy of an android application.	PO5,PO9,PO12,PSO3
2.	CO2: Develop various android applications related to layouts and rich uses interactive interfaces.	PO5,PO9,PO12,PSO3
3.	CO3:Apply essential android programming concept	PO3,PO5,PO9,PO12,PSO1,PSO3
4.	CO4: Distinguish and compare different components of Android	PO5,PO9,PO11,PO12,PSO3
5.	CO5: Access and work with databases under an android operating system.	PO3,PO4,PO5,PO7,PO9,PO11,PO12,PSO3
6.	CO6: Develop Basic and advance android app development for android devices	PO1,PO2,PO3,PO4,PO5,PO7,PO9,PO11,PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Android Application Development **(Course Code** CSE022**)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSE 022_ Android Application Development	CO1					3				2			1			2
	CO2					3				2			1			2
	CO3			2		3				2			1	2		2
	CO4					3				2		2	1			2
	CO5			2	3	3		2		2		2	1			2
	CO6	1	2	3	3	3	3	3		3		3	1	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE022	Android Application Development	1	2	2.3	3	3	3	2.5	0	2.2	0	2.3	1	2.5	3	2.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		School of Engineering and technology		
Department		Department of Computer Science and Engineering		
Program:		B.Tech		
Branch:				
1	Course Code	CSE023		
2	Course Title	Quantum Computing		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	Fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory. Topics include: the quantum circuit model, qubits, unitary operators, measurement, entanglement, quantum algorithms for factoring and search, quantum cryptographic key distribution, error-correction and fault-tolerance, information capacity of quantum channels, complexity of quantum computation.		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1: Analyze the behavior of basic quantum algorithms CO2: Demonstrate simple quantum algorithms CO3: Simulate a simple quantum error-correcting code CO4: Prove basic facts about quantum information channels CO5: Explain quantum computing and quantum protocols CO6: Illustrate information channels in the quantum circuit model		
7	Course Description	This course teaches the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory.		

8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Computers and the Strong Church–Turing Thesis, Circuit Model of Computation	
	B	A Linear Algebra Formulation of the Circuit Model, Reversible Computation	CO1
	C	Quantum Physics and Computation	CO1, CO2
	Unit 2	LINEAR ALGEBRA AND THE DIRAC NOTATION	CO1, CO2,CO4
	A	The Dirac Notation and Hilbert Spaces, Dual Vectors, Operators	
	B	The Spectral Theorem, Functions of Operators	
	C	Tensor Products, The Schmidt Decomposition Theorem	CO1, CO2
	Unit 3	A QUANTUM MODEL OF COMPUTATION	CO1, CO2
	A	The Quantum Circuit Model, Quantum Gates	CO1, CO2,CO5,CO6
	B	Universal Sets of Quantum Gates, Efficiency of Approximating Unitary Transformations	
	C	Implementing Measurements with Quantum Circuits	
	Unit 4	INTRODUCTORY QUANTUM ALGORITHMS	CO1,CO2,CO3
	A	Probabilistic Versus Quantum Algorithms, Phase Kick-Back	CO1,CO2,CO3
	B	The Deutsch Algorithm, The Deutsch–Jozsa Algorithm	CO1,CO2,CO3
	C	Simon's Algorithm	
	Unit 5		
	A	Tools for Analysing Probabilistic Algorithms	CO2,CO3,CO4
	B	Solving the Discrete Logarithm Problem When the Order of a Is Composite	CO3,CO4
	C	Computing Schmidt Decompositions	CO2, CO4,CO5

Mode of examination	Theory/Jury/Practical/Viva		
Weightage Distribution	CA 30%	MTE 20%	ETE 50%

Text book/s*	"An Introduction to Quantum Computing", Phillip Kaye Raymond Laflamme, Michele Mosca
Other References	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Analyze the behavior of basic quantum algorithms	
2.	CO2: Demonstrate simple quantum algorithms	PO1, PO2, PO5, PO8, PO12, PSO3
3.	CO3: Simulate a simple quantum error-correcting code	PO1, PO2, PO3, PSO3
4.	CO4: Prove basic facts about quantum information channels	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
5.	CO5: Explain quantum computing and quantum protocols	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
6.	CO6: Illustrate information channels in the quantum circuit model	PO1, PO2, PO3, PO8, PO9, PSO2,

PO and PSO mapping with level of strength for Course Name Quantum Computing (Course Code yyyy)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Quantum Computing	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Quantum Computing	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* *2.* Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

2.1 Template A1: Syllabus for Theory Courses (SAMPLE)

School:		School of Engineering and technology	
Department		Department of Computer Science and Engineering	
Program:		B.Tech	
Branch:			
1	Course Code	CSE024	
2	Course Title	Parallel Computing Algorithms	
3	Credits	3	
4	Contact Hours (L-T-P)	3 0 2	
	Course Status	Core /Elective/Open Elective	
5	Course Objective	Design and analysis of parallel algorithms on various parallel network model, with emphasis on time complexities after implementation, a comparative study of various architecture with respect to time complexity. Understanding the fundamental of parallel algorithms.	
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1: Acquire the skill to design and develop parallel algorithms with efficient time complexity. CO2: Explain various terminology of parallel processing which is required to design and understand the future processor architectures. CO3: Demonstrate the skill to choose the technology to use, based on the requirements and functionality of multi-processor architecture based on the design parameters of the parallel architectures. CO4: Explain how large-scale parallel systems are architecture and how massive parallelism are implemented in accelerator architectures CO5: Design efficient parallel algorithms and applications CO6: Analyse performance and modeling of parallel programs	
7	Course Description	This course introduces critical methods and techniques related to parallel computing. Particularly, the course focuses on hardware, algorithm, and programming of parallel systems, providing students a complete picture to understand pervasive parallel computing.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Introduction to Parallel Processing Approach	
	B	Difference between Parallel Processing and Serial Processing, Background, Flynn's Taxonomy for serial and parallel computer architecture	CO1
	C	Parallel Algorithms, Performance of Parallel Algorithm.	CO1, CO2
	Unit 2	Basic Techniques and Different Network Architecture	CO1, CO2,CO4
	A	Criteria to evaluate processor organization	
	B	Mesh Networks, Binary Tree Networks, Hypertree Networks, Pyramid Networks, Butterfly Networks, Hypercube (Cube-Connected) Networks,	
	C	Cube-Connected Cycle Networks, Shuffle-Exchange Networks, Case Studies Based on the Parallel Network Architecture.	CO1, CO2
	Unit 3	Parallel Architectures	CO1, CO2
	A	Multiprocessors, Uniform Memory Access (UMA) Multiprocessors and Non-Uniform Memory Access, Mesh of Trees Architecture,	CO1, CO2,CO5,CO6
	B	Applications based on MoT, Advantages/Disadvantages of MoT based on parallel parameters, Multi-Mesh Architecture,	
	C	Applications based on MM, Advantages/Disadvantages of MM based on parallel parameters Multi-Mesh of Trees Architecture, Advantages of MMT over MM and MoT	
	Unit 4	Parallel Algorithms on Different Architectures	CO1,CO2,CO3
	A	One to One Communication Algorithm on Multi-Mesh Architecture and Multi-Mesh of Trees Architecture,	CO1,CO2,CO3
	B	All-to-All Algorithm Communication Algorithm on Multi-Mesh	CO1,CO2,CO3

C	Architecture and Multi-Mesh of Trees Architecture, Sorting Algorithms on MMT, Case Studies based on MMT Architecture	
Unit 5	Parallel computing Application	
A	Performance measurement and analysis of parallel programs	CO2,CO3,CO4
B	Problem solving on clusters using MapReduce	CO3,CO4
C	Warehouse-scale computing	CO2, CO4,CO5
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	"Introduction to Parallel Computing", 2nd Ed, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar	
Other References	• "Using MPI: Portable Parallel Programming with the Message-Passing Interface", 3rd Ed - William Gropp, Ewing Lusk, Anthony Skjellum • "Programming Massively Parallel Processors: A Hands-on Approach", 3rd Ed. - David B. Kirk, Wen-mei W. Hwu	

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Acquire the skill to design and develop parallel algorithms with efficient time complexity.	
2.	CO2: Explain various terminology of parallel processing which is required to design and understand the future processor architectures.	PO1, PO2, PO5, PO8, PO12, PSO3
3.	CO3: Demonstrate the skill to choose the technology to use, based on the requirements and functionality of multi-processor architecture based on the design parameters of the parallel architectures.	PO1, PO2, PO3, PSO3
4.	CO4: Explain how large-scale parallel systems are architecture and how massive parallelism are implemented in accelerator architectures	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
5.	CO5: Design efficient parallel algorithms and applications	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
6.	CO6: Analyse performance and modeling of parallel programs	PO1, PO2, PO3, PO8, PO9, PSO2,

PO and PSO mapping with level of strength for Course Name Parallel Computing (Course Code yyyy)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Parallel Computing	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	Parallel Computing	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* *2.* Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School:		School of engineering and technology	
Department		Department of computer science and engineering	
Program:		B.tech	
Branch:			
1	Course code	CSE025	
2	Course title	3d printing and software tools	
3	Credits	3	
4	Contact hours (l-t-p)	2 0 2	
	Course status	Core /elective/open elective	
5	Course objective	This course will help understand the technical principles and workflows of polymers, metals, and composites.	
6	Course outcomes (must be 6 cos, following verbs given in bloom's taxonomy)	Co1: apply the unique advantages of 3d printing to their designs. Co2: compare additive manufacturing to traditional technologies and choose the best technology for a given application. Co3: distinguish between various 3d printing technologies and materials and select appropriately for a given application. Co4: discuss the economic implications of 3d printing including its impact on startup businesses and supply chains Co5: evaluate real-life scenarios and recommend the appropriate use of 3d printing technology Co6: explain current and emerging 3d printing applications in a variety of industries	
7	Course description	In this course students will gain broad understanding of the advances that led to today's manufacturing environment. They will understand how humans, machines and code work together to make things.	
8	Outline syllabus		Co mapping
	Unit 1	Introduction to 3d printing	
	A	Cutting, subtractive manufacturing	
	B	Forming	Co1
	C	Additive manufacturing	Co1, co2
	Unit 2	Mesh	Co1, co2,co4
	A	Review of geometry terms	
	B	Things to consider when preparing a mesh file	
	C	Making process (a reminder), making by sharing	Co1, co2
	Unit 3	Introduction to computer numerical control (cnc)	Co1, co2
	A	Numerical control, functions of a machine tool, concept of numerical control, historical development, definition	Co1, co2,co5,co6
	B	Advantages of cnc machine tools, evolution of cnc,	

	advantages of cnc, limitations of cnc, features of cnc	
C	The machine control unit (mcu) for cnc, classification of cnc machine tools, cnc machining centers	
Unit 4	Blue print reading	Co1,co2,co3
A	Reading the machining sketches, different geometrical tolerance symbols,	Co1,co2,co3
B	Reading dimensional tolerances, understanding the views,	Co1,co2,co3
C	Concept of first angle & third angle projection	
Unit 5	Cnc milling	
A	Fundamentals of cnc milling, familiarization of control panel	Co2,co3,co4
B	Fundamentals of cnc programming, part programming techniques	Co3,co4
C	Machining practice on cnc milling, practice session at industry	Co2, co4,co5
Mode of examination	Theory/jury/practical/viva	
Weightage distribution	Ca 30% Mte 20% Ete 50%	
Text book/s*	Liza Wallach Kloski, Nick Kloski – "Getting Started with 3D Printing_ A Hands-on Guide to the Hardware, Software, and Services Behind the New Manufacturing Revolution"-Maker Media, Inc (2016)	
Other references		

Co and po mapping

S. No.	Course outcome	Program outcomes (po) & program specific outcomes (pso)
1.	Co1: apply the unique advantages of 3d printing to their designs.	
2.	Co2: compare additive manufacturing to traditional technologies and choose the best technology for a given application.	Po1, po2, po5, po8, po12, pso3
3.	Co3: distinguish between various 3d printing technologies and materials and select appropriately for a given application.	Po1, po2, po3, pso3
4.	Co4: discuss the economic implications of 3d printing including its impact on startup businesses and supply chains	Po1, po2, po3, po5, po9, po12, pso1
5.	Co5: evaluate real-life scenarios and recommend the appropriate use of 3d printing technology	Po1, po2, po4, po5, po6, po8, pso2
6.	Co6: explain current and emerging 3d printing applications in a variety of industries	Po1, po2, po3, po8, po9, pso2,

Po and pso mapping with level of strength for course name 3d printing and software tools (course code yyyy)

Course code_ course name	Co's	Po 1	Po 2	Po 3	Po 4	Po 5	Po 6	Po 7	Po 8	Po 9	Po 10	Po 11	Po 12	Pso 1	Pso 2	Pso 3
3d printing and software tools	Co1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	Co2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	Co3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	Co4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	Co5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	Co6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course code	Course name	Po 1	Po 2	Po 3	Po 4	Po 5	Po 6	Po 7	Po 8	Po 9	Po 10	Po 11	Po 12	Pso 1	Pso 2	Pso 3
	3d printing and software tools	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of correlation

1. Addressed to *slight (low=1) extent* *2.* Addressed to *moderate (medium=2) extent*
3. Addressed to *substantial (high=3) extent*

School: SET **Program:** **Branch:** CSE	**Batch :** 2018-19 **Current Academic Year:** 2018-19 **Semester: Vth | QAB**	
1 Course Code	**ARP 301**	Course Name : **Quantitative Aptitude Behavioural and Interpersonal Skills**
2 Course Title	**Quantitative Aptitude Behavioural and Interpersonal Skills**	
3 Credits	2	
4 Contact Hours (L-T-P)	0-0-4	
Course Status		
5 Course Objective	To enhance holistic development of students and improve their employability skills. Provide a 360 degree exposure to learning elements of Business English readiness program, behavioural traits, achieve softer communication levels and a positive self-branding along with augmenting numerical and altitudinal abilities. To up skill and upgrade students' across varied industry needs to enhance employability skills. By the end of this semester, a will have entered the threshold of his/her 3rd phase of employability enhancement and skill building activity exercise.	
6 Course Outcomes	CO1: *A student will understand & apply Personality and its traits | The art of impression management. A Student will learn Personality development which will help a student groom to meet the needed social strata for establishing himself/herself in the society, make a meaningful personality and find employment* CO2: *At the end of the program Behavioural and Interpersonal Skills curriculum will help a student assert a positive behavioural attitude and attributes developing interpersonal skills for building positive and meaningful social and professional relationships* CO3: *At the end of the program a student will learn the art of avoiding Arguments and learn to build meaningful conversations that will help them become effective speakers and conversation makers helping them succeed in social and professional life| The Art of Assertiveness will help them to become assertive communicators and not aggressive ones for the same end result* CO4: *At the end of the program the Constructive Criticism syllabus will let a student criticize for positive emphasis for improvement, growth and eliminating wasteful synergies that deter holistic development* CO5: *At the end of the program The 4M Model | Verbal Abilities-3 syllabi will teach the students basics of leadership in coaching and mentoring models that will help them become effective leaders and coaches* CO6: *At the end of the program the Level 3 of Quant , Aptitude and Reasoning abilities will help students build enhanced reasoning and aptitudinal abilities*	
7 Course Description	This bundles Training approach attempts to explore the personality, character, and the natural style of the student. This helps to develop character, personality, confidence and interpersonal abilities within the student along with level 3 readiness in quant, aptitude and reasoning skills	
8	Outline syllabus – ARP301	
Unit 1	**Impress to Impact**	**CO MAPPING**
A	What is Personality?| Creating a positive impression – The 3 V's of Impression | Individual Differences and Personalities	CO1
B	Personality Development and Transformation | Building Self Confidence | Behavioural and Interpersonal Skills	CO2
C	Avoiding Arguments | The Art of Assertiveness | Constructive Criticism | The Personal Effectiveness Grid | Assessing our Strengths & Limitations and Creating an Action Plan for Learning with the 4M Model | Verbal Abilities-3	CO5, CO4, CO3
Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	
A	Numbers & Digits , Mathematical Operations | Analytical Reasoning	CO6

B	Cubes & Cuboids | Statement & Assumptions	CO6
C	Strong & Weak Argument	CO6
Unit 3	**Quantitative Aptitude**	
A	Work & Time ,Pipes & Cistern	CO6
B	Time ,Speed & Distance, Quadratic & Linear Equations, Logs & Inequalities	CO6
C	Sequence & Series, Logarithms, Data Interpretation | Data sufficiency - Level 1	CO6
Weightage Distribution	*(CA)Class Assignment/Free Speech Exercises / JAM – 60% | (ETE) Group Presentations/Mock Interviews/GD/ Reasoning, Quant & Aptitude – 40%*	
Text book/s*	*Wiley's Quantitative Aptitude-P Anand* | ***Quantum CAT – Arihant Publications* | *Quicker Maths- M. Tyra*** | *Power of Positive Action (English, Paperback, Napoleon Hill)* | *Streets of Attitude (English, Paperback, Cary Fagan, Elizabeth Wilson) The 6 Pillars of self-esteem and awareness – Nathaniel Brandon* | *Goal Setting (English, Paperback, Wilson Dobson*	

Syllabus: Design and Analysis of Algorithm lab

School:		**Batch:**	
Program:		**Current Academic Year:**	
Branch:		**Semester:**	
1	Course Code	CSP 350	
2	Course Title	**Design and Analysis of Algorithm lab**	
3	Credits		
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory/Elective	
5	Course Objective	Objective of this course is to 1. Reinforce basic design concepts (e.g., pseudocode, specifications, top-down design) 2. Knowledge of algorithm design strategies 3. Familiarity with an assortment of important algorithms. • Enable students to analyze time and space complexity	
6	Course Outcomes (same as theory course)	Students will be able to: **CO1: calculate** time complexity of searching algorithm **CO2**: **Write** program based on dynamic programming. **CO3: apply** greedy algorithm to any problem **CO4: develop** program based on advanced data structure CO5: **design** a program based on different string matching algorithm CO6**: implement** real world problem based on greedy and dynamic algorithm	
7	Course Description	This course introduces concepts related to the design and analysis of algorithms. Specifically, it discusses recurrence relations, and illustrates their role in asymptotic and probabilistic analysis of algorithms. It covers in detail greedy strategies divide and conquer techniques, dynamic programming and max flow - min cut theory for designing algorithms, and illustrates them using a number of well-known problems and applications.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on Searching and sorting**	
		1. WAP to demonstrate the concept of Linear and Binary Search 2. WAP to implement Merge sort 3. WAP to implement Quick Sort	CO1
	Unit 2	**Practical based on Dynamic Programming**	
		1. WAP to implement Matrix Chain Multiplication problem 2. WAP to demonstrate the concept of Longest Common Subsequence(LCS) 3. WAP to demonstrate concept of 0 – 1 Knapsack Problem	CO2, CO6
	Unit 3	**Practical based on Greedy Programming**	
		1. WAP to demonstrate concept of Minimum Spanning Tree(Prim's Algorithm) 2. WAP to demonstrate concept of Fractional	CO3, CO6

Knapsack Problem
3. WAP to implement single source shortest problem using Dijkstra's Algorithm

Unit 4	**Practical based on Advance concepts** WAP to demonstrate concept of Red Black Tree insertion and Deletion	CO4
Unit 5	**Practical based on String Matching** 1. WAP to demonstrate the concept of Naïve String matching algorithm. 2. WAP to demonstrate the concept of Robin Karp Algorithm.	CO5
Mode of examination	Jury/Practical/Viva	
Weightage Distribution	CA 60% MTE 0% ETE 40%	
Text book/s*	-	
Other References		

PO and PSO mapping with level of strength for Course Name Design and Analysis of Algorithms Lab. Course Code CSP 350)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	1	--	--	-	2	-	-	-	2	3	3
CO2	2	3	3	2	2	--	--	-	2	-	-	-	3	2	2
CO3	3	2	2	-	3	--	--	-	1	-	-	-	2	1	-
CO4	2	3	3	3	1	--	--	-	3	-	-	-	3	3	1
CO5	3	2	2	3	2	-	-	-	2	-	-	-	2	3	2
CO6	2	3	3	1	3	-	-	--	1	-	-	-	3	2	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSP 350	Design and Analysis of Algorithms Lab	2.5	2.7	2.5	2.4	2	-	-	-	1.8	-	-	-	2.5	2.3	2.2

School: SET | Batch : 2018 - 2022

School: SET **Batch : 2018 - 2022**
Program: B.tech **Current Academic Year: 2019-2020**
Branch: CSE / IT **Semester: 5th**

1	Course Code	**CSP351** Course Name: Project Based Learning -3
2	Course Title	Project Based Learning -3
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	10. To align student's skill and interests with a realistic problem or project. 11. To understand the significance of problem and its scope. 12. Students will make decisions within a framework.
6	Course Outcomes	Students will be able to: CO1: Identify and formulate problem statement. CO2: Design relational database schema. CO3: Develop the solution by using different aspects of programming language. CO4: Classify and understand various test techniques for verification and validation of project. CO5: Analyze and make use of modern for solving real word problems. CO6: Develop teamwork and need to engage in life-long learning, along with the ability to communicate effectively with others.
7	Course Description	In PBL-3, the students will learn how to define the problem for developing projects, and Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.

8 Outline syllabus

		CO Mapping
Unit 1	Problem Definition and identification, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1,CO4
Unit 2	Use of the relational algebra operations from mathematical set theory (union, intersection, difference, and Cartesian product) and the relational algebra operations developed specifically for relational databases (select (restrict), project, join, and division)..	CO2,CO6
Unit 3	Design; implement project work in any programming language.	CO3
Unit 4	Use of various test tools and techniques for software verification and validation of project	CO4,CO5
Unit 5	Demonstrate and execute Project with the team. Report should include Abstract, Hardware / Software Requirement, Problem Statement, Design/Algorithm, ER diagrams, Use Case Diagrams, State Diagrams, Sequence Diagrams, Communication Diagrams, and Activity	CO6

	Diagrams, Implementation Detail. Validation Reports. References, Test cases if any. The presentation, report, work done during the term supported by the documentation, forms the basis of assessment.
Mode of examination	Practical /Viva
Weight age Distribution	CA MTE
	60% NA ETE

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify and formulate problem statement.	PO1, PO2, PO4,PO6, PO8,PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Design relational database schema.	PO1, PO2, PO3,PO4,PO5, PO7, PO8, PO9, PO11, PO12 , PSO1,PSO2,PSO3
3.	CO3: Develop the solution by using different aspects of programming language.	PO1, PO2, PO3,PO4,PO5, PO6, PO8, PO9, PO11, PO12, PSO1,PSO2
4.	CO4: Classify and understand various test techniques for verification and validation of project.	PO1, PO2, PO3,PO4,PO5, PO8,PO9, PO10, PO11, PO12 ,PSO1,PSO2,PSO3
5.	CO5: Analyze and make use of modern for solving real word problems.	PO1, PO2, PO5, PO6, PO7, PO8, PO9, PO12 PSO1,PSO2
6.	CO6: Develop teamwork and need to engage in life-long learning, along with the ability to communicate effectively with others.	PO2, PO4, PO8,PO9, PO10, PO11, PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Project Based Learning -3 (Course Code CSP351)

CO/PO Mapping

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low

Cos	Programme Outcomes(POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	1	-	1	2	-	2	1	2	2	3
CO2	3	2	2	2	2	-	-	1	2	-	2	1	2	1	1
CO3	3	2	2	2	2	3	-	1	2	-	2	1	2	2	-
CO4	3	3	2	2	3	-	-	1	2	-	-	1	2	2	2
CO5	3	2	-	-	3	-	-	1	2	-	-	1	2	2	-
CO6		1	-	1	-	-	-	2	2	3	3	3	1	-	1
Avg PO attained	3	2.2	1	1.5	1.7	0.7	0	1.2	2	1	2	1	2	1.5	1.2

Technical Skill Enhancement Course-1 (Simulation Lab)

School: SET		**Batch: 2019-2023**		
Program: B.TECH		**Current Academic Year: 2019-2020**		
Branch:CSE		**Semester: V**		
1	Course Code	CSP 395	Technical Skill Enhancement Course-1 (Simulation Lab)	
2	Course Title	Simulation Lab		
3	Credits	1		
4	Contact Hours (L-T-P)	0-0-2		
	Course Status	Lab		
5	Course Objective	The objective of this course is to provide the basic programming concepts of MATLAB such as – functions, arrays, loops, conditional statements, procedures. It also expose students with visual representations of a model and its results.		
6	Course Outcomes	Students will be able to: **CO1:**Use basic fundamentals to write simple Matlab programs. **CO2:** Plot graphs in Matlab and use procedural functions. **CO3**: Writing Matlab programs with logic and flow control. **CO4:**Manipulate and work with text files. **CO5**:Make use of graphical user interfaces in MATLAB. **CO6**: Apply MATLAB Programming to solve real life problem		
7	Course Description	This course introduces the concepts of MATLAB programming, Modelling and simulation to identify the problems, and choose the relevant models and algorithms to apply. Matlab is used for scientific applications involving images, sound, and other signals.		
8	Outline syllabus			CO Mapping
	UNIT-1	**Introduction to MATLAB**		CO1,CO6
	A	Programming Environment: MATLAB Windows, A First Program		
	B	Expressions, Constants, Variables and assignment statement		
	C	Arrays		
	UNIT-2	**Graph Plots & Procedures and Functions**		CO2,CO6
	A	Basic plotting, Built in functions, Generating waveforms, Sound replay, load and save		
	B	Procedures and Functions: Arguments and return values, M-files		
	C	Formatted console input-output, String handling		
	UNIT-3	**Control Statements**		CO3,CO6
	A	Conditional statements: If, Else, Else-if		
	B	Repetition statements: While		
	C	Repetition statements: for loop		
	UNIT-4	**Manipulating Text**		CO4,CO6
	A	Writing to a text file, Reading from a text file		

	B	Randomising and sorting a list			
	C	Searching a list			
	UNIT-5	**GUI Interface**			CO5,CO6
	A	Attaching buttons to actions			
	B	Getting Input, Setting Output			
	C	Develop MATALB Application			
	Mode of examination				
	Weightage Distribution	Project on Simulation based	ETE		
		60 %	40%		
	Text book/s*				
	Other References	1.			

CO and PO Mapping

Mapping between Cos and Pos, PSO's		
Sl. No.	**Course Outcomes (COs)**	**Mapped Program Outcomes and PSO's**
1	**CO1:**Use basic fundamentals to write simple Matlab programs.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
2	**CO2:** Plot graphs in Matlab and use procedural functions.	**PO1,PO3,PO5,PO10,PO12,PSO1,PSO2,PSO3**
3	**CO3**: Writing Matlab programs with logic and flow control.	**PO1,PO2,PO3,PO5,PO12,PSO1,PSO2,PSO3**
4	**CO4:**Manipulate and work with text files.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
5	**CO5**:Make use of graphical user interfaces in MATLAB.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
6	**CO6**: Apply MATLAB Programming to solve real life problem	**PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO8,PO9,PO10,PO11,PO12,PSO1,PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name: Technical Skill Enhancement Course-1 CSP 395)

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO1 1	PO 12	PSO 1	PSO2	PSO3
CO1	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
CO2	1	-	1	-	2	-	-	-	-	2	-	1	1	2	1
CO3	1	2	1	-	2	-	-	-	-	-	-	1	1	2	1
CO4	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
CO5	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
CO6	2	2	3	3	2	2	1	-	2	3	2	2	2	3	1
Avg PO attained	1	0.7	1.3	0.5	2	0.3	0.2	0	0	1	0	1	1	2.2	1

Syllabus: CSP 398, Summer Internship-II

School: SET		**Batch: 2018-2022**		
Program:B.Tech		**Current Academic Year: 2019-20**		
Branch: CSE		**Semester**		
1	Course Code	CSP398	Course Name: **Summer Internship-II**	
2	Course Title	**Summer Internship-II**		
3	Credits	1		
4	Contact Hours (L-T-P)	0-0-2		
	Course Status	UG		
5	Course Objective	1. Experience the activities and functions of business professionals. 2. Develop and refine oral and written communication skills. 3. Identify areas for future knowledge and skill development.		
6	Course Outcomes	Students will be able to: CO1. Integrate the concepts and strategies of academic study in a real time environment. CO2. Identify, formulate and model problems and find engineering solution based on a systems approach. CO3. Develop teamwork and apply prior acquired knowledge in problem solving. CO4. Develop communication, interpersonal and other critical skills required for career growth. CO5. Practice engineer's responsibilities, self-understanding, self-discipline and ethical standards. CO6. Explore career alternatives prior to graduation.		
7	Course Description	An internship experience provides the student with an opportunity to explore career interests while applying knowledge and skills learned in the classroom in a work setting. The experience also helps students gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks.		
8	Outline syllabus			CO Mapping
	Unit 1	Define objectives and conditions for the internship, ensuring students that it is related to the study path carried out at the University		**CO1,CO2**
	Unit 2	Problem Definition and identification, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.		**CO2**
	Unit 3	The internship work plan is drawn up by developing team work and applies prior acquired knowledge in problem solving.		**CO3**
	Unit 4	Demonstrate and execute Project with the team. Submission of evaluation form and final report completed by the intern.		**CO4**
	Unit 5	Final evaluation form completed by the supervisor at the Host Organization and final presentation before departmental committee.		**CO5,CO6**
	Mode of examination	Practical		
	Weightage Distribution	CA 60%	MTE NIL	ETE 40%
	Text book/s*	NA		

	Other References	NA

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1. Integrate the concepts and strategies of academic study in a real time environment.	PO1,PO2,PO4,PO5, PO7,PO8,PO9,PSO1 ,PSO2,PSO3
2.	CO2. Identify, formulate and model problems and find engineering solution based on a systems approach.	PO1,PO2,PO3,PO4, PO5,PO7,PO8,PO9, PSO1,PSO2
3.	CO3. Develop teamwork and apply prior acquired knowledge in problem solving.	PO1,PO3,PO4,PO5, PO8,PO9,PO11,PO1 2, PSO1,PSO2,PSO3
4.	CO4. Develop communication, interpersonal and other critical skills required for career growth.	PO8,PO10
5.	CO5. Practice engineer's responsibilities, self-understanding, self-discipline and ethical standards.	PO6,PO8
6.	CO6. Explore career alternatives prior to graduation.	PO12,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Summer Internship-II (CSP398)

CO/PO Mapping

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low

Programme Outcomes(POs)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	3	2	-	1	1	1	-	-	-	1	2	2
CO2	1	2	1	2	2	-	1	1	1	-	-	-	1	2	-
CO3	2	-	2	2	2	-	-	1	3	-	1	1	1	2	2
CO4	-	-	-	-	-	-	-	1	-	3	-	-	-	-	-
CO5	-	-	-	-	-	2	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	2	2	2	-
Avg PO attained	1	0.7	0.5	1.2	1	0.3	0.3	1.2	1	1	0	1	1	1.3	0.7

TERM-VI

2.1 Template A1: Syllabus for Theory Subjects

School: SET		**Batch : 2016-2020**
Program: B.Tech		**Current Academic Year: 2019**
Branch: Mechanical Engineering		**Semester: III**
1	Course Code	HMM305
2	Course Title	Management for Engineers
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	The objective of this course is to expose the students to understand the basics of Management Foundations. The students will be given a detailed grounding for the theories and cases related to the general management. The aim of the course is to orient the students in theories and practices of Management so as to apply the acquired knowledge in actual business practices. This is a gateway to the real world of management and decision-making.
6	Course Outcomes	CO1: Define basic principles and concepts related to management in an organization including the functions, different theories of management and roles they play in an organization. CO2: Explain the primary function Planning with its process. Also, how forecasting is done in organizations with various techniques are used. CO3: Use of organizing by studying different types of organization and also using decentralization and span of control in organizations. CO4: Analyse jobs, recruitment process, manpower planning, job rotation, trainings and rewards in various organizations. CO5: Measure motivation and management control concepts to obtain effective controlling in management system in organizations. CO6: Develop proper system in an organization by using all the functions of management.
7	Course Description	This course gives an overview of engineering management and help to understand the various functions of management used in an organization. The focus of the course is the development of individual skills and team work.

8	Outline syllabus		CO Mapping
	Unit 1	Introduction of Management & Organisation	CO1,CO6
	A	Management-Definition of Management & Organisation	CO1,CO6
	B	Concept, Nature, Scope and Functions of Management, Levels of Management, Management Theories - Taylors principle, Fayol's Principles, Hawthorne Studies, Systems Approach and Contingency Approach to Management.	CO1,CO6
	C	Mintzberg's Managerial Roles, Skills of Manager, Functions of management	CO1,CO6
	Unit 2	Management Planning Process	CO2,CO6
	A	Planning objectives and characteristics.	CO2,CO6
	B	Hierarchies of planning.	CO2, CO6

	C	The concept and techniques of forecasting.	CO2,CO6
	Unit 3	Organizing	C03,C06
	A	Meaning, Importance and Principles	C03,C06
	B	Departmentalization, Span of Control	CO3,CO6
	C	Types of Organization, Authority, Delegation of Authority	CO3,CO6
	Unit 4	Staffing	CO4,C06
	A	Meaning, Job analysis	CO4,C06
	B	Manpower planning, Recruitment, Transfers and Promotions	CO4, CO6
	C	Appraisals, Management Development, Job Rotation, Training, Rewards and Recognition,	CO4, CO6
	Unit 5	Directing & Controlling	CO5,CO6
	A	Motivation, Co-ordination, Communication,	CO5,CO6
	B	Directing and Management Control, Decision Making,	CO5,CO6
	C	Management by objectives (MBO) the concept and relevance. Objectives and Process of Management Control	CO5,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 30% · MTE: 20% · ETE: 50%	
	Text book/s*	1. Principles & practice of Mgmt., L.M. Prasad	
	Other References	1. Management Today, Burton & Thakur 2. Principles & Practices of Mgmt., C.B. Gupta 3. Understanding Management, Richard L.Daft 4. Management, Stoner, Freemand & Gilbert 5. Essential of Management, Koontz O' Donnel	

Program Outcome Vs Courses Mapping Table:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO305.1	2	1	2	2	2	2	-	2	1	3	-	-	1	1	2
CO305.2	1	1	2	2	1	2	1	-	-	2	2	1	1	1	2
CO305.3	3	1	1	2	3	2	-	2	-	-	1	2	1	2	2
CO305.4	-	2	2	1	-	1	-	1	-	2	1	-	1	1	2
CO305.5	-	1	2	2	-	2	3	1	2	-	-	1	2	2	1
CO305.6	**1**	2	1	1	2	2	2	-	1	-	-	1	2	2	2
CO305															

2.1 Template A1: Syllabus for Theory Courses

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B-Tech**	
Branch:		**Computer Science and Engineering**	
1	Course Code		
2	Course Title	Web Technologies	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Core /Elective/Open Elective	
5	Course Objective	The objective of this course is to provide a foundation of technologies and technical skills in web development. Based upon the development of a web, this course provides an insight of computer and networking technologies, and hands on experience in web programming.	
6	Course Outcomes	CO1: Define the basic concept of HTML CO2: Illustrate the basics of PHP CO3:Develop interactive web pages using HTML5 and CSS3 CO4:Design web pages/site having validation on user data access. CO5:Compare relationship of HTML,Javascript and PHP CO6:Develop web site for business and organization or for individual	
7	Course Description	The purpose of this course is to give students the basic understanding of Web pages and technologies to be used for designing web sites.	
8	Outline syllabus		CO Mapping
	Unit 1	**HTML & HTML 5**	
	A	HTML basic tags, various links implementation, image ,image map, table formatting, Lists, form design.	CO1
	B	Page layout design using frame, div and span tag, iframe	CO1
	C	HTML5: New elements, canvas, offline webpage, HTML Media: video, audio	CO1,CO3
	Unit 2	**CSS &CSS3**	
	A	Introduction, syntax, selector: class and id, text formatting, margin, align, pseudo-class, pseudo-element	CO3
	B	Positioning, background formatting, Navigation bar, and image gallery.	CO3
	C	CSS3: Introduction, colors, text formatting, fonts formatting, Background formatting, 2D transform, animation	CO3
	Unit 3	**Java script**	
	A	Introduction, syntax, comment, statement, variable, operators	CO4,CO5

	B	Conditional statements, looping statements, Functions	CO4,CO5
	C	Object, events, Accessing form elements, validating form elements,popup windows.	CO4,CO5
	Unit 4	**PHP Basics**	
	A	Introduction to PHP, syntax, variables, operators	CO2,CO5
	B	Conditional statement, iterative statements,Functions	CO2,CO5
	C	Array: single, multi dimensional, numeric array, associative array	CO2,CO5
	Unit 5	**File Handling in PHP**	
	A	File Operation: Reading & writing data on web page from file, deleting file, renaming file	CO5,CO6
	B	Session Management: introduction, creation, destroying and login session management	CO5,CO6
	C	PHP Database Connectivity, Retrieving records, retrieving fields from record	CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	1. Ivan Bayross,"HTML,DHTML, JavaScript, Perl & CGI", BPB Publication 2. Schildt H, "The Complete Reference JAVA2", TMH 3. Schildt H, "The Complete Reference J2EE", TMH	
	Other References	1. Rick Delorme," Programming in HTML5 with JavaScript and CSS3", Microsoft	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define the basic concept of HTML	PO5,PSO2
2.	Illustrate the basics of Extensible markup language.	PO5,PSO2,PO12
3.	Develop interactive web pages using HTML5 and CSS3	PO2,PO3,PO5,PO6,PO9, PSO1,PSO2,PSO3
4.	Design web pages/site having validation on user data access.	PO2,PO3,PO5,PO6,PO9, PSO1,PSO2,PSO3
5.	Compare relationship of HTML,Javascript and PHP	PO5,PSO2
6.	Develop web site for business and organization or for individual	PO1, PO2,PO3,PO4,PO5,PO6, PO7,PO9,PO11,PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Web Technologies **(Course Code CSE352)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSE 352_ Web Technologies	CO1					1									1	
	CO2					3							1		1	
	CO3		1	3		2	1			2				1	2	2
	CO4		1	3		1	1			2				1	2	2
	CO5					2									1	
	CO6	2	3	3	1	3	3	1		3		2	2	1	2	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Cse 352	Web Technologies	2	1.6	2.3	1	2	1.6	1	0	2.2	0	2.3	1.5	1	1.5	2.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: CSE 353, Compiler Design

School: SET		**Batch: 2019-2020**	
Program: B.Tech		**Current Academic Year: 2019-2020**	
Branch:CSE		**Semester: V**	
1	Course Code	**CSE353**	Course Name: Compiler Design
2	Course Title	**Compiler Design**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	1. To provide students with an overview of the issues that arise in Compiler construction as well as to throw light upon the significant theoretical developments and tools that are deep rooted into computer science. 2. To introduce the major phases of Compiler construction and also its theoretical aspects including regular expressions, context-free grammars, Finite Automata etc.	
6	Course Outcomes	After the successful completion of this course, students will be able to : **CO 1:Explain** the concepts and different phases of compilation with compile time error handling **CO 2:Represent** language tokens using regular expressions, context free grammar and finite automata and design lexical analyzer for a language **CO 3:Compare** top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input **CO 4: Design** syntax directed translation schemes for a given context free grammar. **CO 5:Generate** intermediate code for statements in high level language, Benefits and limitations of automatic memory management. **CO 6:Apply** optimization techniques to intermediate code and generate machine code for high level language program	
7	Course Description	To provide students with an overview of the issues that arise in Compiler construction as well as to throw light upon the significant theoretical developments and tools that are deep rooted into computer science.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Introduction to Compiler, Phases and passes, Bootstrapping, Cross-Compiler	CO1, CO2

	B	Finite state machines and regular expressions and their applications to lexical analysis	CO1, CO2
	C	lexical-analyzer generator, Lexical Phase errors	CO1, CO2
	Unit 2	**Parsing Techniques**	
	A	The syntactic specification of programming languages: Context free grammars, derivation and parse trees.	CO2, CO3
	B	Basic Parsing Techniques: Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers. Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables	CO2, CO3
	C	Constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars. Syntactic phase errors and semantic errors.	CO2, CO3
	Unit 3	**Syntax Directed Translations And Intermediate Code Generation**	
	A	Syntax directed definition, Construction of syntax trees, syntax directed translation scheme	CO4,CO5
	B	Variants of Syntax Trees, Three Address Codes	CO4,CO5
	C	Translation of Expression, Type Checking and control flow.	CO4,CO5
	Unit 4	**Symbol table**	
	A	Data structure for symbols tables, representing scope information.	CO5
	B	Run-Time Administration: Implementation of simple stack allocation scheme	CO5
	C	Run Time Storage Management	CO5
	Unit 5	**Code Generation And Optimization**	
	A	Sources of Optimization of basic blocks and flow graphs	CO4,CO6
	B	Basic Blocks, Flow graphs, DAG	CO4,CO6
	C	Global Data Flow Analysis	CO4,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA 30% / MTE 20% / ETE 50%	
	Text book/s*	1. 1.Aho, Sethi, Ulman, compilers Principles, Techniques, and Tools, Pearson Education, 2003	
	Other References	2. Lauden, Principles of Compiler Construction. 3. D. M. *Dhamdhere Compiler* Construction--Principles and Practice, Macmillan India,	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific

		Outcomes (PSO)
1.	**CO 1:Explain** the concepts and different phases of compilation with compile time error handling	PO1,PO5,PO6,PO9,PO12, PSO1,PSO2
2.	**CO 2:Represent** language tokens using regular expressions, context free grammar and finite automata and design lexical analyzer for a language	PO1,PO2,PO3, PO4,PO5, PO12, PSO1, PSO2
3.	**CO 3:Compare** top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input	PO1,PO2,PO3,PSO1,PSO 2
4.	**CO 4: Design** syntax directed translation schemes for a given context free grammar.	PO1,PO2,PO3, PO4,PO5,PO9, PSO2,PSO3
5.	**CO 5:Generate** intermediate code for statements in high level language, Benefits and limitations of automatic memory management.	PO1,PO2,PO3, PO4,PO5,PO9,PO12,PSO 1,PSO2,PSO3
6.	**CO6:Apply** optimization techniques to intermediate code and generate machine code for high level language program	PO1, PO3,PO4, PO4,PO5,PO9,PO12 PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Compiler Design (Course Code CSE 353)

Cos	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO 11	PO12	PS O1	PSO2	PSO3
CO1	3	--	--	--	3	--	--	--	2	--	--	3	2	1	--
CO2	2	2	3	3	2	--	--	--	--	--	--	2	3	2	--
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	2	--
CO4	1	2	3	3	3	--	--	--	3	--	--	--	--	3	2
CO5	1	1	2	3	2	--	--	--	3	--	--	3	1	2	2
CO6	2	--	3	3	2	--	--	--	3	--	--	3	3	2	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE353	Compiler Design	2	1.3	2.3	2	2	0	0-	0	1.8	0	0	2	2	2	1.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET **Batch : 2019-2023**
Program: B-TECH **Current Academic Year: 2019-20**
Branch: CSE **Semester: VI**

1	**Course Code**	**CSA031** **Course Name: Digital Image Processing**
2	**Course Title**	**Digital Image Processing**
3	**Credits**	**3**
4	**Contact Hours (L-T-P)**	**3-0-0**
	Course Status	**Program Elective 3**
5	**Course Objective**	The objective of this course is to introduce the students to the fundamental techniques and algorithms used for acquiring, processing and extracting useful information from digital images. Particular emphasis will be placed on covering methods used for image sampling and quantization, image transforms, image enhancement and restoration, image encoding, image analysis and pattern recognition. In addition, the students will learn how to apply the methods to solve real-world problems in several areas including medical, remote sensing and surveillance and develop the insight necessary to use the tools of digital image processing (DIP) to solve any new problem
6	**Course Outcomes (CO's)**	The Successful Completion of the Course Enables the Students to achieve the following learning Objectives: CO-7. Define the fundamental concepts of a digital image processing system. CO-8. Classify images in the frequency domain using various transformations. CO-9. Apply various operations for image enhancement and image restoration. CO-10. Analyse image segmentation and various representation techniques. CO-11. Choose various morphological operations for Digital Image processing. CO-12. Discuss and Build various image processing techniques for real life applications.
7	**Course Description**	Images and Visual information are integral parts of our daily lives. Digital image processing plays an important role in various practical applications including television, medical imaging modalities such as X-ray or ultrasound, photography, security, astronomy and remote sensing. This subject will introduce the fundamentals of image processing and manipulation, while image applications will be used for illustrations etc. The subject emphasizes general principles of image processing rather than specific applications and also to know and understand how computers can process digital images and some of the fundamental operations in image processing.

8	**Syllabus Outline**		**CO Mapping**
	Unit 1	**Introduction**	
	A	Fundamental of digital image processing, Elements of Visual Perception system, Applications of Digital Image Progressing	CO1
	B	Image Sampling and Quantization, Relationships between pixels , Image Sensing and Acquisition	CO1
	C	Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT, DWT.	CO1
	Unit 2	**Image Enhancement in Spatial and Frequency Domain**	
	A	Spatial Domain: Gray level Transformations, Histogram Processing , Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering	CO2
	B	Frequency Domain: Introduction to Fourier Transform– Low-pass filter in frequency domain	CO2
	C	High-pass filters in frequency domain	CO2

Unit 3	**Image Restoration and Compression**	
A	Restoration Process model, Noise models , Mean Filters, Order Statistics, Adaptive filters	CO3
B	Frequency Domain Filtering: Band reject Filters, Band pass Filters , Notch Filters, Optimum Notch Filtering, Inverse Filtering, Wiener filtering	CO3
C	Encoder-Decoder model, Types of redundancies, Brief Overview of Lossy and Lossless Compression Techniques	CO3
Unit 4	**Image Segmentation**	
A	Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform	CO4,CO6
B	Thresholding, Global Threshloding, adaptive thresholding, Iterative thresholding, Otsu's method, Moving averages, Multivariable thresholding	CO4,CO6
C	Region based segmentation, Watershed algorithm, Use of motion in segmentation	CO4,CO6
Unit 5	**Morphological Image Processing**	
A	Basics, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform	CO5 ,CO6
B	Morphological Algorithms: Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning	CO5,CO6
C	Geodesic Dilation, Erosion, Reconstruction by dilation and erosion. Applications of Morphological Image Processing	CO5,CO6

Mode of examination	Theory		
Weightage Distribution	***CA***	***MTE***	***ETE***
	30%	20%	50%

Text Books

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.

Reference Books

1. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.
2. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ.
3. Image Processing, Analysis and Machine Vision , by Milan Sonka ,Vaclav Hlavac , Roger Boyle Cengage Learning 3rd Edition
4. Digital Image Processing, by S Jayaraman, S Esakkirajan, T Veerakumar TMH Publication

Online Materials

1. https://nptel.ac.in/courses/106105032/
2. http://users.rowan.edu/~polikar/WTtutorial.html

CO and PO Mapping

S. No.	Course Outcome (CO)	Program Outcomes (PO) & Program Specific Outcomes (PSO)

1	Define the fundamental concepts of a digital image processing system.	PO1,PO2,PO3,PO5,PO8,PSO1,PSO2
2	Classify images in the frequency domain using various transformations.	PO1,PO2,PO3,PO4,PO5,PO6,PO8, PO9,PO10,PSO1,PSO2
3	Apply various operations for image enhancement and image restoration.	PO1,PO2,PO3,PO4,PO5,PO6,PO8, PO9,PO10,PO12,PSO1,PSO2
4	Analyse image segmentation and various representation techniques.	PO1,PO2,PO3,PO4,PO5,PO6,PO8, PO9,PO10,PO12,PSO1,PSO2
5	Choose various morphological operations for Digital Image processing.	PO1,PO2,PO3,PO4,PO5,PO6,PO8, PO9,PO10,PO12,PSO1,PSO2
6	Discuss and Build various image processing techniques for real life applications.	PO1,PO2,PO3,PO4,PO5,PO6,PO8, PO9,PO10,PO12,PSO1,PSO2

CO-PO and PSO Mappings of Digital Image Processing CSE031

Subject	PO's / PSO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Digital Image Processing CSE031	CO1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
	CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
	CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
	CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA031	**Digital Image Processing**	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00

Total- 32.83

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***

3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B. Tech**	
Branch:			
1	Course Code	CSE032	
2	Course Title	Cryptography and Network Security	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	The objective of this course is to provide an intention to explain basic concepts and algorithms of symmetric &asymmetric key cryptography, including encryption/decryption and key exchange with the application of cryptography and technique.	
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Identify the basic concepts of computer security, algorithms of symmetric Key cryptography, including encryption/decryption. CO2: Apply the tools and methodologies used to perform mathematic concepts behind the cryptographic algorithms.. CO3: Explain the tools and methodologies used to perform Security analysis. CO4: Interpret use of cryptographic data integrity algorithms and user authentication protocols CO5: Examine security at application layer, transport layer and network layer. CO6: Compare various algorithm of cryptography used for Network Security.	
7	Course Description	This course will provide a deterministic approach of both the principles and practice of cryptography & network security. It covers the basic issues to be addressed by a network security capability, and explored by providing a tutorial and survey of cryptography and network security technology.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction& symmetric Key Cryptography**	
	A	Computer Security Concepts- OSI security Architecture, Security attacks, Services, mechanism, model of network security	CO1
	B	Classical encryption techniques- Substitution Cipher(Mono-alphabetic, Poly-alphabetic), Transposition cipher, Stegnography	CO1
	C	Block Cipher- Encryption Principles, DES and its variants, strength of DES	CO1
	Unit 2	**Mathematics of Cryptography**	

	A	Eucledian, Extended Eucledian Algorithm, EuilersTotient Function , Ferment little Theorem, Eulers theorem			CO2
	B	Primality Testing-Miller Rabin test, Chinese Remainder Theorem			CO2, CO6
	C	Exponential- square and multiply method, Discrete Logarithm			CO2, CO6
	Unit 3	**Asymmetric Cryptography & Key Exchange**			
	A	Public Key cryptography-RSA, Cryptanalysis of RSA			CO3
	B	Elgamal cryptography, Elliptic Curve cryptography			CO3, CO6
	C	Key Management and distribution : KDC, Diffie Hellman Key Exchange			CO3, CO6
	Unit 4	**Digital signatures**			
	A	User Authentication protocol- Kerberos			CO4
	B	Digital Signature –RSA, Elgamal, DSS			CO4
	C	Data integrity algorithms-Hash Functions, MD5, SHA-512			CO4
	Unit 5	**Security**			
	A	Security at Application layer-Email Architecture, S/MIME, PGP-Scenarios, key rings			CO5
	B	Security at Transport layer-SSL(Services, Protocols)			CO5
	C	Security at Network layer-IPSec(Modes, Security Protocols-AH, ESP, Services provided by IPSEC)			CO6
	Mode of examination	Theory/Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Atul Kahate , "Network Security ", Wiley India Pvt Ltd, 2010. 2. Michael T. Simpson, "Hands-on Cryptography & Network Security & Network Defense", Course Technology, 2010. 3. Rajat Khare, "Network Seuciryt and Cryptography & Network Security ", Luniver Press, 2006.			
	Other References	1. Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc, 2001. 2. Behrouz A. Forouzan, "Cryptography And Network Security"- McGraw Hill 1. Internet as a resource for reference.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Identifybasic concepts of computer security, algorithms of symmetric Key cryptography, including encryption/decryption.	PO1, PO2, PSO1. PSO2
2.	CO2: Apply the tools and methodologies used to perform mathematic concepts behind the cryptographic algorithms..	PO1,PO2,PO3, PO4, PSO1,PSO2
3.	CO3: Explain the tools and methodologies used to perform Security analysis.	PO1, PO3, PO5, PSO1, PSO2
4.	CO4: Analyze and use cryptographic data integrity	PO1, PO4, PO6, PO7, PSO1,PSO2

	algorithms and user authentication protocols	
5.	CO5. Examine security at application layer, transport layer and network layer.	PO5,PO7, PO8, PO9, PSO1,PSO2
6.	CO6: Compare various algorithm of cryptography used for Network Security.	PO10,PO11,PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Cryptography and Network Security **(Course Code CSE032)**

Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE032_Cryptography and Network Security	**CO1**	3	2		-	-	-	-	-	-	-	-	-	3	1	-
	CO2	2	3	2	1	-	-	-	-	-	-	-	-	2	3	-
	CO3	2	-	2	-	3	-	-	-	-	-	-	-	2	2	1
	CO4	2	-	-	2	-	2	2	-	-	-	-	-	2	2	
	CO5	-	-	-	-	2	-	2	2	2		-	-	1	-	-
	CO6	-	-	-	-	-	-	-	-	-	2	2	2	2	-	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CSE032	Cryptography and Network Security y and Network Security	**2.5**	**2.5**	**2**	**1.5**	**2.5**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1.5**

Strength of Correlation

1. Addressed to***Slight (Low=1) extent*** ***2.*** Addressed to***Moderate (Medium=2) extent***

3. Addressed to***Substantial (High=3) extent***

Syllabus: CSE041 SOFTWARE PROJECT MANAGEMENT

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B.Tech**		
Branch:		**Computer Science and Engineering**		
1	Course Code	CSE041		
2	Course Title	SOFTWARE PROJECT MANAGEMENT		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core /Elective/Open Elective		
5	Course Objective	To provide fundamental skills of software Project management emphasizing on issues & hurdles associated with delivering successful projects. Apply project management concepts through working in a group as team leader or active team member on an IT project.		
6	Course Outcomes (6)	After successful completion of this course students should be able to: CO1: Define the Project Management principles while developing software. CO2: Explain different project scheduling techniques. CO3: Apply various project monitoring,control and review techniques CO4: Categorize various activities and estimate the risks involved in various project activities. CO5: Assess project quality and issues related to contract management. CO6: Discuss the impact of project planning on the performance of the organizations		
7	Course Description	This course is aimed at introducing the primary important concepts of project management related to managing software development projects. Students will also get familiar with the different activities involved in Software Project Management. Further, they will also come to know how to successfully plan and implement a software project management activity, and to complete a specific project in time with the available budget.		

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Software Project Planning**	
	A	Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope Document, Project Management Cycle, SPM Objectives	CO1
	B	SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of Project Plan, Structure of a Software Project Management Plan	CO1
	C	Software Project Estimation, Estimation Methods, Estimation Models, Decision Process	CO1
	Unit 2	**Project Organization and Scheduling Project Elements**	
	A	Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle	CO2
	B	Ways to Organize Personnel, Project Schedule, Scheduling Objectives, Building the Project Schedule, Scheduling Terminology and Techniques	CO2
	C	Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts	CO2
	Unit 3	**Project Monitoring and Control**	

A	Dimensions of Project Monitoring & Control, Earned Value Analysis	CO3, CO6
B	Earned Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI)	CO3
C	Software Reviews, Types of Review: Inspections, Deskchecks, Walkthroughs, Code Reviews	CO3
Unit 4	**Project Management Tools**	
A	Software Configuration Items and Tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control	CO4
B	Risk Management: Risks and Risk Types, Risk Breakdown Structure (RBS), Risk Management Process: Risk Identification, Risk Analysis, Risk Planning, Risk Monitoring	CO4, CO6
C	Cost Benefit Analysis, Software Project Management Tools: CASE Tools, MS-Project	CO4, CO6
Unit 5	**Software Quality and Staffing in Project Management**	
A	Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model (CMM)	CO5, CO6
B	SQA Activities, Formal SQA Approaches: Proof of Correctness, Statistical Quality Assurance, Product versus process quality management,	CO5
C	Introduction, types of contract, stages in contract, placement, typical terms of a contract, contract management, acceptance	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	

Weightage Distribution	CA	MTE	ETE
	30%	20%	50%

Text book/s*

1. Cottrell M. and Hughes B., "Software Project Management", 5th Edition, The McGraw-Hill Companies.
2. Walker Royce: —Software Project Management- Addison-Wesley, 1998

Other References

1. Pankaj Jalote, “Software Project Management in practice”, 1st Edition, Pearson Education, 2005.
2. Kathy Schwalbe, “Information Technology Project Management” International Student Ed. THOMSON Course Technology

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the Project Management principles while developing software.	PO1,PO3,PO5,PO9,PO10, PO11,PO12,PSO3
2.	CO2: Explain different project scheduling techniques.	PO1,PO3,PO5,PO9,PO10, PO11,PO12,PSO3
3.	CO3: Apply various project monitoring, control and review techniques	PO1,PO3,PO5,PO8,PO9, PO10,PO11,PO12,PSO3
4.	CO4: Categorize various activities and estimate the risks involved in various project activities.	PO1,PO3,PO5,PO8,PO9, PO10,PO11,PO12,PSO3
5.	CO5: Assess project quality and issues related to contract management.	PO1,PO3,PO5,PO6,PO8,PO9, PO10,PO11,PO12,PSO3
6.	CO6: Discuss the impact of project planning on the performance of the organizations	PO1,PO3,PO4,PO5,PO6,PO8,PO9, PO10,PO11,PO12,PSO3

PO and PSO mapping with level of strength for Software Project management (Course code CSE 041)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE041_ Software Project Management	CO1	3	-	1	-	1	-	-	-	3	2	3	2	-	-	2
	CO2	2	-	2	-	2	-	-	-	3	3	3	3	-	-	2
	CO3	2	-	3	-	2	-	-	1	3	2	3	3	-	-	3
	CO4	2	-	2	-	2	-	-	1	3	2	3	3	-	-	3
	CO5	1	-	3	-	2	3	-	1	3	3	3	3	-	-	3
	CO6	2	-	3	3	2	2	-	1	3	3	3	2	-	-	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE041	Software Project Management	2	-	2.3	3	1.8	2.5	-	1	3	2.5	3	2.6	-	-	2.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

CSE042 SOFTWARE TESTING

School:		**SET**		
Program:		**B.Tech**		
Branch:		**CSE**		
1	Course Code	CSE042		
2	Course Title	SOFTWARE TESTING		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core /Elective/Open Elective (Drop Down)		
5	Course Objective	The primary objective of this course is to introduce and instruct software testing and Quality assurance concepts, strategies, and techniques in order to develop a total understanding of the testing process and how it impacts the software project.		
6	Course Outcomes (5-6)	On successful completion of this module students will be able to CO1: Define Basic concepts of Testing and Debugging CO2: Make use of Control flow graph to perform white box testing CO3: Apply Data flow and integration testing to develop feasible software CO4: Classify techniques of Functional testing and design test cases CO5: Evaluate the software quality using Reviews, maturity models and ISO standards. CO6: Adapt software testing methods and modern software testing tools for their testing projects.		
7	Course Description	This course will examine fundamental software testing and related program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing the significance of each phase when testing different types of software. The course will also include concepts such as test generation, test oracles, test coverage, regression testing, mutation testing, program analysis (e.g., program-flow and data-flow analysis), and test prioritization.		
8	Outline syllabus			CO Mapping
	Unit 1	Introduction		
	A	Human and errors, Testing Objectives, Principles of Testing, Behaviour and Correctness, verification and validation, Debugging and its techniques		CO1
	B	Software metrics, Software Testing Life Cycle, Testing activities , Test Levels,		CO1
	C	Testing exit criteria, Bug defect life cycle, White Box and Black Box Testing, test planning and design		CO1
	Unit 2	Unit and Control Flow Testing		
	A	Concept of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing		CO2,CO6
	B	Control Flow Testing: Overview of Control Flow Testing, Control Flow Graph, Paths in a Control Flow Graph		CO2,CO6
	C	Cyclomatic complexity, Path Selection Criteria, Generating test input		CO2,CO6

Unit 3	Data Flow & Performance testing	
A	Data Flow Anomaly, Overview of Dynamic Data Flow Testing, Data Flow Graph, Data Flow Terms	CO3,CO6
B	Data Flow Testing Criteria, Comparison of Data Flow Test Selection Criteria, Feasible Paths and Test Selection Criteria	CO3,CO6
C	Integration Testing: Introduction, Integration Techniques, Regression testing, Performance testing: Stress, Load, Volume, Soak and Spike, Overview of performance tools: Jmeter, Loadrunner, WebLoad	CO3,CO6
Unit 4	Functional Testing	
A	Equivalence Class Partitioning, Boundary Value Analysis, Decision Tables, Random Testing: Monkeys & Gorillas, Error Guessing	CO4,CO6
B	Test case designing – Test cases, Test case format, Test case designing, Acceptance testing and criteria	CO4,CO6
C	Automation testing**:** Need for automation, categorization of Testing tools, Selection of testing tools, Guidelines for automated testing, Overview of commercial testing tools	CO4,CO6
Unit 5	**Reviews and Quality Control**	
A	Testing maturity model, Test metrics and measurements – project, progress and productivity metrics – Status Meetings – Reports and Control Issues – Criteria for Test Completion	CO5,CO6
B	Types of reviews – Developing a review program – Components of Review Plans– Reporting Review Results	CO5,CO6
C	Five Views of Software Quality, McCall's Quality Factors and Criteria, ISO 9000:2000 Software Quality Standard, evaluating software quality	CO5,CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% / MTE 20% / ETE 50%	
Text book/s*	1. Sagar Naik & Piyu Tripathy, "Software Testing and Quality Assurance: Theory and Practice", Wiley.	
Other References	1. Naresh Chauhan, "Software Testing : Principles and practices", Oxford university press 2. Boris Beizer, "Software Testing Techniques", Dreamtech Press 3. K.K. Aggrawal and Yogesh Singh, " Software Engineering" New Age International Publication	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define Basic concepts of Testing and Debugging	PO1,PO2,PO10,PO12,PSO3
2.	CO2: Make use of Control flow graph to perform white box testing	PO1,PO2,PO3,PO4,PO5,PO6, PO8,PO9,PO10,PO12,PSO1,PSO3
3.	CO3: Apply Data flow and integration testing to develop feasible software	PO1,PO2,PO3,PO4,PO5,PO6, PO8,PO9,PO10,PO12,PSO1,PSO3
4.	CO4: Classify techniques of Functional testing and design test cases	PO1,PO2,PO3,PO4,PO5,PO6, PO8,PO9,PO10,PO12,PSO1,PSO3
5.	CO5: Evaluate the software quality using Reviews, maturity models and ISO standards.	PO1,PO2,PO3,PO4,PO5,PO6, PO8,PO9,PO10,PO12,PSO1,PSO3
	CO6: Adapt software testing methods and modern software testing tools for their testing projects.	PO1,PO2,PO3,PO4,PO5,PO6,PO7, PO8,PO9,PO10,PO11,PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Software Testing (CSE 042)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSE042_ Software Testing	CO1	2	1	-	-	-	-	-	-	-	3	-	2	-	-	3
	CO2	3	3	3	2	3	1	-	1	2	3	-	2	2	-	3
	CO3	3	3	3	2	2	2	-	1	2	3	-	2	2	-	3
	CO4	3	3	3	2	3	1	-	1	2	3	-	2	2	-	3
	CO5	3	3	2	2	2	2	-	1	2	3	-	2	2	-	3
	CO6	3	3	3	2	3	2	3	2	3	3	3	3	2	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE042	Software Testing	2.8	2.6	2.8	2	2.6	1.6	3	1.2	2.2	3	3	2.1	2	-	3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET **Batch :** 2018-19

Program: **Current Academic Year:** 2018-19

Branch: CSE **Semester:** **VIth |HOM**

1	Course Code	**ARP 302** Course Name : **Higher Order Mathematics and Advanced People Skills**
2	Course Title	**Higher Order Mathematics and Advanced People Skills**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	
5	Course Objective	To enhance holistic development of students and improve their employability skills. Provide a 360 degree exposure to learning elements of Business English readiness program, behavioural traits, achieve softer communication levels and a positive self-branding along with augmenting numerical and altitudinal abilities. To up skill and upgrade students' across varied industry needs to enhance employability skills. By the end of this semester, a will have entered the threshold of his/her 4^{th} phase of employability enhancement and skill building activity exercise.
6	Course Outcomes	CO1: *A student will be able to Understanding basics of Human Resources, which will help him understand how the employment domains work and the key skills needed to get employed. A Student will learn role Clarity | KRA | KPI | Understanding JD to anticipate and prepare for an upcoming job interview OR interpret the job responsibilities by reading the KPI and KRA statements* CO2: *At the end of the program, a student will be able to learn to avoid conflicts and learn Conflict Management at workplace and help to build a workplace and society more free from conflicts and work towards resolving conflicts* CO3: *At the end of the program, a student will be able to Understanding The art of Negotiations and negotiate better to get maximum from any deal in practical life scenarios* CO4: *At the end of the program, a student will be able to Understanding how Personal Branding is critical to create a brand image and the art of self-branding as a positive self-branding is extremely important for success in life* CO5: *At the end of the program, a student will be able to Understanding the art of Relationship Management as managing people and relationships holds the key to success in social and professional life. | Verbal Abilities-4 will equip the students on advanced communication skills and practices* CO6: *At the end of the program, a student will be able to understand Level-4 Quant & aptitude, Reasoning abilities to deal with real life logical situations better and more effectively with sharpened reasoning skills*
7	Course Description	This penultimate stage introduces the student to the basics of Human Resources. Allows the student to understand and interpret KRA | KPI and understand Job descriptions. A student also understands how to manage conflicts, brand himself/herself, understand relations and empathise others with level-4 of quant, aptitude and logical reasoning
8		Outline syllabus – ARP 302

Unit 1	**Ace the Interview**	**CO MAPPING**
A	HR Sensitization (Role Clarity | KRA | KPI | Understanding JD) | Conflict Management	CO1, CO2,
B	Negotiation Skills | Personal Branding	CO3, CO4
C	Empathy VS Sympathy | Relationship Management | Verbal Abilities-4	CO5
Unit 2	**Introduction to APTITUDE TRAINING- Reasoning- Logical/ Analytical**	
A	Sitting Arrangement & Venn Diagrams | Puzzles | Distribution | Selection	CO6

B	Direction Sense | Statement & Conclusion | Strong & Weak Arguments	CO6
C	Analogies, Odd One out | Cause & Effect	CO6
Unit 3	**Quantitative Aptitude**	
A	Average , Ratio & Proportions, Mixtures & Allegation	CO6
B	Geometry-Lines, Angles & Triangles	CO6
C	Problem of Ages | Data Sufficiency - L2	CO6
Weightage Distribution	*(CA)Class Assignment/Free Speech Exercises / JAM – 60% | (ETE) Group Presentations/Mock Interviews/GD/ Reasoning, Quant & Aptitude – 40%*	
Text book/s*	*Wiley's Quantitative Aptitude-P Anand | **Quantum CAT – Arihant Publications | Quicker Maths- M. Tyra |** Power of Positive Action (English, Paperback, Napoleon Hill) | Streets of Attitude (English, Paperback, Cary Fagan, Elizabeth Wilson) The 6 Pillars of self-esteem and awareness – Nathaniel Brandon | Goal Setting (English, Paperback, Wilson Dobson*	

School: SET	**Batch:**	
Program: BTECH	**Current Academic Year:**	
Branch:CSE	**Semester:**	
1 Course Code	CSP 352	
2 Course Title	Web Technologies Lab	
3 Credits	1	
4 Contact Hours (L-T-P)	0-0-2	
Course Status		
5 Course Objective	Provide the knowledge to design and develop web application .Students will gain the skills and project-based experience needed for entry into web application and development careers	
6 Course Outcomes	CO1:Select essential skills to create simple, original web pages CO2:Demonstrate interactive web pages using CSS and Javascript CO3:Develop web pages/site having validation on user data access. CO4: Examine well-formed XML Document and XML technology CO5: Evaluate Dynamic web site using HTML,Javascript and PHP CO6:Develop web site for small business and organization or for individual	
7 Course Description	This course is an overview of the modern technologies used for the Web development.	
8		CO Mapping
Unit 1	**HTML & HTML 5**	
	Program related to HTML and HTML5 new elements	CO1
Unit 2	**CSS &CSS3**	
	Program related to CSS and CSS3	CO2
Unit 3	**Java script & Jquery**	
	Program related to form validation using javascript and Jquery effect	CO2,CO3
Unit 4	**PHP**	
	Program related to File handling, session management, PHP-ODBC connectivity.	CO3,CO5
Unit 5	**XML**	
	Program related to XML schema ,XSLT,DTD	CO4,CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	4. Ivan Bayross,"HTML,DHTML, JavaScript, Perl & CGI", BPB Publication 5. Schildt H, "The Complete Reference JAVA2", TMH 6. Schildt H, "The Complete Reference J2EE", TMH	
Other References	2. Rick Delorme," Programming in HTML5 with JavaScript and CSS3", Microsoft	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Select essential skills	PO5,PO9,PSO2

	to create simple, original web pages	
2.	Demonstrate interactive web pages using CSS and Javascript	PO2,PO3,PO5,PO9,PO12,PSO2,PSO3
3.	Develop web pages/site having validation on user data access.	PO3,PO5,PO6,PO9,PSO2,PSO3
4.	Examine well-formed XML Document and XML technology	PO5,PO6
5.	Evaluate Dynamic web site using HTML,Javascript and PHP	PO1,PO5,PO9,PO12,PSO1,PSO2
6.	Develop web site for small business and organization or for individual	PO1,PO2,PO3,PO4,PO5,PO6,PO9,PO11,PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Web Technologies Lab **(Course Code CSP352)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSP 352_ Web Technologies Lab	CO1					1				2					1	
	CO2		1	1		3				2			1		1	2
	CO3			1		2	1			2					1	2
	CO4					1	1									
	CO5		1			2				2			1		1	2
	CO6	2	3	3	1	3	3			3		2	2	1	2	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSP 352	Web Technologies Lab	2	1.67	1.67	1	2	1.67	0	0	2.2	0	2	1.3	1	1.2	2.25

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Syllabus: Compiler Design lab

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:CSE	**Semester:**	
1 Course Code	CSP353	
2 Course Title	Compiler Design Lab	
3 Credits	1	
4 Contact Hours (L-T-P)	0-0-2	
Course Status	Compulsory	
5 Course Objective	This laboratory course is intended to make the students experiment on the basic techniques of compiler construction and tools that can used to perform syntax-directed translation of a high-level programming language into an executable code. Students will design and implement language processors in C by using tools to automate parts of the implementation process. This will provide deeper insights into the more advanced semantics aspects of programming languages, code generation, machine independent optimizations, dynamic memory allocation, and object orientation.	
6 Course Outcomes	CO1 **Apply** different compiler writing tools to implement the different Phases CO2: **Understand** and define the role of lexical analyzer, use of regular expression and transition diagrams. CO3: **Implement** a parser for different context free grammars. CO4: **Construct** the intermediate representation CO5: **Implement** Symbol table CO6: **Compare** various code optimization techniques	
7 Course Description	This self-paced course will discuss the major ideas used today in the implementation of programming language compilers, including lexical analysis, parsing, syntax-directed translation, abstract syntax trees, types and type checking, intermediate languages, dataflow analysis, program optimization, code generation, and runtime systems. As a result, you will learn how a program written in a high-level language designed for humans is systematically translated into a program written in low-level assembly more suited to machines	
8 Outline syllabus		CO Mapping
Unit 1	**Practical based on Designing of Finite Automata and Compiler construction tools**	
	4. Design a DFA which will accept all the strings containing even number of 0's and even number of 1's over an alphabet {0, 1} and write a program to implement the DFA. 5. Design a DFA which will accept all the strings containing mod 3 of 0's over an alphabet {0, 1} and write a program to implement the DFA. 6. Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines	CO1

Unit 2	**Practical related to -- Parsing Techniques**	
	4. Write an algorithm and program on Recursive Descent parser.	CO2,CO3
	5. Write an algorithm and program to compute FIRST and FOLLOW function.	
	6. Develop an operator precedence parser for a given language.	
	7. Implementation of shift reduce parsing algorithm and LR parser	
Unit 3	**Practical related to--- Syntax Directed Translations And Intermediate Code Generation**	
	4. Write code to generate abstract syntax tree.	CO4
	5. Intermediate Code Generation	
Unit 4	**Practical related to---Symbol table**	
	Implement Symbol table	CO5
Unit 5	**Practical related to---Code optimization techniques**	
	4. Implementation of Directed Acyclic Graph	CO4,CO5
	5. Implementation of Code Generation	
Mode of examination	Jury/Practical/Viva	
Weightage Distribution	CA 60% · MTE 0% · ETE 40%	
Text book/s*	Aho, Sethi, Ulman, compilers Principles, Techniques, and Tools, Pearson Education, 2003	
Other References	Lauden, Principles of Compiler Construction. 4. D. M. *Dhamdhere Compiler* Construction--Principles and Practice, Macmillan India,	

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1 **Apply** different compiler writing tools to implement the different Phases	PO1,PO5,PO6,PO9,PO12,PSO1,PSO2
2.	CO2: **Understand** and define the role of lexical analyzer, use of regular expression and transition diagrams.	PO1,PO2,PO3, PO4,PO5, PO12, PSO1, PSO2
3.	CO3: **Understand** and use Context free grammar, and parse tree construction.	PO1,PO2,PO3,PSO1,PSO2
4.	CO4: **Construct** the intermediate representation	PO1,PO2,PO3, PO4,PO5,PO9, PSO2,PSO3
5.	CO5: **Implement** Symbol table	PO1,PO2,PO3, PO4,PO5,PO9,PO12,PSO1,PSO2,PSO3
6.	CO6: **Compare** various code optimization techniques	PO1, PO3,PO4, PO4,PO5,PO9,PO12 PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Compiler Design Lab (Course Code CSP353)

Cos	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO 11	PO1 2	PS O1	PSO2	PSO3
CO1	3	--	--	--	3	--	--	--	2	--	--	3	2	1	--
CO2	2	2	3	3	2	--	--	--	--	--	--	2	3	2	--
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	2	--
CO4	1	2	3	3	3	--	--	--	3	--	--	--	--	3	2
CO5	1	1	2	3	2	--	--	--	3	--	--	3	1	2	2
CO6	2	--	3	3	2	--	--	--	3	--	--	3	3	2	3

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Average of non-zeros entry in following table (should be auto calculated).

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	P O 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE353	Compiler Design	2	1.3	2.3	2	2	0	0-	0	1.8	0	0	2	2	2	1.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch : 2018 - 2022**	
Program: B.tech		**Current Academic Year: 2019-2020**	
Branch: CSE / IT		**Semester: 6th**	
1	Course Code	**CSP392** Course Name: Project Based Learning -4	
2	Course Title	Project Based Learning -4	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	13. To align student's skill and interests with a realistic problem or project. 14. To understand the significance of problem and its scope. 15. Students will make decisions within a framework.	
6	Course Outcomes	Students will be able to: CO1: Identify and formulate problem statement. CO2: Design relational database schema. CO3: Develop the solution by using different aspects of programming language. CO4: Classify and understand various test techniques for verification and validation of project. CO5: Analyze and make use of modern for solving real word problems. CO6: Develop teamwork and need to engage in life-long learning, along with the ability to communicate effectively with others.	
7	Course Description	In PBL-4, the students will learn how to define the problem for developing projects, and Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.	
8	Outline syllabus		CO Mapping
	Unit 1	Problem Definition and identification, Team/Group formation and Project Assignment. Finalizing the problem statement, resource requirement, if any.	CO1,CO4
	Unit 2	Use of the relational algebra operations from mathematical set theory (union, intersection, difference, and Cartesian product) and the relational algebra operations developed specifically for relational databases (select (restrict), project, join, and division)..	CO2,CO6
	Unit 3	Design; implement project work in any programming language.	CO3
	Unit 4	Use of various test tools and techniques for software verification and validation of project	CO4,CO5
	Unit 5	Demonstrate and execute Project with the team. Report should include Abstract, Hardware / Software Requirement, Problem Statement, Design/Algorithm, ER diagrams, Use Case Diagrams, State Diagrams, Sequence Diagrams, Communication Diagrams, and Activity	CO6

	Diagrams, Implementation Detail. Validation Reports. References, Test cases if any. The presentation, report, work done during the term supported by the documentation, forms the basis of assessment.
Mode of examination	Practical /Viva
Weight age Distribution	CA MTE
	60% NA ETE

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify and formulate problem statement.	PO1, PO2, PO4,PO6, PO8,PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Design relational database schema.	PO1, PO2, PO3,PO4,PO5, PO7, PO8, PO9, PO11, PO12 , PSO1,PSO2,PSO3
3.	CO3: Develop the solution by using different aspects of programming language.	PO1, PO2, PO3,PO4,PO5, PO6, PO8, PO9, PO11, PO12, PSO1,PSO2
4.	CO4: Classify and understand various test techniques for verification and validation of project.	PO1, PO2, PO3,PO4,PO5, PO8,PO9, PO10, PO11, PO12 ,PSO1,PSO2,PSO3
5.	CO5: Analyze and make use of modern for solving real word problems.	PO1, PO2, PO5, PO6, PO7, PO8, PO9, PO12 PSO1,PSO2
6.	CO6: Develop teamwork and need to engage in life-long learning, along with the ability to communicate effectively with others.	PO2, PO4, PO8,PO9, PO10, PO11, PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Project Based Learning – 4 (Course Code CSP392)

CO/PO Mapping

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Low

Cos	Programme Outcomes(POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	-	1	-	1	2	-	2	1	2	2	3
CO2	3	2	2	2	2	-	-	1	2	-	2	1	2	1	1
CO3	3	2	2	2	2	3	-	1	2	-	2	1	2	2	-
CO4	3	3	2	2	3	-	-	1	2	-	-	1	2	2	2
CO5	3	2	-	-	3	-	-	1	2	-	-	1	2	2	-
CO6	-	1	-	1	-	-	-	2	2	3	3	3	1	-	1
Avg PO attained	3	2.2	1	1.5	1.7	0.7	0	1.2	2	1	2	1	2	1.5	1.2

Syllabus: CSP 396, Technical Skill Enhancement Course-2(Application Development Lab)

School: SET		**Batch: 2019-2023**	
Program: BTech		**Current Academic Year: 2019-2020**	
Branch:		**Semester:6**	
1	Course Code	CSP301	
2	Course Title	Technical Skill Enhancement Course-2(Application Development Lab)	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory/Elective	
5	Course Objective	Describe the components and structure of a mobile development frameworks (Android SDK and Eclipse Android Development Tools (ADT)) and learn how and when to apply the different components to develop a working system.	
6	Course Outcomes	On successful completion of the course, the student will be able to: **CO1:**Explainthe fundamentals of Android App Development. **CO2:**Make use of UI components to create Android applications. **CO3:**Examine the services and notifications in android to perform event driven programming. **CO4:**Develop database SQLite based Android applications. **CO5:**Analyze the usage of commonly available device sensors while building Android App. **CO6:**Develop application using Android software development tools.	
7	Course Description	The course will introduce concepts of the Android platform, Android application components, Activities and their lifecycle, UI design. It will also help students to build applications according to their problem statements.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Android**	
		Configuration of android SDK and test run of application on device, Create "Hello World" application, develop an Android Application to implement Activity life cycle.	CO1,CO6
	Unit 2	**Android UI Components**	
		Create a layout of Calculator using Grid layout, develop an Android Application to implement event listener on above layout, develop an Android Application to implement implicit intent.	CO1,CO2, ,CO6
	Unit 3	**Services and Notification**	
		Develop an Android Application to implement Service life cycle, Develop an Android Application to implement status bar notification, Create a menu with 5 options and selected option should appear in text box	CO3, ,CO6
	Unit 4	**Working with SQL Lite**	
		Create and Login applicationfor above mentioned problems, Create an application to implement Create, Insert and update operation on the database, Create an application to perform Delete and retrieve operation on the database.	CO4, ,CO6
	Unit 5	**Sensor Device**	

		Develop an Android Application to detect availability of all sensors, Develop an Android Application to Fetch data from sensors, Develop an Android Application for development of compass application with help of Orientation sensor			CO5, ,CO6
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	1. AnubhavPradhan and Anil V. Deshpande , Composing Mobile Apps: Learn, Explore, Apply Using Android , 1st Edition, Wiley India.			
	Other References	1. Wei-MengLee , Beginning Android 4 Application Development. 2. Neil Smyth ,Android Studio Development essentials-Android 6			

CO and PO Mapping

Mapping between Cos and Pos, PSO's		
Sl. No.	**Course Outcomes (COs)**	**Mapped Program Outcomes and PSO's**
1	**CO1:** Explain the fundamentals of Android App Development.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
2	**CO2:** Make use of UI components to create Android applications.	**PO1,PO3,PO5,PO10,PO12,PSO1,PSO2, PSO3**
3	**CO3:** Examine the services and notifications in android to perform event driven programming.	**PO1,PO2,PO3,PO5,PO12,PSO1,PSO2,PSO3**
4	**CO4:** Develop database SQLite based Android applications.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
5	**CO5:** Analyze the usage of commonly available device sensors while building Android App.	**PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3**
6	**CO6:** Develop application using Android software development tools.	**PO1,PO2,PO3,PO4,PO5,PO6,PO7,PO9, PO10,PO11,PO12,PSO1,PSO2,PSO3**

PO and PSO mapping with level of strength for Course Name Technical Skill Enhancement Course-2 (Course Code CSP 396)

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO1 1	PO 12	PSO 1	PSO2	PSO3
CO1	1	-	1	-	2	-	-	-	-	-	-	1	1	2	1
CO2	1	-	1	-	2	-	-	-	-	2	-	1	1	2	1
CO3	1	2	1	-	2	-	-	-	-	-	-	1	1	2	1
CO4	1	-	2	-	2	-	-	-	-	-	-	1	1	2	1
CO5	2	-	1	-	2	-	-	-	-	-	-	1	1	2	1
CO6	2	2	3	2	2	2	1	-	2	3	2	2	2	3	1
Avg PO attained	1	0.7	1.5	0.3	2	0.3	0.2	0	0	1	0	1	1	2.2	1

TERM-VII

CSE451: **Artificial Intelligence**

School: SET		**Batch : 2018-2022**		
Program: B.Tech				
Branch: ALL		**Semester: VII**		
1	**Course Code**	**CSE451**	**Course Name: Artificial Intelligence**	
2	**Course Title**	**Artificial Intelligence**		
3	**Credits**	**3**		
4	**Contact Hours (L-T-P)**	**3-0-0**		
	Course Status	**CORE**		
5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Artificial Intelligence (AI), with a practical approach in understanding them. To visualize the scope of AI and its role in futuristic development.		
6	Course Outcomes	After the completion of this course, students will be able to: CO-1. ***Relate*** the goals of Artificial Intelligence and AI and non-AI solution. CO-2. ***Analyze and*** various AI uninformed and informed search algorithms. CO-3. ***Extend*** knowledge representation, reasoning, and theorem proving techniques to real-world problems CO-4. ***Make use of:*** Machine learning algorithms in various application domains of AI. CO-5. ***Select*** Artificial Intelligent based applications. CO-6. ***Develop*** independent (or in a small group) research and communicate it effectively.		
7	Course Description	In this course students will learn basic introduction of Artificial Intelligence, problem solving agents, reasoning, learning and applications of artificial intelligence.		
8	Outline syllabus			CO Mapping
	Unit 1	**INTRODUCTION TO AI**		
	A	Foundation of AI, Goals of AI, History and AI course line		CO1
	B	Introduction to Intelligent Agents; Environment; Structure of Agent		CO1
	C	AI Solutions Vs Conventional Solutions; a philosophical approach; a practical approach		CO1, CO2
	Unit 2	**PROBLEM SOLVING AGENTS**		
	A	Problem solving using Search Techniques; Problems; Solutions; Optimality		CO1, CO2
	B	Informed Search Strategies; Greedy Best-First; A* Search; Heuristic Functions		CO1, CO2
	C	Uninformed Search Strategies; BFS; DFS; DLS; UCS; IDFS; BDS		CO1, CO2
	Unit 3	**KNOWLEDGE & REASONING**		
	A	Knowledge-Based Agents; Logic; First-Order Logic; Syntax-Semantics in FOL; Simple usage;		CO3
	B	Inference Procedure; Inference in FOL; Reduction; Inference Rules;		CO3
	C	Forward Chaining; Backward Chaining; Resolution		CO3
	Unit 4	**LEARNING**		
	A	Common Sense Vs Learning; Components; Representations; Feedback		CO1, CO2, CO3,CO4
	B	Learning Types: Supervised; Unsupervised;		CO1, CO2,

		Reinforcement Learnings			CO3,CO4
	C	Artificial Neural Networks: Introduction, types of networks; Single Layer and Multi-Layer n/w.			CO1, CO2, CO3,CO4
	Unit 5	**APPLICATIONS**			
	A	AI Present & Future; application case studies on NLP, Image Processing;			CO3, CO4, CO5, CO6
	B	Robotics – Hardware; Vision; Navigation based case studies;			CO3, CO4, CO5, CO6
	C	Ambient Intelligence case studies;			CO3, CO4, CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	**1. Rich E**& Knight K, **Artificial Intelligence,** Tata McGraw Hill, Edition 3.			
	Reference Books	1. Russell S &Norvig P, *Artificial Intelligence: A Modern Approach*, Prentice Hall. 2. Dan W. Patterson, Artificial Intelligence & Expert Systems, Pearson Education with Prentice Hall India. Indian Edition.			

<u>Course Outcomes:</u>

Sl. No.	Course Outcome (CO)	
CO-1:	***Relate*** the goals of Artificial Intelligence and AI and non-AI solution.	PO3, PO4, PO5, PO10, PSO1, PSO2, PSO3
CO-2:	***Analyze and*** various AI uninformed and informed search algorithms.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2, PSO3
CO-3:	***Extend*** knowledge representation, reasoning, and theorem proving techniques to real-world problems	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2, PSO3
CO-4:	***Make use of:*** Machine learning algorithms in various application domains of AI.	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2, PSO3
CO-5:	***Select*** Artificial Intelligent based applications.	PO1, PO2, PO3, PO4, PO5, PO9, PO10 PO12, PSO1, PSO2, PSO3
CO-6:	***Develop*** independent (or in a small group) research and communicate it effectively.	PO1, PO2, PO3, PO4, PO5, PO9, PO10 PO12, PSO1, PSO2, PSO3

<u>Mapping of POs & COs:</u> CO-PO and CO-PSO Mapping with level of strength

Course Objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	2					2		2	3	2	2
CO2	2	3	3	2	3					2		2	3	3	2
CO3	3	3	3	3	2	1	1			1	2	3	3	2	3
CO4	3	3	3	3	2	2	1			2	1	3	3	2	3
CO5	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
CO6	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2

1	Course Code	**CSE051**	
2	Course Title	**Wireless Networks**	
3	Credits	3	
4	Contact Hours	**3-0-0**	
5	Course Objective	The objective of this course is to provide fundamental knowledge about Wireless networks, protocol stack and standards, understand and analyze the network layer solutions for Wireless networks, and make student aware of 4G Services.	
6	Course Outcomes	After successful completion of this course students should be able to: CO1. Enumerate, identify the foundation, and describe properties and capabilities of commonly used wireless technologies CO2. Identify and describe the infrastructure and requirements of Mobile IP and Mobile IPv6 CO3.Illustrate the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer CO4. Demonstrate the typical mobile networking infrastructure through a popular GSM protocol CO5. Identify and describe the structure of current 4G cellular networks. CO6.Compare applications of 4G technologies.	
7	**Course Description**	The course will describe concepts, technology and applications of wireless networking as used in current and next-generation wireless networks. In addition, the course addresses the fundamentals of wireless communications and provides an overview of existing and emerging wireless communication networks.	
8	**Course Contents**		
8.01	Unit A	**WIRELESS LAN**	**CO Mapping**
8.02	Unit A Topic 1	Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture,	CO1
8.03	Unit A Topic 2	Physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2	CO1
8.04	Unit A Topic 3	Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX	CO1
8.05	Unit B	**MOBILE NETWORK LAYER**	
8.06	Unit B Topic 1	Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation,	CO1, CO2
8.07	Unit B Topic 2	IPV6-Network layer in the internet Mobile IP session initiation protocol	CO1, CO2
8.08	Unit B Topic 3	Mobile ad-hoc network: Routing Destination Sequence distance vector, Dynamic source routing.	CO1, CO2
8.09	Unit C	**MOBILE TRANSPORT LAYER**	
8.10	Unit C Topic 1	TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility	CO3
8.11	Unit C Topic 2	Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing	CO3
8.12	Unit C Topic 3	Selective retransmission, Transaction oriented TCP - TCP over 3G wireless networks.	CO3
8.13	Unit D	**WIRELESS WIDE AREA NETWORK**	
8.14	Unit D Topic 1	Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture	CO3, CO4
8.15	Unit D Topic 2	3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall,	CO3, CO4
8.16	Unit D Topic 3	DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.	CO3, CO4

8.17	Unit E	**4G NETWORKS**	
8.18	Unit E Topic 1	Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies	CO5, CO6
8.19	Unit E Topic 2	Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems,	CO5, CO6
8.20	Unit E Topic 3	Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.	CO5, CO6
10	**Reading Content**		
9.1	Text book*	1. Jochen Schiller, Mobile Communications, Second Edition, Pearson Education 2012.(Unit I,II,III)	
9.2	other references	1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008. 2.Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", First Edition, Elsevier 2011. 3.Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Enumerate, identify the foundation, and describe properties and capabilities of commonly used wireless technologies	PO1,PO3,PO8 PSO3
2.	CO2. Identify and describe the infrastructure and requirements of Mobile IP and Mobile IPv6	PO1,PO2,PO3,PO8 PSO3
3.	CO3.Illustrate the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer	PO1,PO2,PO3,PO8 PSO3
4.	CO4. Demonstrate the typical mobile networking infrastructure through a popular GSM protocol	PO1,PO2,PO3,PO8 PSO3
5	CO5. Identify and describe the structure of current 4G cellular networks.	PO1,PO2,PO3,PO4,PO5,PO8 PSO3
6.	CO6.Compare applications of 4G technologies.	PO1,PO2,PO3,PO4,PO5,PO8 PSO3

PO and PSO mapping with level of strength for Course Name Wireless Networks (CSE051)

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	3	-	-	-	-	1	-	-	-	-	-	-	2
CO 2	3	2	3	-	-	-	-	1	-	-	-	-	-	-	2
CO 3	3	2	3	-	-	-	-	1	-	-	-	-	-	-	2

CO 4	3	2	3	-	-	-	-	1	-	-	-	-	-	-	2
CO 5	3	2	3	2	2	-	-	1	-	-	-	-	-	-	3
CO 6	3	2	3	2	2	-	-	1	-	-	-	-	-	-	3
Avg.	3	1.6	3	0.6	0.6	-	-	1	-	-	-	-	-	-	2.3

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B. tech**		
Branch: CSE		**Semester:**		
1	Course Code	CSE052		
2	Course Title	**Risk Management**		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Core /Elective/Open Elective		
5	Course Objective	The objective of this course is to provide an insight to fundamentals of risk management in which business and society make an assessment of, control, regulation of risk management and transfer risk.		
6	Course Outcomes	On successful completion of this module students will be able to: CO1: define the basic concept of risk, types, uncertainty, managing, evaluation and prediction of risk. CO2: illustrate the key stages, component, framework, standards, architecture, strategy policies, and protocols process of the risk management. CO3: identify various risk, score them, control and opportunity risk CO4: apply approach/technique of risk assessment for strategy, projects and operations, and make use of risk matrix CO5: analyze uncertainty and risk in projects and apply measurement CO6: Explain, compare and apply risk management concept and techniques in projects to the success of the organization.		
7	Course Description	This course is to provide students with the concepts and fundamentals of risk management, a study of risk assessment and management techniques, methods, and models used in industry to minimize, control and communicate risks.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction**		
	A	The Concept of Risk, Risk and Uncertainty: Distinction, Classification of Risks		CO1, CO6
	B	Managing Risk, Sources and Measurement of Risk		CO1, CO6
	C	Risk Evaluation and Prediction, Types of Risk		CO1, CO6
	Unit 2	**Principles and aims of risk management**		
	A	Principles of risk management, Importance of risk		CO2, CO6

		management, Risk management activities, Perspectives of risk management			
	B	Scope of risk management standards:- Risk management process, Risk management framework			CO2, CO6
	C	Risk architecture, strategy Policies and protocols			CO2, CO6
	Unit 3	**Risk classification Systems**			
	A	Shor, Medium and long term Risk			CO3, CO6
	B	FIRM risk scorecard, PESTLE risk classification system			CO3, CO6
	C	Hazard, control and opportunity risk			CO3, CO6
	Unit 4	**Risk Assessment**			
	A	Importance of risk assessment, Approaches to risk assessment, risk assessment techniques			CO4, CO6
	B	Risk Matrix, Risk Perception, Risk appetite			CO4, CO6
	C	Application of risk matrix, inherent and current level of risk, 4T's of risk response			CO4, CO6
	Unit 5	**Risk Management**			
	A	Importance of risk appetite – Risk tolerance, treatment, termination			CO5, CO6
	B	Introduction to Project Risk Management, uncertainty in projects , project lifecycle, Project risk analysis and management			CO5, CO6
	C	Operational risk management- definition, measurement, difficulties of measurement			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Paul Hopkin,"Fundamental of Risk Management- Understanding evaluating and implementing effective risk management", KoganPage London Philadelphia New Delhi.			
	Other References	1. Internet			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: define the basic concept of risk, types, uncertainty, managing, evaluation and prediction of risk.	PO1, PO2, PO7, P12, PSO1
2.	CO2: illustrate the key stages, component, framework, standards, architecture, strategy policies, and protocols process of the risk management.	PO1, PO4, PO5, PO8, PO9, PO10, PO11, PO12 PSO3
3.	CO3: identify various risk, score them, control and opportunity risk	PO1, PO2, PO4, PO9, P12, PSO1
4.	CO4: apply approach/technique of risk assessment for strategy, projects and operations, and make use of risk matrix	PO1, PO3, PO5, PO6, PO9, P11, PSO3
5.	CO5: analyze uncertainty and risk in projects and apply measurement	PO1, PO2, PO4, PO5, PO7, PO9, PSO3
6.	CO6: explain, compare and apply risk management concept and techniques in projects to the success of the organization.	PO1, PO3, PO5, PO7, PO9, P11, P12, PSO2

PO and PSO mapping with level of strength for Course Name Risk Management (Course Code CSE052)

	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE052 _ Risk Management	CO1	3	-	-	-	-	-	1	-	-	-	-	1	2	-	-
	CO2	2	2	-	3	2	-	-	1	2	1	1	1	-	-	2
	CO3	2	-	-	-	-	-	-	-	2	-	-	1	1	-	-
	CO4	1	-	2	-	3	-	-	-	2	2	2	-	-	-	1
	CO5	2	2	-	2	1	-	1	-	2	1	1	-	-	-	1
	CO6	2	2	2	-	-	-	1	-	2	1	1	1	-	1	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSE052	Risk Manage ment	2	2	2	2.5	2	-	1	1	2	1.25	1.25	1	1.5	1	1.33

Syllabus: CSE062 MOBILE COMPUTING

School:		**SET**			
Program:		**B.Tech**			
Branch:		**CSE**			
1	Course Code	CSE062			
2	Course Title	MOBILE COMPUTING			
3	Credits	3			
4	Contact Hours (L-T-P)	3	0	0	
	Course Status	Core /Elective			
5	Course Objective	The objective of the course is to impart knowledge of mobile and wireless computing systems and techniques			
6	Course Outcomes (5-6)	On successful completion of this module students will be able to CO1: synthesize the basic concepts and principles in mobile computing. CO2: analyze the concept of wireless& telecommunication networks. CO3: synthesize the concepts of IEEE802.11, Bluetooth and HYPERLAN. CO4: Understand the concept of mobile IP & various Routing Protocols CO5: synthesize the concepts of Mobile Transport Layer & WAP CO6: Comparison of all the protocols			
7	Course Description	This course will cover various topics of mobile computing, networking, and systems, including but not limited to: applications of smart phones, cellular networks, embedded sensor systems, localization systems, energy efficiency of mobile devices, wearable and vehicular mobile systems, mobile security etc.			
8	Outline syllabus				CO Mapping
	Unit 1	**INTRODUCTION**			
	A	Wireless transmission , Frequencies for radio transmission			CO1
	B	Signals , Antennas , Signal Propagation , Multiplexing, Modulations			CO1
	C	Spread spectrum, MAC, SDMA , FDMA , TDMA , CDMA , Cellular Wireless Networks			CO1
	Unit 2	**TELECOMMUNICATION NETWORKS**			
	A	GSM: Mobile services, System architecture, Radio interface, Protocols			CO2
	B	Localization and calling, Handover, Security			CO2
	C	General Packet Radio Service (GPRS): GPRS Architecture, GPRS network nodes,			CO2
	Unit 3	**WIRELESS LANS**			
	A	Introduction to IEEE 802.11b/g/n			CO3
	B	Bluetooth technologies and architecture.			CO3
	C	HIPERLAN, WML programming			CO3
	Unit 4	**MOBILE NETWORK LAYER**			
	A	Mobile IP Goals, Entities, IP packet Delivery Agent Advertisement and Discovery, Registration.			CO4
	B	Hidden and exposed terminal problems ,Routing protocols classification,			CO4
	C	DSDV, DSR, AODV ,Security			CO4

Unit 5	**Mobile Transport Layer & Wireless Application Protocol**	
A	Traditional TCP, Indirect TCP,	CO5
B	Snooping TCP, Mobile TCP	CO5,CO6
C	WAP: Protocols, Architecture	CO5,CO6
Mode of examination	Theory/Jury/Practical/Viva	

Weightage	CA	MTE	ETE
Distribution	30%	20%	50%

Text book/s*

2. JochenSchiller : Mobile Communication, Pearson Education.
3. U. Hansman and L. Merck : Principles of Mobile Computing", 2nd Ed., Springer

Other References

4. A. S. Tanenbaum. : Computer Networks, 4th Ed., Pearson Education.
5. D. Milojicic, F. Douglis. : Mobility Processes, Computers and Agents",Addison Wesley
6. D.B. Lange and M. Oshima : Programming and Deploying Java Mobile Agents with Aglets, Addison Wesley.

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: synthesize the basic concepts and principles in mobile computing.	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2
2.	CO2: analyze the concept of wireless& telecommunication networks.	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2
3.	CO3: synthesize the concepts of IEEE802.11, Bluetooth and HYPERLAN.	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2
4.	CO4: Understand the concept of mobile IP & various Routing Protocols	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2
5.	CO5: synthesize the concepts of Mobile Transport Layer & WAP	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2
6.	CO6: Comparison of all the protocols	PO1, PO2, PO4, PO5, PO10, PSO1, PSO2

PO and PSO mapping with level of strength for Mobile Computing (CSE 062)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSE062_ MOBILE COMPUTING	CO1	3	3	-	2	3	-	-	-	-	2	-	-	3	2	-
	CO2	3	3	-	2	3	-	-	-	-	2	-	-	3	2	-
	CO3	3	3	-	2	3	-	-	-	-	2	-	-	2	3	-
	CO4	3	3	-	2	3	-	-	-	-	2	-	-	3	2	-
	CO5	3	3	-	2	3	-	-	-	-	2	-	-	2	2	-
	CO6	3	3	-	2	3	-	-	-	-	2	-	-	2	2	-
Avg.		3	3	-	2	3	-	-	-	-	2	-	-	2	2	-

CSP451: Artificial Intelligence Lab

School:		**School of Engineering and technology**
Department		**Department of Computer Science and Engineering**
Program:		**B-TECH**
Branch:		**Computer Science and Engineering**
1	Course Code	CSP451
2	Course Title	**Artificial Intelligence Lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Artificial Intelligence (AI), with a practical approach in understanding them. To visualize the scope of AI and its role in futuristic development. • To develop a sense of appreciation for traditional AI Programming • To use classical AI problems to understand cognitive process. • To have an overview of the various processes involved in Machine Learning • To develop a working model of real life problem base on Artificial Agent.
6	Course Outcomes	After the completion of this course, students will be able to: CO-7. ***Relate*** the goals of Artificial Intelligence and AI and non-AI solution. CO-8. ***Analyze and*** various AI uninformed and informed search algorithms. CO-9. ***Extend*** knowledge representation, reasoning, and theorem proving techniques to real-world problems CO-10. ***Make use of:*** Machine learning algorithms in various application domains of AI. CO-11. ***Select*** Artificial Intelligent based applications. CO-12. ***Develop*** independent (or in a small group) research and communicate it effectively.
7	Course Description	In this course students will learn basic introduction of Artificial Intelligence, problem solving agents, reasoning, learning and applications of artificial intelligence.

8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on goal based problems** Sub unit - a, b and c detailed in Instructional Plan	
	Unit 2	**Practical related to uninformed search algorithm.** Sub unit - a, b and c detailed in Instructional Plan	
	Unit 3	**Practical related to informed search algorithm.** Sub unit - a, b and c detailed in Instructional Plan	
	Unit 4	**Practical related to knowledge representations and logical reasoning** Sub unit - a, b and c detailed in Instructional Plan	
	Unit 5	**Practical related to machine learning algorithms** Sub unit - a, b and c detailed in Instructional Plan	

Mode of examination	Practical/Viva
Weightage Distribution	CA 60% MTE 0% ETE 40%
Text book/s*	2. **Rich E**& Knight K, **Artificial Intelligence,** Tata McGraw Hill, Edition 3.
Other References	3. Russell S &Norvig P, *Artificial Intelligence: A Modern Approach*, Prentice Hall. 4. Dan W. Patterson, Artificial Intelligence & Expert Systems, Pearson Education with Prentice Hall India. Indian Edition.

Course Outcomes:

Sl. No.	Course Outcome (CO)	
CO-7:	***Relate*** the goals of Artificial Intelligence and AI and non-AI solution.	PO3, PO4, PO5, PO10, PSO1, PSO2, PSO3
CO-8:	***Analyze and*** various AI uninformed and informed search algorithms.	PO1, PO2, PO3, PO4, PO5, PO10, PSO1, PSO2, PSO3
CO-9:	***Extend*** knowledge representation, reasoning, and theorem proving techniques to real-world problems	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2, PSO3
CO-10:	***Make use of:*** Machine learning algorithms in various application domains of AI.	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2, PSO3
CO-11:	***Select*** Artificial Intelligent based applications.	PO1, PO2, PO3, PO4, PO5, PO9, PO10 PO12, PSO1, PSO2, PSO3
CO-12:	***Develop*** independent (or in a small group) research and communicate it effectively.	PO1, PO2, PO3, PO4, PO5, PO9, PO10 PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Artificial Intelligence Lab (Course Code CSP451)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSP 312: Artificial Intelligence Lab	CO1	1	2	3	2	2					2		2	3	2	2
	CO2	2	3	3	2	3					2		2	3	3	2
	CO3	3	3	3	3	2	1	1			1	2	3	3	2	3
	CO4	3	3	3	3	2	2	1			2	1	3	3	2	3
	CO5	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2
	CO6	2	3	3	3	3	2	2	2	3	2	2	2	3	3	2

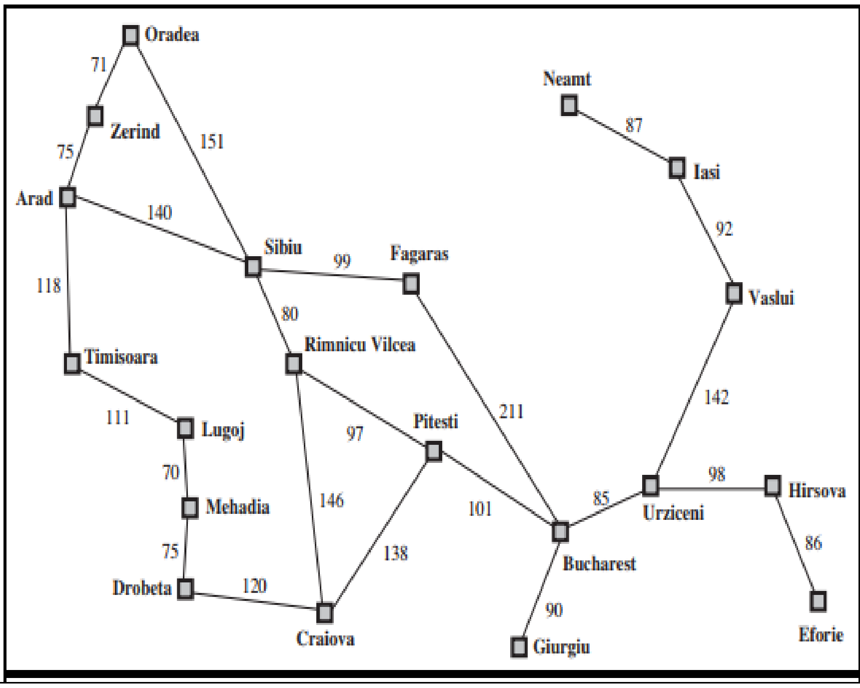
Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

List of Practical's:

	Unit 1	**Practical based on goal based problems**

Week 1	a	Lab expt.1	Implementation of Water Jug Problem.
Week 2, 3	b	Lab expt.2	Introduction to Lisp, and basic programming in Lisp like following: i. Write a LISP function to compute sum of squares. ii. Write a LISP function to compute difference of squares. (if x > y return $x^2 - y^2$, Otherwise $y^2 - x^2$). iii. Write a Recursive LISP function which takes one argument as a list and return last element of the list. (Do not use last predicate.) iv. Write a Recursive LISP function which takes one argument as a list and return list except last element of the list. (Do not use butlast.) v. Write a Recursive LISP function which takes one argument as a list and return reverse of the list. (Do not use reverse predicate). vi. Write a Recursive LISP function which takes two arguments first an atom second a list returns a list after removing first occurrence of that atom within the list. vii. Write a Recursive LISP function which appends two lists together. viii. Write a recursive LISP function which takes 2 lists as arguments and returns a list containing alternate elements from each list.
Week 4	c	Lab expt.3	Advance programming in Lisp like following: i. Write a function that compute the factorial of a number.(factorial of 0 is 1, and factorial of n is n*(n-1)*...1.Factorial is defined only for integers greater than or equal to 0.) ii. Write a function that evaluate a fully parenthesized infix arithmetic expression. For examples, (infix (1+ (2*3))) should return 7. iii. Write a function that performs a depth first traversal of binary tree. The function should return a list containing the tree nodes in the order they were visited. iv. Write a LISP program for water jug problem. v. Write a LISP program that determines whether an integer is prime.
	Unit 2	**Practical related to uninformed search algorithm.**	
Week 5	a, b,	Lab expt.4	Refer following figure as map with distance details, Write a program in your preferred language to generate path from ARAD to BUCHREST, analyze result obtained by a) Depth First Search b) Breadth First Search c) Uniform Cost Search

			
Week 6	c	Lab expt.5	Write a program in your preferred language to generate steps to solve Tower of Hanoi problem.
	Unit 3	**Practical related to informed search algorithm.**	
Week 7	Mid term		
Week 8	a,b,c	Lab expt.6	Write a program in your preferred language to solve the 8 puzzle Problem-using A* algorithm.
	Unit 4	**Practical related to knowledge representations and logical reasoning**	
Week 9	A	Lab expt.7	Write PROLOG program to Program to categorize animal characteristics.
Week 10	B	Lab expt.8	Write PROLOG program to solver for the linear equation A*X + B = 0. Let the predicate linear (A, B, X) return the root X of the equation.
Week 11	c	Lab expt.9	Write a PROLOG program that answers questions about family members and relationships includes predicates and rules which define sister, brother, father, mother, grandchild, grandfather and uncle. The program should be able to answer queries such as the following: father(x, Amit) grandson(x, y) uncle (sumit, puneet) mother (anita, x)
	Unit 5	**Practical related to machine learning algorithms**	
Week 12	a,	Project	Project Work Evaluation-0: Problem Statement
Week 13	b	Project	Project Work Evaluation-1: Design Specification
Week 14	c	Project	Project Work Evaluation-2: Development

Syllabus: CSP 499, Summer Internship-III

School: SET		**Batch: 2019-2023**	
Program:B.Tech		**Current Academic Year: 2019-2020**	
Branch: CSE		**Semester:VII**	
1	Course Code	CSP499	Course Name
2	Course Title	Summer Internship-III	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	UG	
5	Course Objective	1. Get hands-on experience about real world problems in a field relevant to their major of studies. 2. Acquire confidence for employment after graduation. 3. Acquire skills important for time management, discipline, self learning 4. Effective communication and so on. Learn practically about team-work, collaboration, and leadership.	
6	Course Outcomes	Students will be able to: CO1: Apply the technical knowledge learned in classrooms in real industrial situations and problems. CO2: Expose themselves to the engineer's responsibilities and ethics in carrying out internship workflow plan. CO3: Practice communication and teamwork skills. CO4: Demonstrate strategies like time management, multi-tasking approaches to problem solving. CO5: Identify career preferences and professional goals. CO6: Evaluate and use appropriate methods and professional standards in computing practice.	
7	Course Description	The Internship aims to offer students the opportunity to apply their knowledge in real-life environments through an industry placement for eight-weeks. It is expected that the skills students will gain from working with an organization will help them perform better on their jobs after graduation. In addition, the Internship greatly increases the chances for students to obtain full time employment after graduation.	
8	Outline syllabus		CO Mapping
	Unit 1	Define objectives and conditions for the internship, ensuring students that it is related to the study path carried out at the University. Specify the names of the university supervisor, the Host Organization supervisor and the duration, the period in which the internship will be carried out and any changes in duration	**CO1,CO2,CO3,CO4,CO6**
	Unit 2	The internship work plan is drawn up in consultation with the student, the supervising faculty at the university	**CO1,CO2,CO3,CO4,CO5,CO6**

		and the internship supervisor for the organisation offering the internship.			
	Unit 3	Project during Internship involves: a) project activated by the Program Director / Host Organization. b) Project activity to be monitored by faculty members at the University. This activity must guarantee continuous presence and continuity to activities related to project.			**CO3,CO4,CO5,CO6**
	Unit 4	Submission of evaluation form and final report completed by the intern.			**CO3,CO4,CO5,CO6**
	Unit 5	Final evaluation form completed by the supervisor at the Host Organization and final presentation before departmental committee.			**CO3,CO4,CO5,CO6**
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		60%	NIL	40%	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Apply the technical knowledge learned in classrooms in real industrial situations and problems.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Expose themselves to the engineer's responsibilities and ethics in carrying out internship workflow plan.	PO2, PO3, PO4, PO5, PO8, PO9,PO12,PSO1,PSO2,PSO3
3.	CO3: Practice communication and teamwork skills.	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
4.	CO4: Demonstrate strategies like time	PO9, PO11, PO12,PSO1,PSO2,PSO3

	management, multi-tasking approaches to problem solving.	
5	CO5: Identify career preferences and professional goals.	PO9, PO11, PO12,PSO1,PSO2,PSO3
6	CO6: Evaluate and use appropriate methods and professional standards in computing practice.	PO6,PO9,Po10,PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Summer Internship-III (Course Code CSP499)

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	3	3	3	3	3	2	1	1	2	2	1	1	2	2	2
CO 2	-	2	2	2	2	-	-	3	2	-	-	2	2	2	2
CO 3	1	2	1	1	2	-	-	-	2	3	2	2	1	1	1
CO 4	-	-	-	-	--	-	-	-	2	-	3	2	1	1	1
CO 5	-	-	-	-	-	-	-	-	2	-	3	2	2	1	-
CO 6	-	-	-	-	-	2	-	-	1	1	-	2	1	3	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

Syllabus: CSP 497, Major Project -1

School: SET		**Batch: 2019-2023**		
Program: B.tech		**Current Academic Year: 2019-2020**		
Branch: CSE		**Semester: 7th**		
1	Course Code	**CSP497**	Course Name: Major Project -1	
2	Course Title	Major Project -1		
3	Credits	3		
4	Contact Hours (L-T-P)	0-0-0		
	Course Status	Compulsory		
5	Course Objective	Project being the student's last activity at the institution, it fulfills a purpose of synthesis of all the knowledge they have acquired throughout the different years. In addition, this knowledge must be used in a particular way, in order to solve a specific problem, which lets student demonstrate their aptitude by applying this knowledge.		
6	Course Outcomes	Students will be able to: CO1: Identify problem statement in engineering and technology in selected field of interest. CO2: Analyze the gathered information required to develop a project. CO3: Apply prior knowledge of mathematics, computer science and engineering. CO4: Participate in different teams and to focus on getting a working project done on time with each student being held accountable for their part of the project. CO5: Prepare the designs requirements, functional and conceptual design. CO6: Initiate the actual implementation of the project work to produce the deliverables and explain the work in written and oral forms.		
7	Course Description	The object of Major Project-I is to enable the student to take up investigative study in the broad field of Computer Science & Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor.		
8	Outline syllabus			CO Mapping
	Unit 1	Problem identification, Literature survey/Gather & analyze information from multiple sources		CO1, CO2,CO4,
	Unit 2	Formulate solution/ Problem Description: Project Planning, Time and Cost Estimation and budgeting, Risk Management, Project scheduling and Planning Tools: Work Breakdown structure/ LRC/ Gantt charts/CPM/PERT Networks. Creating System Requirement Specifications (Functional & Non Functional)		CO1, CO2, CO3
	Unit 3	Preparing Design: Data Flow Diagrams & Flow Charts, Use of appropriate tools and techniques for project design		CO3, CO4
	Unit 4	Identify and Implement Project Modules.		CO4, CO5
	Unit 5	Use of appropriate tools/technologies for coding the modules		CO2, CO5, CO6
		Report on final problem statement, specifications, project schedule, final concept design and project schedule Report and Presentation - Project Modules development		
	Mode of examination	Practical		
	Weight age Distribution	CA	MTE	ETE
		60%	NA	40%
	Text book/s*			
	Other References			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Identify problem statement in engineering and technology in selected field of interest.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Analyze the gathered information required to develop a project.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
3.	CO3: Apply prior knowledge of mathematics, computer science and engineering.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
4.	CO4: Participate in different teams and to focus on getting a working project done on time with each student being held accountable for their part of the project.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
5.	CO5: Prepare the designs requirements, functional and conceptual design.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
6.	CO6: Initiate the actual implementation of the project work to produce the deliverables and explain the work in written and oral forms.	PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Major Project -1 (Course Code CSP497)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	2	1	2	1	1	2	2	3	3
CO2	3	3	3	3	2	1	1	1	2	1	1	2	3	3	3
CO3	3	1	3	3	2	1	1	1	2	1	1	2	3	3	3
CO4	1	1	2	1	2	3	3	1	2	3	1	2	1	2	3
CO5	1	2	2	1	2	1	1	1	2	2	1	2	1	2	3
CO6	2	1	2	1	3	-	-	1	2	3	1	2	3	3	3

1-Slight (Low)   2-Moderate (Medium)   3-Substantial (High)

Syllabus: CSP 498, Major Project - 2

School: SET		**Batch: 2019-2023**			
Program: B.tech		**Current Academic Year: 2019-2020**			
Branch: CSE / IT		**Semester: VIII**			
1	Course Code	**CSP498**	Course Name: Major Project -2		
2	Course Title	Major Project -2			
3	Credits	8			
4	Contact Hours (L-T-P)	0-0-16			
	Course Status	Compulsory			
5	Course Objective	1. To understand the concept of project design after the completion of project planning 2. Students making decisions within a framework 3. Continuous evaluation of the project 4. A final product to be evaluated for quality			
6	Course Outcomes	Students will be able to: CO1: Demonstrate the implementation of the project. CO2: Identify the test procedure for each implemented module. CO3: Deploy and evaluate the modules to verify the required need of the project. CO4: Use different tools for communication, testing and report writing. CO5: Develop the attitude and ethics of a professional engineer. CO6: Demonstrate an ability to present and defend their project work to a panel of experts.			
7	Course Description	The objective of Major Project-II is to enable the student to extend further the development of project till testing and deployment under the guidance of a Supervisor.			
8	Outline syllabus				CO Mapping
	Unit 1	Complete the implementation of the project. Testing of the modules, Use of appropriate tools/techniques for testing			CO1, CO2
	Unit 2	Deploy & demonstrate developed modules of the project			CO2, CO3
	Unit 3	Preparing a Project Report in the standard format for being evaluated by the Supervisor			CO4, CO5
	Unit 4	Submission of Project and Report to Departmental Committee			CO4, CO5, CO6
	Unit 5	Final Presentation before Departmental Committee			CO6
	Mode of examination	Practical			
	Weight age Distribution	CA			MTE
	Text book/s*	60%	NA	ETE	
				40%	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1: Demonstrate the implementation of the project.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
2.	CO2: Identify the test procedure for each implemented module.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
3.	CO3: Deploy and evaluate the modules to verify the required need of the project.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
4.	CO4: Use different tools for communication, testing and report writing.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
5.	CO5: Develop the attitude and ethics of a professional engineer.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3
6.	CO6: Demonstrate an ability to present and defend their project work to a panel of experts.	PO1, PO2, PO3, PO4, PO5,PO6,PO7, PO8, PO9, PO10, PO11, PO12,PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Major Project -2 (Course Code CSP498)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	3	2	2	2	2	2	2	2	3	3	3
CO2	2	2	3	2	3	2	2	2	2	2	2	2	11	3	3
CO3	3	3	3	3	3	2	2	2	2	2	2	1	1	3	3
CO4	2	2	2	2	3	2	2	2	2	3	2	1	1	2	2
CO5	1	2	2	1	3	2	2	2	2	3	2	1	1	2	2
CO6	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2

1-Slight (Low) **2-Moderate (Medium)** **3-Substantial (High)**

B.Tech-Computer Science & Engineering with specialization in Artificial Intelligence & Machine Learning

SHARDA UNIVERSITY
Beyond Boundaries

School:		**School of Engineering and Technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in AI & ML**		
1	**Course Code**	**CSA103**		
2	**Course Title**	**Introduction to Artificial Intelligence & Machine Learning**		
3	Credits	2		
4	Contact Hours (L-T-P)	2	0	0
	Course Status	Core		
5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Artificial Intelligence (AI) and Machine Learning (ML) as well as to give a strong foundation of AI Techniques.		
6	Course Outcomes	CO-1. Define the requirement of Artificial Intelligence CO-2. Classify the functionality of agents along with acting environment of Intelligence in Artificial Intelligence. CO-3. Apply the concepts of Propositional Logic for real-world AI based problems. CO-4. Analyse the various ML techniques and apply them to solve the real world societal problems. CO-5. Explain the Use Cases of AIML in real world societal problems. CO-6. Discuss the applicability of Artificial Intelligence and Machine learning Approaches to develop sustainable solutions using professional ethics.		
7	Course Description	Artificial Intelligence (AI) and Machine Learning (ML) are increasingly necessary to translate today's data into direct business value. This course introduces learners to the basic concepts of AI and ML, and covers how learning algorithms work. It illustrates how AI and ML fit in the data science ecosystem, and presents several real-world use cases that show how companies are implementing.		

8	**Outline syllabus**		CO Mapping
	Unit 1	**Introduction of Artificial Intelligence**	
	A	Introduction to Artificial Intelligence, Foundation of Artificial Intelligence: Acting humanly: The Turing Test approach , Thinking humanly: The cognitive modeling approach , Thinking rationally: The laws of thought approach , Acting rationally: The rational agent approach	CO1
	B	History of Artificial Intelligence, Applications of AI in Pattern Recognition, Autonomous planning and scheduling, Game playing, Spam filtering, Logistics planning , and Machine Translation.	CO1, CO6
	C	Case Study on AI Solutions Vs. Conventional Solutions, Google Duplex, Do you think AI is good or evil?	CO1, CO6
	Unit 2	**Introduction to Intelligent Agents**	
	A	Introduction to Intelligent Agents, How Agents Should	CO2

	Act, The ideal mapping from percept sequences to actions, Properties of Agents: Intelligence, Autonomy, Ability to Learn, Cooperation.	
B	Classification of Agents: Reactive Agents, Collaborative Agents, Interface Agents, Mobile Agents, Information gathering Agents	CO2
C	The nature of Environments: Specifying the task environment, Properties of task environments, Applications of Intelligent agents: Robotic vehicles, driver less cars	CO2
Unit 3	**Introduction to Propositional Logic**	
A	Introduction, What Is Logic? Why Logic is used in Artificial Intelligence, Logical Operators, Translating between English and Logic Notation, Truth Tables.	CO3
B	Complex Truth Tables, Tautology, Equivalence	CO3
C	Propositional Logic, Syntax, Semantics, Deduction, The Deduction Theorem	CO3
Unit 4	**Introduction to Machine Learning**	
A	Introduction, Training, Rote Learning , Learning Concepts, A Simple Learning Algorithm, Supervised Learning, Unsupervised Learning, Reinforcement Learning	CO4, CO6
B	Introduction to Linear Regression, Application of Linear Regression in various application domains through case study.	CO4, CO6
C	Introduction, Neurons, Artificial Neurons, Perceptron, Neural Networks Architecture, Feed forward Neural Networks, Applications of Neural Networks	CO4, CO6
Unit 5	**Applications of AIML**	
A	Case Study on applications of AI ML in Human Resource: Screening Tons Of Resumes, Attracting Talent, Schedule Management Case Study on applications of AI ML in Health Care: Virtual assistance in healthcare, Diagnostics assistance and medical imaging	CO5, CO6
B	Use Cases on applications of AI ML in Banking, Use Cases on applications of AI ML in insurance,	CO5, CO6
C	Use Cases on applications of AI ML in cyber security Use Cases on applications of AI ML in weather forecasting	CO5, CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	Coppin Ben, Artificial Intelligence Illuminated, Jones and Bartlett Publishers	
Other References	1) Russell S & Norvig P, Artificial Intelligence: A Modern Approach, Prentice Hall 2) Rich E & Knight K, Artificial Intelligence, Tata McGraw Hill, Edition 3	

3) Dan W. Patterson, Artificial Intelligence & Expert Systems, Pearson Education with Prentice Hall India. Indian Edition.
https://analyticsindiamag.com/top-use-cases-ai-human-resources/

CO and PO Mapping

S. No.		Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1.	Define the requirement of Artificial Intelligence	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2.	Classify the functionality of agents along with acting environment of Intelligence in Artificial Intelligence.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO-3.	Apply the concepts of Propositional Logic for real-world AI based problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO-4.	Analyse the various ML techniques and apply them to solve the real world societal problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5.	Explain the Use Cases of AIML in real world societal problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6.	Discuss the applicability of Artificial Intelligence and Machine learning Approaches to develop sustainable solutions using professional ethics.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Artificial Intelligence & Machine Learning **(Course Code** CSA-103**)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
Introduction to Artificial Intelligence & Machine Learning (CSA-103)	CO1	3	3	3	1	2	1	1	1	2	3	1	3	2	3	1
	CO2	3	3	3	1	2	3	3	1	2	3	1	3	2	3	2
	CO3	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
	CO4	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
	CO5	3	3	3	1	2	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	1	2	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-103	Introduction to Artificial Intelligence & Machine Learning	3.00	3.00	3.00	1.00	2.00	2.67	2.67	1.33	2.67	3.00	2.33	3.00	2.67	3.00	2.50

***Total*--37.83**

School:		**School of Engineering and Technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in AI & ML**		
1	Course Code	**CSA202 Concepts of Machine Learning**		
2	Course Title	**Concepts of Machine Learning**		
3	Credits			
4	Contact Hours (L-T-P)	3	0	2
	Course Status	Core		

5 Course Objective

Students are Expected to learn and develop Comprehensive Understanding of the of the following Concepts and Techniques:

1. To introduce the ideas of learning rule and implement them based on human experience.
2. To conceptualize the working of human brain using SVM, RF and ANN.
3. To become familiar with decision boundaries that can learn from available examples and generalize to form appropriate learning rules for inference systems.
4. To provide the mathematical background for SVM, RF and Neural Network based classification techniques.
5. To understand and demonstrate how to solve patterns learning from a large series of data using computer based learning algorithms

6 Course Outcomes

A Successful completion of this Course Ensures the following Outcomes

CO 1 : Define basics of Machine Learning and stochastic concepts.

CO-2 : Classify and Compare existing models to understand the applicability in solve real world societal problems.

CO-3 : Identify develop and apply mathematical models to find sustainable solutions.

CO-4 : Analyse the logical ability to apply feature engineering to extract hierarchical patterns existing in real life problems.

CO-5 : Evaluate the learning models to glance the upcoming world through it.

CO-6 : Discuss the applicability of Machine learning Approaches to develop sustainable solutions using professional ethics.

7 Course Description

This course introduces computational learning paradigm for critical & implementable understanding for supervised and unsupervised learning based problem areas.

8			CO Mapping
	Unit 1	**Core Concepts of Machine Learning**	
	A	What is Machine Learning? What kind of problems can be tackled using machine learning? The ML Mindset, Introduction to Machine Learning Problem Framing(Common ML Problems, ML Use Cases, Identifying Good Problems for ML, Hard ML Problems), Machine Learning Applications(Image Recognition, Speech Recognition, Medical Diagnosis, Statistical Arbitrage, Learning Associations), Standard learning tasks(Machine Learning Pipeline, Classification, Regression, Ranking, Clustering, Dimensionality reduction or Manifold learning)	CO1
	B	Learning Stages(Features, Labels, Hyperparameters, Validation Samples, Test Samples, Loss Function, Hypothesis Tests), Learning Scenarios(Supervised learning, Unsupervised learning, Semi- Supervised learning, Transductive inference, On-line	CO1, CO2

	learning, Reinforcement learning, Active learning), Generalization Supervised Learning, Unsupervised Learning, Reinforcement learning)	
C	Data Preparation and Feature Engineering in ML(Data and Features, Information, Knowledge, Data Types, Big Data), Data Preprocessing: An Overview(Data Quality: Why Preprocess the Data?, Major Tasks in Data Preprocessing), Data Cleaning(Missing Values, Noisy Data, Data Cleaning as a Process), Data Integration(The Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Detection and Resolution of Data Value Conflicts), Data Reduction(Overview of Data Reduction Strategies, Attribute Subset Selection, Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation), Data Transformation and Data Discretization(Overview of Data Transformation Strategies, Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis, Discretization by Cluster, Decision Tree, and Correlation Analyses, Concept Hierarchy Generation for Nominal Data)	CO1, CO2
Unit 2	**Supervised Learning Algorithms - Part One**	
A	How Supervised Learning Algorithms Work ? Steps (Bias-variance trade off, Function complexity and amount of training data, Dimensionality of the input space, Noise in the output values, Algorithms, Other factors to consider (Heterogeneity of the data, Redundancy in the data, Presence of interactions and non-linearities	CO1, CO2, CO6
B	Linear Regression Model Representation, Linear Regression Learning the Model (Simple Linear Regression, Ordinary Least Squares, Gradient Descent), Regularization / Shrinkage Methods (Bias-variance trade-off, Overfitting Issues, Lasso Regression, Ridge Regression), Making Predictions with Linear Regression(Cost Function, Feature Scaling, Normalization, Mean Normalization, Learning Rate, Automatic Convergence Test)	CO1, CO2, CO6
C	Logistic Regression, The Logistic Model (Latent variable interpretation, Logistic function, odds, odds ratio, and logit, Definition of the logistic function, Definition of the inverse of the logistic function, Interpretation of these terms, Definition of the odds, The odds ratio, Multiple explanatory variables), Model fitting ("Rule of ten", Iteratively reweighted least squares (IRLS), Evaluating goodness of fit, Limitations of Logistic Regression), Linear discriminant analysis (LDA for two classes, Assumptions, Discriminant functions, Discrimination rules, Eigenvalues, Effect size), Practical use and Applications (Bankruptcy prediction, Face recognition, Marketing, Biomedical, studies), Comparison to Logistic Regression	CO1, CO2, , CO6
Unit 3	**Supervised Learning Algorithms - Part Two**	
A	Support Vector Machines, Linear SVM (Hard-margin, Soft-margin), Nonlinear Classification, Computing the SVM classifier(Primal, Dual, Kernel trick), Modern methods(Sub-gradient descent, Coordinate descent), Empirical risk minimization(Risk minimization, Regularization and stability, SVM and the hinge loss, Target functions), Properties(Parameter selection, Issues)	CO1,CO2,CO3, , CO6
B	Introduction to Artificial Neural Networks (Feed-forward Network Functions, Weight-space symmetries), Network Training (Parameter optimization, Local quadratic approximation, Use of gradient information, Gradient descent optimization), Error Backpropagation(Evaluation of error-function derivatives, Simple examples, Efficiency of backpropagation)	CO1,CO2,CO3, CO6
C	Decision Tree Learning (Decision tree representation, ID3 learning algorithm, Entropy, Information gain, Overfitting and Evaluation,	CO1,CO2,CO3,

	Overfitting, Validation Methods, Avoiding Overfitting in Decision Trees, Minimum-Description Length Methods, Noise in Data), Random Forests Algorithm (Preliminaries: decision tree learning, Bagging, From bagging to random forests, Extra Trees, Properties, Variable importance)	CO6
Unit 4	**Unsupervised Learning**	
A	Unsupervised Learning (What is Unsupervised Learning?), Clustering Methods (Method Based on Euclidean Distance, Method Based on Probabilities, Hierarchical Clustering Methods, Method Based on Euclidean Distance)	CO2,CO3,CO4, CO6
B	k-means Clustering Algorithm (Standard algorithm (naive k-means), Initialization methods), Applications (Vector quantization, Cluster analysis, Feature learning) Gaussian mixture models , Expectation-Maximization method	CO2,CO3,CO4, CO6
C	Principal Component Analysis for making predictive models (First component, Further components, Covariances, Dimensionality reduction, Singular value decomposition), Properties and limitations of PCA (Properties, Limitations), Computing PCA using the covariance method, Typical Applications	CO2,CO3,CO4, CO6
Unit 5	**Parameter Estimation, Model Evaluation and Ensemble Methods**	
A	Parameter Estimation (Point Estimation, Maximum Likelihood Estimation, Unbiased Estimation, Confidence Intervals for One Mean, Two Mean, Variances)	CO2,CO5,CO6
B	Model Evaluation (ML Model Validation by Humans, Holdout Set Validation Method, Cross-Validation Method for Models, Leave-One-Out Cross-Validation, Random Subsampling Validation, Teach and Test Method, Bootstrapping ML Validation Method, Running AI Model Simulations, Overriding Mechanism Method), The ROC Curve	CO3,CO5,CO6
C	**Ensemble Methods (Ensemble Theory, Ensemble Size, Voting and Averaging Based Ensemble Methods Boosting, Weightage Average, Stacking, Bagging, Boosting and Bootstrap Aggregating)**	CO4,CO5,CO6
Mode of examination	Theory and Practical	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag. 2. Foundations of Machine Learning, Second Edition By Mehryar Mohri, Afshin Rostamizadeh and Ameet Talwalkar, MIT Press, Second Edition, 2018. 3. Introduction to Machine Learning, Third Edition, By Ethem Alpaydin, The MIT Pressmitpress.mit.edu › books › introduction-machine-learni...	
Other References	4) Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press. 5) Russel, S. and Norvig, P. (2003). Artifiical Intelligence: A Modern Approach. 2ndEdition. New York: Prentice-Hall. 6) Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press. 7) https://www.toptal.com/machine-learning/ensemble-methods-machine-learning.	

CO and PO Mapping

SHARDA UNIVERSITY
Beyond Boundaries

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO 1 :** ***Define basics of*** *Machine Learning and stochastic concepts.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**CO-2 :** ***Classify and Compare*** *existing models to understand the applicability in solve real world societal problems.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**CO-3 :** ***Identify develop and apply*** *mathematical models to find sustainable solutions.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**CO-4 :** ***Analyse*** *the logical ability to apply feature engineering to extract hierarchical patterns existing in real life problems.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**CO-5 :** ***Evaluate*** *the learning models to glance the upcoming world through it.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**CO-6 :** *Discuss the applicability of Machine learning Approaches to develop sustainable solutions using professional ethics.*	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Concepts of Machine Learning **(Course Code** CSA-202**)**

Subject	PO's / PSO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Concepts of Machine Learning **(Course Code** CSA-201**)**	CO1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
	CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-201	Concepts of Machine Learning	3.00	3.00	3.00	3.00	3.00	3.00	2.83	2.00	2.00	3.00	2.67	3.00	2.83	2.83	2.67

Total- 41.83
Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: SET		**Batch: 2019-2023**	
Program: B.Tech.		**Current Academic Year: 2019-2020**	
Branch: CSE/IT		**Semester: III**	
1	**Course Code**	**CAL201**	
2	**Course Title**	**Machine Learning Lab**	
3	**Credits**	**1**	
4	**Contact Hours (L-T-P)**	**0-0-2**	
	Course Status	Core	
5	Course Objective	5. Learn the basic concepts of Machine Learning algorithms. 6. Make use of Data sets in implementing the machine learning algorithms. 7. Implement the machine learning concepts and algorithms in any suitable language of choice.	
6	Course Outcomes	CO 1: Show the implementation of linear and logistic Regression on real life applications. CO-2: Interpretation of existing models to understand the solution environment. CO-3: Application of existing mathematical solutions to test real world problems. CO-4: Analyse the logical ability to apply clustering approach to extract hierarchical patterns existing in real life problems. CO-5 : Build the understanding of learning theory to glance the upcoming world through it. CO-6: Appraise recent trends in machine learning and applications.	
7	Course Description	This course introduces computational learning paradigm for critical & implementable understanding for supervised and unsupervised learning based problem areas.	
8	Outline syllabus		CO Mapping
	Unit 1	**Core Concepts of Machine Learning**	
		Write a Program to load and view data set file.	CO1
		Write a program to implement simple linear regression using housing price prediction problem.	CO1, CO2
		Write a program to implement binary logistic regression using cancer identification problem.	CO1, CO2
	Unit 2	**Supervised Learning Algorithms - Part One**	
		Write a program to implement gradient descent method for learning.	CO1, CO2, CO6
		Write a program to implement regularized linear regression.	CO1, CO2, CO6
		Write a program to implement regularized logistic regression.	CO1, CO2, , CO6
		Write a program to Normalize the data used in linear regression problem above before predicting prices, and then predict the housing prices.	CO1, CO2, CO6
	Unit 3	**Supervised Learning Algorithms - Part Two**	
		Write a program to implement Support Vector Machine regression using suitable dataset.	CO1,CO2,CO3, , CO6
		Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.	CO1,CO2,CO3, CO6
		Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	CO1,CO2,CO3, , CO6
		Write a program to demonstrate the working of the Random Forest algorithm. Use an appropriate data set for classifying a new sample.	CO1,CO2,CO3, CO6
	Unit 4	**Unsupervised Learning**	
		Write a program to implement K-Means clustering algorithm using an appropriate dataset.	CO2,CO3,CO4, CO6

		Write a program to implement K-Means clustering algorithm using an appropriate dataset.			CO2,CO3,CO4, CO6
	Unit 5	**Hypothesis Testing, Parameter Estimation, Model Evaluation and Ensemble Methods**			
		Write a program to implement data split into training, cross validation and testing data.			CO2,CO5,CO6
		Implement an Ensemble approach by combining different models to solve time series based prediction problem.			CO3,CO5,CO6
		Conduct hypothesis testing using some statistical toolkit on appropriate problem.			CO4,CO5,CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	1. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag. 2. Foundations of Machine Learning, Second Edition By Mehryar Mohri, Afshin Rostamizadeh and Ameet Talwalkar, MIT Press, Second Edition, 2018. 3. Introduction to Machine Learning, Third Edition, By EthemAlpaydin, The MIT Pressmitpress.mit.edu › books › introduction-machine-learni...			
	Other References	1) Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press. 2) Russel, S. and Norvig, P. (2003). Artifiical Intelligence: A Modern Approach. 2ndEdition. New York: Prentice-Hall. 3) Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press. 4) https://www.toptal.com/machine-learning/ensemble-methods-machine-learning.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO 1 : Show the implementation of linear and logistic Regression on real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2 : Interpretation of existing models to understand the solution environment.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO-3 : Application of existing mathematical solutions to test real world problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO-4 : Analyse the logical ability to apply clustering approach to extract hierarchical patterns existing in real life problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5 : Build the understanding of learning theory to glance the upcoming world	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6: Appraise recent trends in machine learning and applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Concepts of Machine Learning **(Course Code** CAL201**)**

Subject	PO's / PSO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Concepts of Machine Learning **(Course Code** CAL-201**)**	CO1	3	3	3	3	3	3	2	1	1	3	1	3	2	2	1
	CO2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA -201	Concepts of Machine Learning	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.83**	**2.00**	**2.00**	**3.00**	**2.67**	**3.00**	**2.83**	**2.83**	**2.67**

Total- 41.83
Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and Technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in AI & ML**		
1	Course Code	**CSA-203**		
2	Course Title	**Concepts of Neural Networks**		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		
5	Course Objective	1. To introduce the ideas of learning rule and implement them based on human experience. 2. To conceptualize the working of human brain using ANN. 3. To become familiar with neural networks that can learn from available examples and generalize to form appropriate learning rules for inference systems. 4. To provide the mathematical background for Neural Network and classification techniques. 5. To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.		
6	Course Outcomes	On successful completion of this module students will be able to: 1. **Define** biological significance of Neural Network and list ANN components. 2. **Classify** various learning paradigms based on real file problems 3. **Apply basic concepts to build** single and multi-layer feed-forward neural networks. 4. **Analyze** and train radial-basis function and recurrent networks; 5. **Explain self-organizing map** for real life problems. 6. **Discuss** and adapt appropriate neural networks model for real life applications.		
7	Course Description	This course introduces the basic models, learning algorithms, and some applications of neural networks. After this course, we should be able to know how to use neural networks for solving different problems related to pattern recognition, function approaximation, data visualization, and so on.		
8				
	Unit 1	**Introduction**		
	A	Introduction, Motivation and History, Components of a Neuron-synapses, dendrite, cell nucleus, axon	CO1	
	B	Important Terminologies of ANNs: Propagation function,	CO1	

	Activation function, output function, Components of Artificial Neural Network: common activation functions, network topologies- feed forward, recurrent networks, completely linked networks	
C	Neuron Activation order: Synchronous activation, asynchronous activation, Communication with the outside world: input and output of data in and from neural networks	CO1
Unit 2	**Learning Paradigms**	
A	Learning Paradigms and their real Applications, Unsupervised learning and Supervised learning, Reinforcement learning, Offline and online learning and their applications based on real life problems.	CO2, CO6
B	Training patterns and teaching inputs, use of training samples, data set split into training, validation and testing data, Implication of splitting of data set, Learning curves and their importance in diagnostics	CO2, CO6
C	Gradient optimization procedures, Hebbian learning rule	CO2
Unit 3	**The Perceptron, Backpropagation and its variants**	
A	Single layer Perceptron network, Perceptron Learning Algorithm and convergence theorem, Delta rule as a gradient based learning strategy, Limitations of Single Layer Perceptron network	CO3
B	Multilayer Perceptron Network, Backpropagation learning and its applications	CO3
C	Analysing effect of learning rate on learning process, Variants of Backpropagation algorithm	CO3
Unit 4	**Radial Basis Function Neural Networks**	
A	Components & Structure of an RBF network, Information processing of an RBF network, Information Processing in RBF neurons, analytical thoughts prior to training	CO4
B	Equation system and gradient strategies for training, Growing RBF Networks, comparison of RBF Networks and Multilayer Perceptrons	CO4
C	Recurrent Neural Networks: Jordan networks, Elman Networks, Training Recurrent neural networks	CO4
Unit 5	**Unsupervised Learning Network Paradigms**	
A	Self-organizing feature maps, structure of a self-organizing feature map, Training of SOM, Topology function, common distance and topology functions, relationship between learning rates and neighbourhoods,	CO5,CO6

	applications of SOMs	
B	Introduction to Adaptive Resonance Theory, Task and structure of an ART Network, Learning process of an ART Network- top down and bottom up learning, Extensions- ART2, ART3	CO5,CO6
C	Introduction to Hobbfield Network, Associative Network (Homogenous & Heterogeneous), Introduction to Restricted Boltzman Machine.	CO5,CO6
Mode of examination		
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. David Kriesel, 2007, "A Brief Introduction to Neural Networks", available at http://www.dkriesel.com 2. Simon O. Haykin, **"Neural Networks and Learning Machines",** Pearson	
Other References	1. ANDERSON, JAMES A., AN INTRODUCTION TO NEURAL NETWORKS, PHI Learning. 2. Christopher M. Bishop & Geoffrey Hinton, Neural Networks for Pattern Recognition, Oxford University Press.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** biological significance of Neural Network and list ANN components.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**Classify** various learning paradigms based on real life problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**Apply basic concepts to build** single and multi-layer feed-forward neural networks.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**Analyze** and train radial-basis function and recurrent networks;	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**Explain self-organizing map** for real life problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**Discuss** and adapt appropriate neural networks model for real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name: Neural networks (Course Code- CSA-203)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Neural networks (Course Code- CSA-203)	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3
CSA-203	Neural networks	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67

Total 40.3

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:	**School of Engineering and Technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B. Tech**	
Branch:	**CSE with Specialization in AI & ML**	

1	**Course Code**	**CSA301**		
2	**Course Title**	**SOFT COMPUTING**		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		

5 Course Objective

The primary objective of this course is to provide an introduction to the basic principles, techniques, and applications of soft computing.

- Upon successful completion of the course, students will have an understanding of the basic areas of Soft Computing including Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms.
- Provide the mathematical background for carrying out the optimization associated with neural network learning.
- Aim of this course is to develop some familiarity with current research problems and research methods in Soft Computing by working on a research or design project.

6 Course Outcomes

The Completion of this Course will Enable the Students to be able to Learn

CO1: Define the basic concepts of soft computing.

CO2: Explain applications & operations of Fuzzy Logic in real life problems.

CO3: Apply different FIS models to solve optimization problems.

CO4: Analyse and examine Evolutionary and swarm algorithms in solving real world Multi-Objective optimization problems

CO5: Choose of different optimization algorithms to solve real-life multi objective problems.

CO6: Discuss applications of Soft Computing and solve Problems in Varieties of Application Domains.

7 Course Description

This course will cover fundamental concepts used in Soft computing. The concepts of Fuzzy logic (FL) will be covered first, followed by Artificial Neural Networks (ANNs) and optimization techniques using Genetic Algorithm (GA). Applications of Soft Computing techniques to solve a number of real life problems will be covered to have hands on practices.

8

		CO Mapping
Unit 1	**Introduction to Soft Computing**	
A	Concept of computing systems. What is Soft Computing?	CO1
B	"Soft" Computing versus "Hard" computing	CO1
C	Characteristics of Soft computing, Some applications of Soft computing techniques	CO1, CO6
Unit 2	**FUZZY LOGIC**	
A	Introduction to Fuzzy logic, Fuzzy sets and membership functions	CO2
B	Operations on Fuzzy sets. Fuzzy relations, rules, propositions, implications and inferences.	CO2
C	Defuzzification techniques, Fuzzy logic controller design, Some real life societal applications of Fuzzy logic.	CO2
Unit 3	**Fuzzy inference System**	
A	Fuzzy Inference Systems, Different Fuzzy Models: Mamdani	CO3

	Fuzzy Models, Sugeno Fuzzy Models	
B	Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.	CO3
C	Neuro Fuzzy Modelling: Adaptive Neuro-Fuzzy Inference Systems, Architecture, Hybrid Learning Algorithm, Learning Method that Cross- fertilize ANFIS and RBFN	CO3
Unit 4	**Swarm and Evolutionary Algorithms**	
A	Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques	CO4
B	Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, Solving single-objective optimization problems	CO4
C	Swarm Optimization: Introduction to Ant Colony Optimization, Particle Swarm Optimization etc.	CO4
Unit 5	**Multi-objective Optimization Problem Solving**	
A	Concept of multi-objective optimization problems (MOOPs) and issues of solving them.	CO5,CO6
B	Multi-Objective Evolutionary Algorithm (MOEA) Non-Pareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs , Some applications with MOEAs	CO5,CO6
C		CO5,CO6
Mode of examination	Theory and Practical	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. George J. Klir and Bo Yuan, "Fuzzy sets and Fuzzy Logic", Prentice Hall, USA. 2. Goldberg D.E., Genetic Algorithms in Search, Optimization, and Machine Learning Addison Wesley. 3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill	
Other References	1. Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall. 2. An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000. 3. Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002. 4. Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Define the basic concepts of soft computing.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**CO2:** Explain applications & operations of Fuzzy Logic in	PO1,PO2,PO3,PO4,

	real life problems.	PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**CO3:** Apply different FIS models to solve optimization problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**CO4:** Analyse and examine Evolutionary and swarm algorithms in solving real world Multi-Objective optimization problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**CO5:** Choose of different optimization algorithms to solve real-life multi objective problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**CO6:** Discuss applications of Soft Computing and solve Problems in Varieties of Application Domains.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name SOFT COMPUTING **(Course Code** CSA-202**)**

Subject	PO's / PSO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
SOFT COMPUTING CSA301	CO1	3	3	1	1	1	1	1	1	2	1	1	3	1	3	1
	CO2	3	3	3	3	2	3	2	2	2	2	3	3	3	3	3
	CO3	3	3	3	3	3	3	1	2	2	2	3	3	3	3	3
	CO4	3	3	3	3	3	3	3	2	2	2	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3
	CO6	3	3	3	3	3	1	3	2	3	2	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA 301	SOFT COMPUTING	3.00	3.00	3.00	3.00	3.00	3.00	2.83	2.00	2.00	3.00	2.67	3.00	2.83	2.83	2.67

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:	**School of Engineering and Technology**	
Program:	**Department of Computer Science and Engineering**	
Branch:	**CSE**	
1	Course Code	CSA303
2	Course Title	**Pattern Recognition**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	CORE
5	Course Objective	**Students will try to learn t**o introduce the ideas of existing patterns and implement them based on data analysis. Also, to conceptualize the working of patterns explorations using computational algorithms. In addition to it, students will aim to become familiar with feature knowledge that can be extracted from available examples and generalize to form appropriate feature models.
6	Course Outcomes	On successful completion of this module students will be able to: CO 1. Define Pattern concept and random process ideas, understand mathematical background. CO 2. Explain preliminary models to understand the solution environment. CO 3. Apply of existing mathematical solutions to test problems. and Perform Subspace analysis for classification problems CO 4. Classify patterns using Bayesian Decision Theory. CO 5. Evaluate patterns using Parametric and Non-Parametric techniques. CO 6. Discuss trajectory of recent trend in pattern recognition & understand various real world applications.
7	Course Description	Pattern recognition theory and practice is concerned with the design, analysis, and development of methods for the classification or description of patterns, objects, signals, and processes. At the heart of this discipline is our ability infer the statistical behavior of data from limited data sets, and to assign data to classes based on generalized notions of distances in a probabilistic space.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and mathematical preliminaries**	
	A	Introduction to Pattern recognition; Applications areas in medical, defence, E-commerce, The Design Cycle.	CO1
	B	Clustering vs. Classification; Learning and Adaptation, Relevant basics of Linear Algebra.	CO1, CO2
	C	Vector spaces, Probability Theory, Estimation Theory.	CO1, CO2
	Unit 2	**Bayes Decision Theory**	

A	Data processing, Outliers, Correlation, Expectation, mean and covariance, classifiers	CO1, CO2, CO4
B	Normal Distribution, Bayesian Classification, The Nearest- Neighbor Rule	CO2, CO4, CO5
C	Introduction to Bayesian Decision Theory, Normal density and discriminant functions for the normal density	CO2, CO4
Unit 3	**Clustering**	
A	Basics of Clustering; similarity / dissimilarity measures; Criterion Functions for Clustering. Different distance functions and similarity measures, ,	CO1, CO2, CO3
B	Clustering Techniques: K-means algorithm, Agglomerative hierarchical clustering	CO1, CO2, CO3
C	K-medoids, DBSCAN, Cluster validation	CO1, CO2, CO3
Unit 4	**Feature extraction and Feature selection**	
A	Principal Component Analysis (PCA), Kernel PCA, Singular Value Decomposition, Fisher Linear discriminant analysis	CO2, CO3, CO5
B	Algorithms - Branch and bound algorithm, sequential forward / backward selection algorithms, Maximum-Likelihood estimation,	CO2, CO3, CO5
C	Probabilistic separability-based criterion functions, interclass distance-based criterion functions, K-Nearest Neighbor Estimation	CO2, CO3, CO5
Unit 5	**Recent Advances in Patterns Recognitions**	
A	Introduction to advanced pattern recognition schemes, Resources and tools used, Gaussian mixture models	CO2, CO3, CO6
B	Support Vector Machine, Neural Networks, Hidden Markov Models (HMM),	CO2, CO3, CO6
C	Basics to Biometrics: Biometric methodologies: finger prints, hand geometry, facial recognition, Iris scanning, retina scanning	CO2, CO3, CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	3. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, John Wiley, 2001. 4. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer publication, 2006	
Other References	3. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009. 4. Robert Schalkoff, "Pattern Recognition: Statistical, Structural and Neural Approaches", John Wiley & Sons, Inc.1992. 5. K.Jain, R.Bolle, S.Pankanti, "Biometric: Personal Identification	

in network society", Kluwer academic publishers, 1999.

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define Pattern concept and random process ideas, understand mathematical background.	
2.	Explain preliminary models to understand the solution environment.	
3.	Apply of existing mathematical solutions to test problems. and Perform Subspace analysis for classification problems	
4.	Classify patterns using Bayesian Decision Theory.	
5.	Evaluate patterns using Parametric and Non-Parametric techniques.	
6.	Discuss trajectory of recent trend in pattern recognition & understand various biometric technologies.	

PO and PSO mapping with level of strength for Course Name Pattern Recognition

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define Pattern concept and random process ideas, understand mathematical background.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	Explain preliminary models to understand the solution environment.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	Apply of existing mathematical solutions to test problems. and Perform Subspace analysis for classification problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	Classify patterns using Bayesian Decision Theory.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	Evaluate patterns using Parametric and Non-Parametric techniques.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	Discuss trajectory of recent trend in pattern recognition & understand various biometric technologies.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Pattern Recognition CSA- 302

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Pattern Recognition CSA- 302	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	2	3	1	1	3	3	1	3	3	3	3
	CO3	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
	CO4	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
	CO5	3	3	3	3	2	3	1	1	2	3	1	3	3	3	3
	CO6	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-302	Pattern Recognition	3.00	3.00	3.00	3.00	2.17	2.33	1.50	1.17	2.17	3.00	0.00	3.00	3.00	3.00	2.67

Total 36

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School:		**School of Engineering and Technology**	
Program:		**B. Tech**	
Branch:		**Department of Computer Science and Engineering**	
1	Course Code	CAL302	
2	Course Title	**Pattern Recognition Lab**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	CORE	
5	Course Objective	**Students will try to learn t**o introduce the ideas of existing patterns and implement them based on data analysis. Also, to conceptualize the working of patterns explorations using computational algorithms. In addition to it, students will aim to become familiar with feature knowledge that can be extracted from available examples and generalize to form appropriate feature models.	
6	Course Outcomes	On successful completion of this module students will be able to: CO 1. Define and Show naïve Bayesian Classifier for real world pro CO 2. Classify patterns using Bayesian Decision Theory. CO 3. Apply clustering techniques on read world problems CO 4. Classify Feature extraction and Feature selection techniques. CO 5. Evaluate patterns using Parametric and Non-Parametric techniques. CO 6. Discuss trajectory of recent trend in pattern recognition & understand various biometric technologies.	
7	Course Description	This course introduces neural computational paradigm for critical & implementable understanding of feature engineering.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and mathematical preliminaries**	
	1	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set	CO1
	2	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets	
	Unit 2	**Bayes Decision Theory**	
	3	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart	CO1, CO2, CO4

Disease Data Set from Repository.

Unit 3	**Clustering**	
4	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program	CO1, CO2, CO3
5	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set from Repository.	
Unit 4	**Feature extraction and Feature selection**	
5	Write a program to implement PCA example using scikit-learn on Iris Data-set	CO2, CO3, CO5
7	Write a program to implement Nearest Neighbors classification on Iris Data-set and plot the decision boundaries for each class.	
Unit 5	**Recent Advances in Patterns Recognitions**	
8	Write a program to perform binary classification using non-linear SVC with RBF kernel.	CO2, CO3, CO6
9	Write a program to implement SVM for classification on standard dataset	
10	Write a program to implement Neural network for classification on standard dataset	
Mode of examination	Theory	
Weightage Distribution	CA 30% / MTE 20% / ETE 50%	
Text book/s*	5. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, John Wiley, 2001. 6. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer publication, 2006	
Other References	6. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009. 7. Robert Schalkoff, "Pattern Recognition: Statistical, Structural and Neural Approaches", John Wiley & Sons, Inc.1992. 8. K.Jain, R.Bolle, S.Pankanti, "Biometric: Personal Identification in network society", Kluwer academic publishers, 1999.	
Web Link	https://scikit-learn.org/stable/auto_examples/	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define and Show naïve Bayesian Classifier for real world pro	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	Classify patterns using Bayesian Decision Theory.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	Apply clustering techniques on read world problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	Classify Feature extraction and Feature selection techniques.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	Evaluate patterns using Parametric and Non-Parametric techniques.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	Discuss trajectory of recent trend in pattern recognition & understand various biometric technologies.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Pattern Recognition CAL- 302

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Pattern Recognition CAL- 302	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	2	3	1	1	3	3	1	3	3	3	3
	CO3	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
	CO4	3	3	3	3	2	2	2	1	2	3	1	3	3	3	3
	CO5	3	3	3	3	2	3	1	1	2	3	1	3	3	3	3
	CO6	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3
CAL- 302	**Pattern Recognition**	3.00	3.00	3.00	3.00	2.17	2.33	1.50	1.17	2.17	3.00	0.00	3.00	3.00	3.00	2.67

Total 36

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**

3. Addressed to **Substantial (High=3) extent**

School: SET		Batch : 2019-2023
Program: B-TECH		Current Academic Year: 2019-20
Branch: CSE		Semester:
1	Course Code	CSA303
2	Course Title	**Deep Leaning and its Applications**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	CORE
5	Course Objective	This course aims to present the mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text and data. We will delve into selected topics of Deep Learning, discussing recent models from both supervised and unsupervised learning. Special emphasis will be on convolutional architectures, invariance learning, unsupervised learning and non-convex optimization.To understand and demonstrate how to solve general learning from a large series of data using computer based deep learning algorithms
6	Course Outcomes (CO's)	On successful completion of this module students will be able to: 1. Recall Neural Networks relate it with Deep Learning concepts to solve real life applications 2. Compare and classify Regularization approaches for Deep Learning. 3. Build Convolutional Neural Networks models for image analysis and its applicability in societal problem solving. 4. Examine the Sequence models and analyse the relationships among them. 5. Assess the different Deep learning models based on their design processes. 6. Predict the behaviour of Deep learning models and apply them to solve real life applications.
7	Course Description	This course starts with introduction to Deep Learning and further build, train, and deploy real world applications such as object recognition and Computer Vision, image and video processing, text analytics, Natural Language Processing, recommender systems, and other types of classifiers.

8	**Syllabus Outline**		**CO Mapping**
	Unit 1	**Deep Feed forward Networks**	
	A	Recall Neural networks, Deep learning and its Practical aspects for real life applications ,Introduction to Simple Deep Neural Networks, Platform for Deep Learning, Deep Learning Software Libraries	CO1, CO6

B	Introduction to Deep Feed Forward Networks ,Learning XOR, Gradient-Based Learning, Activation Functions, ReLU, Softmax, Sigmoid , Error Functions	CO1
C	Architecture Design- Hidden Units Back-Propagation and Other Differentiation Algorithms	CO1
Unit 2	**Regularization for Deep Learning**	
A	Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask Learning, Early Stopping, Parameter Tying and Parameter Sharing, Bagging , Drop Out, Difficulty of training deep neural networks, Greedy layer wise training, Adversarial Training	CO2
B	How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms: Stochastic Gradient Descent, Momentum, Nesterov Momentum Parameter Initialization Strategies Algorithms with Adaptive Learning Rates, AdaGrad. RMSProp. Adam	CO2
C	Introduction to Autoencoder, Undercomplete Autoencoder, Regularized Autoencoders, Representational Power, Layer Size and Depth. Stochastic Encoders and Decoders, Applications of Encoder Decoder models	CO2
Unit 3	**Convolutional Neural Networks**	
A	Why CNN?, Its role, significance and applicability in societal problem solving , The Convolution Operation, Motivation, Pooling, The Neuroscientific Basis for Convolutional Networks	CO1, CO3, CO6
B	Prior probability distribution, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data types with different dimensionalities and number of channel	CO1, CO3
C	Efficient Convolution Algorithms, Random or Unsupervised Features of CNN , Normalization, Applications of CNN in Computer Vision – ImageNet	CO1, CO3, CO6
Unit 4	**Sequence Modeling: Recurrent Neural Networks**	
A	Sequence Learning Problems , Recurrent Neural Network and its significance in real world, RNN model, Backpropagation through time ,Bidirectional RNNs	CO4, CO6
B	Different types of RNNs, Gated Recurrent Unit (GRU) Recursive Neural Networks , The Challenge of Long-Term Dependencies	CO4
C	Introduction of Long Short Term Memory Neural Networks, Learning Algorithm of LSTM/ RNN Bidirectional LSTMs	CO4
Unit 5	**Deep Networks and design process**	

A	Introduction to Generative Adversarial Networks , Generative Adversarial Networks – Architecture,	CO5,CO6
B	DCGAN, GAN hack, Applications of Generative Adversarial Networks	CO5,CO6
C	Practical design process for deep learning techniques based on real world problems: Performance Metrics , Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies	CO5,CO6

Mode of examination	Theory		
Weightage Distribution	**CA**	**MTE**	**ETE**
	30%	20%	50%

Text Books

1. **Deep Learning, by Goodfellow I., Bengio Y. & Courville A. (2016)**
2. **Visualizing and Understanding Convolutional Networks, by Matt Zeiler, Rob Fergus**
3. **TensorFlow: a system for large-scale machine learning, by Martín A., Paul B., Jianmin C., Zhifeng C., Andy D. et al. (2019)**

Reference Books

1. Deep learning in neural networks, **by JuergenSchmidhuber (2015)**
2. https://cs230.stanford.edu/syllabus/
3. https://towardsdatascience.com/september-edition-machine-learning-case-studies-a3a61dc94f23
4. **Deep Learning: A Practitioner's Approach by Josh Patterson, Oreilly.**

Online Materials

CO and PO Mapping

S. No.	Course Outcome (CO)	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Recall Neural Networks relate it with Deep Learning concepts to solve real life applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2	Compare and classify Regularization approaches for Deep Learning.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3	Build Convolutional Neural Networks models for image analysis and its applicability in societal problem solving.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4	Examine the Sequence models and analyse the relationships among them.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5	Assess the different Deep learning models based on their design processes.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6	Predict the behaviour of Deep learning models and apply them to solve real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name: Introduction to Deep Leaning

(Course Code- CSA302)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3

Deep Leaning and its Applications (Course Code-CSA303)	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA 303	**Deep Leaning and its Applications**	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67

Total 40.3

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET | **Batch : 2019-2023**
Program: B-TECH | **Current Academic Year: 2019-20**
Branch: CSE | **Semester:**

1	**Course Code**	CAL303
2	**Course Title**	**Deep Leaning and its Applications Lab**
3	**Credits**	1
4	**Contact Hours (L-T-P)**	0-0-2
	Course Status	CORE
5	**Course Objective**	This course aims to present the mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text and data. We will delve into selected topics of Deep Learning, discussing recent models from both supervised and unsupervised learning. Special emphasis will be on convolutional architectures, invariance learning, unsupervised learning and non-convex optimization. To understand and demonstrate how to solve general learning from a large series of data using computer based deep learning algorithms
6	**Course Outcomes (CO's)**	On successful completion of this module students will be able to: 1. Define and show the implementation of Deep Learning concepts to solve real life applications 2. Compare and classify Regularization approaches for Deep Learning. 3. Build Convolutional Neural Networks models for image analysis and its applicability in societal problem solving. 4. Examine the Sequence models and analyse the relationships among them. 5. Assess the different Deep learning models based on their design processes. 6. Predict the behaviour of Deep learning models and apply them to solve real life applications.
7	**Course Description**	This course starts with introduction to Deep Learning and further build, train, and deploy real world applications such as object recognition and Computer Vision, image and video processing, text analytics, Natural Language Processing, recommender systems, and other types of classifiers.

8	Outline syllabus		CO Mapping
	Unit 1	**Deep Feed Forward Networks**	
	1	Write a program to implement Deep Feed Forward Network to predict Housing price available on Kaggle.	**CO1**
	2	Write a program to implement classification using Deep Feed Forward Network on dataset available on Kaggle.	**CO1**

	Unit 2	**Regularization for Deep Learning**		
	3	Write a program to implement regularization to overcome over fitting problem in Housing price Prediction		CO2
	Unit 3	**Convolutional Neural Networks**		
	4	**Digit Recognition from** MNIST : Given a zip codes hand written on envelops, identify the digit for each hand written character. A model of this problem would allow a computer program to read and understand handwritten zip codes and sort envelops by geographic region.		CO1, CO3, , CO6
	5	Dog-Breed Classifier :Design and train a convolutional neural network to analyze images of dogs and correctly identify their breeds. Use transfer learning and well-known architectures to improve this model—this is excellent preparation for more advanced applications.		CO1, CO3
	Unit 4	**Sequence Modelling: Recurrent Neural Networks**		
	6	**Stock market prediction on** NASDAQ stocks: Given the current and past price movements for a stock, determine whether the stock should be bought, held or sold. A model of this decision problem could provide decision support to financial analysts.		CO4, CO6
	7	The Slot-Filling (Spoken Language Understanding) consists in assigning a label to each word given a sentence. It's a classification task.		CO4
	8	Write a program to implement credit card fraud detection prediction		CO4
	Unit 5	**Deep Networks and design process**		
	9	Implement Convolutional Autoencoders in Python with Keras on MNIST dataset		CO5,CO6
	10	Write a program to implement Generative Adversarial Network		CO5,CO6
	Mode of examination	Practical		
	Weightage Distribution	CA 60%	MTE 0%	ETE 40%
	Text book/s*	1. Lipschutz, "Data Structures" Schaum's Outline Series, TMH		
	Other References	1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI 2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication 3. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill		

		4. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education 5. G A V Pai, “Data Structures and Algorithms”, TMH	
	Weblink	**https://towardsdatascience.com/getting-rich-quick-with-machine-learning-and-stock-market-predictions-696802da94fe** **https://www.datacamp.com/community/tutorials/autoencoder-keras-tutorial** http://deeplearning.net/tutorial/rnnslu.html	

CO and PO Mapping

S. No.	Course Outcome (CO)	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Define and show the implementation of Deep Learning concepts to solve real life applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2	Compare and classify Regularization approaches for Deep Learning.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3	Build Convolutional Neural Networks models for image analysis and its applicability in societal problem solving.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4	Examine the Sequence models and analyse the relationships among them.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5	Assess the different Deep learning models based on their design processes.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6	Predict the behaviour of Deep learning models and apply them to solve real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name: Introduction to Deep Leaning

(Course Code- CAL303)

Course Code_ Course Name	CO’s	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
Deep Leaning and its Applications Lab **(Course Code- CAL303)**	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CAL 303	**Deep Leaning and its Applications Lab**	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67

Total 40.3

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School SET		**Batch 2019-2023**	
Program B-TECH		**Academic Year 2019-20**	
Branch CSE		**Semester VI**	
1	Course Code	**CSA041**	Course Name **Natural Language Processing**
2	Course Title	**Natural Language Processing**	
3	Credits	3	
4	Contact Hours (L-T-P)	**3-0-0**	
	Course Status	**Specialization Elective**	
5	Course Objective	**Students will try to learn** 1. Basics of natural language processing. 2. How to apply basic algorithms in natural language processing. 3. Algorithmic description of the main language levels morphology, syntax, semantics, and pragmatics. 4. Basics of knowledge representation, inference, and relations to the artificial intelligence. 5. Techniques such as tokenization, stemming, and lemmatization.	
6	Course Outcomes	Students will be able to CO-13. **Define** Computational Linguistics phenomena and making decisions using it. CO-14. **Explain** how to access Text Corpora and Lexical Resources. CO-15. **Apply** processing of raw text using NLP programming concepts. CO-16. **Analyze** tagging of words and Extracting Information from Text. CO-17. **Discuss** analysis of sentences using CFG and Propositional Logic. CO-18. **Design** NLP based applications for different business environment.	
7	Course Description	This course provides an introduction to the field of computational linguistics, aka natural language processing (NLP). We will learn how to create systems that can understand and produce language, for applications such as information extraction, machine translation, automatic summarization, question-answering, and interactive dialogue systems. The course will cover linguistic (knowledge-based) and statistical approaches to language processing in the three major subfields of NLP: syntax (language structures), semantics (language meaning), and pragmatics/discourse (the interpretation of language in context).	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction and Computational Linguistics**	

	A	What is Natural Language Processing, hands-on demonstrations. Ambiguity and uncertainty in language. The Turing test	CO1
	B	Computing with Language Texts and Words Implementation of NLTK, Searching Text, Counting Vocabulary, A Closer Look at Python Texts as Lists of Words, Computing with Language Simple Statistics, Frequency Distributions, Fine-grained Selection of Words, Collocations and Bigrams,	CO1
	C	Making Decisions and Taking Control, Conditionals, Operating on Every Element, Nested Code Blocks, Looping with Conditions	CO1
	Unit 2	**Accessing Text Corpora and Lexical Resources**	
	A	Automatic Natural Language Understanding, Word Sense Disambiguation, Pronoun Resolution, Generating Language Output, Machine Translation, Spoken Dialog Systems, Textual Entailment, Limitations of NLP	CO2
	B	Accessing Text Corpora, Gutenberg Corpus, Web and Chat Text, Brown Corpus, Reuters Corpus, Inaugural Address Corpus, Annotated Text Corpora, Corpora in Other Languages	CO2
	C	Text Corpus Structure, Loading your own Corpus, Conditional Frequency Distributions, Conditions and Events, Counting Words by Genre, Plotting and Tabulating Distributions, Generating Random Text with Bigrams,	CO2
	Unit 3	**Processing Raw Text**	
	A	Lexical Resources,, Wordlist Corpora, A Pronouncing Dictionary, Comparative Wordlists, Shoebox and Toolbox Lexicons, WordNet, Senses and Synonyms, The WordNet Hierarchy, Lexical Relations, Semantic Similarity	CO3
	B	Accessing Text from the Web and from Disk, Strings Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation,Formatting From Lists to Strings	CO3
	C	NLP Programming Sequences, Style, Functions for text processing, Program Development & Algorithm Design using, Python Libraries	CO3
	Unit 4	**Tagging & Information Extraction**	
	A	Categorizing and Tagging Words Using a Tagger,Tagged Corpora,Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging,Transformation-Based Tagging, Determine the Category of a Word	CO4
	B	Text classification Supervised Classification, Examples of Supervised Classification,Evaluation,Decision Trees,Naive Bayes Classifiers,Maximum Entropy Classifiers,Modeling Linguistic Patterns	CO4
	C	Extracting Information from Text Information Extraction,Chunking,Developing and Evaluating Chunkers,Recursion in Linguistic Structure,Named Entity Recognition,Relation Extraction	CO4

	Unit 5	**Analysis of sentences**			
	A	Analyzing Sentence Structure Grammatical Dilemmas,What's the Use of Syntax?,Context-Free Grammar,Parsing with Context-Free Grammar,Dependencies and Dependency Grammar,Grammar Development			CO5
	B	Analyzing the Meaning of Sentences Natural Language Understanding,Propositional Logic,First-Order Logic,The Semantics of English Sentences,Discourse Semantics			CO5
	C	Managing Linguistic DataCorpus Structure,The Life Cycle of a Corpus,Acquiring Data,Working with XML,Working with Toolbox Data,Describing Language Resources Using OLAC Metadata			CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Speech and Language processing An introduction to Natural Language Processing, Computational Linguistics and speech Recognition by Daniel Jurafsky and James H. Martin (ISBN13: 978-0131873216) 2. Ruslan Mitkov, The Oxford Handbook of Computational Linguistics, Oxford University Press, 2005			
	Other References	1. Charu C. Aggarwal and Cheng Xiang Zhai, Mining Text Data, Springer, 2012 2. Hopcroft, J.E. and Ullman, J.D., Introduction to Automata, Theory and Languages, Addison-Wesley, 1979			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** Computational Linguistics phenomena and making decisions using it.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**Explain** how to access Text Corpora and Lexical Resources.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**Apply** processing of raw text using NLP programming concepts.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**Analyze** tagging of words and Extracting Information from Text.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**Discuss** analysis of sentences using CFG and Propositional Logic.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**Design** NLP based applications for different business environment.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8,

		PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Natural Language Processing **(Course Code CSA041)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1	1	1	1	3	1	3	2	3	1
CO2	3	3	3	3	3	1	1	1	1	3	1	3	3	3	2
CO3	3	3	3	3	3	2	1	1	1	3	1	3	3	3	1
CO4	3	3	3	3	3	1	2	1	1	3	1	3	3	3	3
CO5	3	3	3	3	3	2	2	1	2	3	1	3	3	3	3
CO6	3	3	3	3	3	3	3	1	3	3	2	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA 041	Natural Language Processing	3.00	3.00	3.00	3.00	3.00	1.67	1.67	1.00	1.50	3.00	0.00	3.00	2.83	3.00	2.17

Total- 34.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET		**Batch : 2019-2023**	
Program: B-TECH		**Current Academic Year: 2019-20**	
Branch: CSE		**Semester:**	
1	**Course Code**	**CSA402**	
2	**Course Title**	**Applications of AIML in healthcare/ ICT/ Computer Networks**	
3	**Credits**	**3**	
4	**Contact Hours (L-T-P)**	3-0-0	
	Course Status	CORE	
5	**Course Objective**	1. Applications of AI & ML in in healthcare/ICT and Computer Network. 2. To find the automated solutions of real life problems.	
6	**Course Outcomes (CO's)**	On successful completion of this module students will be able to: 1. Demonstrate a good understanding of key concepts and terminology in healthcare/ICT and Computer Network. 2. Illustrate and describe major characteristics and potential applications of various Microcontroller System and Sensors Systems 3. Examine and analyse Signal Processing and data Acquisition Techniques 4. Discuss Actuators and Its Mechanisms 5. Analyse key data challenges in healthcare/ Network and ICT and develop data science proposals with clear objectives towards overcoming these challenges 6. Discuss current AI trends and predict future trends in Real world applications	
7	**Course Description**	This course provides students with a working knowledge of methods for design and analysis of AI& ML based applications in the field of healthcare/ICT and Computer Network.	
8	**Syllabus Outline**		**CO Mapping**
	Unit 1	**Introduction**	
	A	Brief history of AI and ML in healthcare (Examples of existing/earlier developed healthcare systems like-MYCIN), Data:-Electronic health records (EHR), Types of health care Data, diversity of digital health data, data standardization,	CO1, CO6
	B	Role of AI and ML in Computer Networks (Vulnerability assessment, forensic analysis, Network traffic analysis AI and ML techniques	CO1

		for Vulnerability assessment)	
	C	Introduction to recent information and Communication Technologies , Case study/ use cases on AI ML based ICT applications	CO1
	Unit 2	**Microcontroller System and Sensors Systems**	
		Introduction to Advance System of Chip Computers , Different types of SOC and their applications, Case study/ use cases on SOC based Real life applications	CO2
		Sensors and transducers, Displacement, position and proximity sensors, Velocity and motion sensors, Force sensors, Fluid pressure sensors and transducers	CO2
		Liquid flow & level sensors, Temperature sensors and transducers, Light sensors, Case studies for Selection of sensors in real world Applications	CO2, CO6
	Unit 3	**Signal Processing and Data Acquisition Sensors**	
	A	Signal conditioning, Operational amplifier, Protection , Filtering, Wheatstone bridge,	CO3
	B	Digital signals, Multiplexers, Data acquisition, Basics of Digital signal processing,	CO3
	C	Pulse modulation, Displays, Testing and calibration, Case studies for use of Data acquisition in real world Applications	CO3, CO6
	Unit 4	**Actuators and Its Mechanisms**	
	A	Actuation systems, Pneumatic and hydraulic systems,	CO4, CO6
	B	Directional control valves, Pressure control valves, Process control values, Rotary actuators, Mechanical systems, Types of motion, Cams, Gear trains, Belt and chain drives, Bearings	CO4
	C	Electrical systems, Mechanical switches, Solid state switches, Solenoids, AC & DC Motors, Steppers Motors	CO4, CO6
	Unit 5	SOC and AIML use cases in Health Care/ Networks/ ICT	
	A	Use case SOC and AIML Patient care: Assisted or automated diagnosis & prescription, Real-time prioritization and triage, Personalized medications and care, Medical Imaging and Diagnostic: Early diagnosis, Medical imaging insight	CO1, CO5, CO6
	B	Use case SOC and AIML: Network Traffic prediction and classification, Network Protection	CO1, CO5, CO6
	C	Use case SOC and AIML: Education System,	CO1, CO5,

		Agriculture, Customer support , Telecommunications			CO6
	Mode of examination	Theory			
	Weightage Distribution	**CA**	**MTE**	**ETE**	
		30%	20%	50%	
	Text Books	• Guide to Vulnerability Analysis for Computer Networks and Systems: An Artificial Intelligence Approach edited by Simon Parkinson, Andrew Crampton, Richard Hill • W.Bolton, "Mechatronics (Electronic Control Systems in Mechanical and Electrical Engineering), Third Edition, Pearson Education, • David G "Introduction to Mechatronics and Measurements Systems", Tata MeGraw Hill			
	Reference Books				
	Online Materials	https://www.engineersgarage.com/article_page/sensors-different-types-of-sensors/ https://www.raspberrypi.org/magpi-issues/Beginners_Guide_v1.pdf			

CO and PO Mapping

S. No.	Course Outcome (CO)	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Demonstrate a good understanding of key concepts and terminology in healthcare/ICT and Computer Network.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2	Illustrate and describe major characteristics and potential applications of various Microcontroller System and Sensors Systems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3	Examine and analyse Signal Processing and data Acquisition Techniques	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4	Discuss Actuators and Its Mechanisms	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5	Analyse key data challenges in healthcare/ Network and ICT and develop data science proposals with clear objectives towards overcoming these challenges	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6	Discuss current AI trends and predict future trends in Real world applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Applications of AIML in healthcare/ ICT/ Computer Networks (Course Code CSA402)

Course Objectives	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	1	2	3	1	3	1	3	3	3	1
CO2	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	2	2	3	2	3	3	3	3	3	3
CO4	3	3	3	3	3	2	2	3	2	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA402	Applications of AIML in healthcare/ ICT/ Computer Networks	3.00	3.00	3.00	3.00	3.00	1.83	2.00	3.00	2.33	3.00	0.00	3.00	3.00	3.00	2.67

Total- 33.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET		**Batch : 2019-2023**		
Program: B.Tech		**Current Academic Year: 2019-20**		
Branch: ALL		**Semester: VII**		
1	**Course Code**	**CSA401**	**Course Name: Computer Vision**	
2	**Course Title**	**Computer Vision**		
3	**Credits**	**3**		
4	**Contact Hours (L-T-P)**	**3-0-0**		
	Course Status	**Program Elective**		
5	Course Objective	6. To implement fundamental image processing techniques required for computer vision 7. To develop applications using computer vision techniques		
6	Course Outcomes	Students will be able to have thorough Understanding of: CO-1 Define the Fundamentals of Computer Vision and Computer Graphics and relate them with real world applications CO-2 Explain Image formation models and Foundations for Mathematical basis for various Projection Systems CO- 3 Apply Image processing techniques such as Segmentation and Edge Detection for real time and real world applications. CO- 4 Analyze various feature extraction techniques for different problem domain. CO-5 Evaluate Pattern Recognition Using Clustering, Classification, Supervised Learning and Unsupervised Learning Techniques CO-6 Build computer vision applications for real world Applications.		
7	Course Description	In this course students will learn basic principles of image formation, image processing algorithms, extracting the features and then analyzing the underlying patterns.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction to Computer Vision**		
	A	Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level		CO1
	B	Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis		CO1
	C	Face detection, Face recognition, Eigen faces, Active appearance and 3D shape models of faces, Surveillance, foreground-background separation, vehicle vision system: locating roadway, road markings, identifying road signs, locating pedestrians		CO1
	Unit 2	**Image Formation Models**		
	A	Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, Brightness, color etc,		CO2
	B	Orthographic & Perspective Projection ,Camera model and		CO2

		Camera calibration, Binocular imaging systems			
	C	Multiple views geometry, Structure determination, shape from shading, Weak perspective projection and orthographic projection, Concept of image coordinate system and camera coordinate system;			CO2
	Unit 3	**Image Processing**			
	A	Image preprocessing: The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Discrete Cosine Transform (DCT)			CO3, CO6
	B	Wavelet Transforms in One Dimension-The Discrete Wavelet Transform (DWT) and The Continuous Wavelet Transform. Wavelet Decomposition,			CO3, CO6
	C	Orthogonal, Euclidean, Affine, Projective, etc; Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.			CO3, CO6
	Unit 4	**Image Processing Operations**			
	A	Image Filtering (spatial domain), Mask-based (e.g., correlation, convolution), Smoothing (e.g., Gaussian), Sharpening (e.g., gradient)			CO4
	B	Segmentation : Edge-based (e.g., voting, optimization, perceptual grouping), Pixel-based (e.g., clustering)			CO4
	C	Colour fundamentals, Colour models, Colour transformation, Smoothing and Sharpening, Colour segmentation			CO4
	Unit 5	**Feature Extraction**			
	A	Edge detection: Canny, Laplacian of Gaussian; Line detectors (Hough Transform)			CO5, CO6
	B	Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH			CO5, CO6
	C	Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Digital Image Processing and Computer Vision"Cengage Learning, 1st Edition, 2008 2. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.			
	Reference Books	1, Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall. 2. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992. 3. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1 Define the Fundamentals of Computer Vision and Computer Graphics and relate them with real world applications	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2 Explain Image formation models and Foundations for Mathematical basis for various Projection Systems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO- 3 Apply Image processing techniques such as Segmentation and Edge Detection for real time and real world applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO- 4 Analyze various feature extraction techniques for different problem domain.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5 Evaluate Pattern Recognition Using Clustering, Classification, Supervised Learning and Unsupervised Learning Techniques	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6 Build computer vision applications for real world applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Computer Vision **(Course Code** CSA-401**)**

Subject	PO's / PSO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Computer Vision CSA-401	CO1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
	CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
	CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
	CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-401	Computer Vision	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00

Total- 32.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET		**Batch : 2019-2023**		
Program: B.Tech		**Current Academic Year: 2019-20**		
Branch: ALL		**Semester: VII**		
1	**Course Code**	**CAL401**	**Course Name: Computer Vision Lab**	
2	**Course Title**	**Computer Vision Lab**		
3	**Credits**	**1**		
4	**Contact Hours (L-T-P)**	**0-0-2**		
	Course Status	**Core**		
5	Course Objective	To implement fundamental image processing techniques required for computer vision To develop applications using computer vision techniques		
6	Course Outcomes	Students will be able to have thorough Understanding of: CO-1 Define and show the Fundamentals of Computer Vision techniques on images CO-2 Show the Image filtering and opening / closing operations on Color images CO- 3 Apply Image transformation techniques such as for real time and real world applications. CO- 4 Analyze various feature extraction techniques for different Problem domains. CO-5 Evaluate Pattern Recognition Using Clustering, Classification Techniques CO-6 Build computer vision applications for real world Problems.		
7	Course Description	In this course students will learn basic principles of image formation, image processing algorithms, extracting the features and then analyzing the underlying patterns.		

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Computer Vision**	
	1	To create a program to display grayscale image using read and write operation.	CO1
	2	To create a vision program to find histogram value and display histograph of a grayscale and color image.	CO1
		Write a program for color image processing	
	Unit 2	**Image Formation Models**	
	3	To Implement smoothing or averaging filter in spatial domain	CO2
	4	Program for opening and closing of the image.	CO2
	5	To fill the region of interest for the image	CO2
	Unit 3	**Image Processing**	
	6	To create a vision program for Non-Linear Filtering technique using edge detection	CO3, CO6
	7	To create a program to discretize an image using Fourier transformation.	CO3, CO6
	8	To create a vision program to determine the edge detection of an image using different operators.	CO3, CO6

	Unit 4	**Feature Extraction**			
	9	Program of sharpen image using gradient mask.			CO4
	10	Program for morphological operation: erosion and dilation.			CO4
	11	Write a program for image segmentation using local and global thresholding			CO4
	Unit 5	**Pattern Analysis**			
	12	Write a program to implement image classification.			CO5, CO6
	13	Write a program to implement image clustering.			CO5, CO6
	Mode of examination	Lab			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Digital Image Processing and Computer Vision"Cengage Learning, 1st Edition, 2008 2. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.			
	Reference Books	1, Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall. 2. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992. 3. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1 Define and show the Fundamentals of Computer Vision techniques on images	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2 Show the Image filtering and opening / closing operations on Color images	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO- 3 Apply Image transformation techniques such as for real time and real world applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO- 4 Analyze various feature extraction techniques for different Problem domains.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5 Evaluate Pattern Recognition Using Clustering, Classification Techniques	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6 Build computer vision applications for real world Problems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Computer Vision **(Course Code** CSA-301**)**

Subject	PO's / PSO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Computer Vision CAL-401	CO1	3	3	3	3	1	1	1	1	1	2	1	3	2	3	1
	CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
	CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
	CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO6	3	3	3	3	2	3	3	1	3	2	1	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CAL-401	**Computer Vision**	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00

Total- 32.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET **Batch : 2019-2023**
Program:B.Tech **Current Academic Year:**
Branch:IT **Semester: IV**

1	Course Code	CSA021 Course Name	
2	Course Title	Human Computer Interaction	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Specialization Elective	
5	Course Objective	5. Understand fundamental design and evaluation methodologies of human computer interaction. 6. Demonstrate knowledge of human computer interaction design concepts and related methodologies. 7. Apply theories and concepts associated with effective work design to real-world application.	
6	Course Outcomes	CO1: Define the capabilities of both humans and computers from the viewpoint of human information processing. CO2: Explain typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms. CO3: Apply HCI design principles, standards and guidelines. CO4: Analyse and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems. CO5:Analyse the tasks of HCI systems. CO6:Adopt a variety of simple methods for evaluating the quality of a user interface.	
7	Course Description	Students will learn the fundamental concepts of human-computer interaction and user centred design thinking, through working in teams on an interaction design project, supported by lectures, readings, and discussions. They will learn to evaluate and design usable and appropriate software based on psychological, social, and technical analysis. They will become familiar with the variety of design and evaluation methods used in interaction design.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Why Human–Computer Interaction?, What is Hci?, Who is Involved in Hci?,Models of Interaction Theory And Hci, Human Introduction, Input–Output Channels(Vision, Hearing, Touch, Movement), Human Memory(Sensory Memory,Long-Term Memory,), Psychology And The Design Of Interactive Systems,	CO1
	B	Input Devices For Interactive Use, Allowing Text Entry, Drawing And Selection From The Screen:–(Text Entry, Pointing, 3d Interaction Devices), Output Display Devices For Interactive Use, Virtual Reality Systems And 3d Visualization, Various Devices In The Physical World, Paper Output And Input, Memory(Short-Term Memory, Long-Term Memory, Access Methods), Processing(Effects, Limitations, Networks And Impact On System Performance)	CO1
	C	The Interaction:Introduction, Models Of Interaction (Execution–Evaluation Cycle, Interaction Framework), Frameworks And Hci, Ergonomics, Interaction Styles, Elements Of The Wimp Interface, Interactivity, Context Of The Interaction,Experience, Engagement And Fun	CO1

Unit 2	**Design Process**	
A	Interaction Design Basics: Introduction, The Process of Design, User Focus, Scenarios, Navigation Design (Local Structure, Global Structure), Screen Design And Layout (Tools For Layout, User Action And Control, Appropriate Appearance), Iteration And Prototyping	CO2
B	HCI in The Software Process: Introduction, The Software Life Cycle (Activities, Validation and Verification, Management and Contractual Issues, Interactive Systems for Software Lifecycle), Usability Engineering, Iterative Design and Prototyping, Techniques For Prototyping, Design Rationale (Process-Oriented Design Rationale, Design Space Analysis, Psychological Design Rationale)	CO2
C	Design Rules: Introduction, Principles to Support Usability (Learnability, Flexibility, Robustness), Standards, Guidelines, Golden Rules and Heuristics (Shneiderman's Eight Golden Rules 0f Interface Design, Norman's Seven Principles for Transforming Difficult Tasks into Simple Ones), HCI Patterns	CO2
Unit 3	Implementation Support	
A	Introduction of Implementation Support, Elements of Windowing Systems: Examples of Imaging Models, Architectures of Windowing Systems, Programming The Application, Using Toolkits, Usability Principles, User Interface Management Systems: UIMS As A Conceptual Architecture, Implementation Considerations)	CO3
B	Evaluation Techniques, what is Evaluation? Goals of Evaluation, Evaluation Through Expert Analysis: Cognitive Walkthrough, Heuristic Evaluation, Model-Based Evaluation, Evaluation Through User Participation, Empirical Methods: Experimental Evaluation, Observational Techniques, Query Techniques, Evaluation Through Monitoring Physiological Responses, Choosing an Evaluation Method, A Classification Of Evaluation Techniques	CO3
C	Universal Design: Introduction, Universal Design Principles, Multi-Modal Interaction, Sound in The Interface, Touch In The Interface, Handwriting Recognition, Gesture Recognition, Designing For Diversity: Designing For Users With Disabilities, Designing For Different Age Groups, Designing For Cultural Differences	CO3
Unit 4	**Models and Theories**	
A	Cognitive Models: Introduction, Goal And Task Hierarchies(GOMS, Cognitive Complexity Theory, Problems And Extensions Of Goal Hierarchies), Linguistic Models(BNF, Task–Action Grammar), Challenge Of Display-Based Systems, Physical And Device Models(Keystroke-Level Model, Three-State Model), Cognitive Architectures(The Problem Space Model, Interacting Cognitive Subsystems)	CO4
B	Socio-Organizational Issues And Stakeholder Requirements: Introduction, Organizational Issues: Cooperation or Conflict? Invisible Worker, Automating Processes – Workflow and BPR, Capturing Requirements (Stakeholders, Socio-Technical Models, Soft Systems Methodology, Participatory Design, Ethnographic Methods)	CO4

C	Communication And Collaboration Models: Introduction, Face-To-Face Communication(Transfer Effects and Personal Space, Eye Contact and Gaze, Gestures and Body Language, Back Channels, Confirmation and Interruption, Turn-Taking), Conversation, Speech Act Theory, Text-Based Communication(Back Channels and Affective State, Grounding Constraints, Turn-Taking, Context And Deixis, Pace And Granularity, Linear Text Vs. Hypertext), Group Working.	CO4
Unit 5	**Task Analysis**	
A	Introduction of Task, Differences Between Task Analysis and Other Techniques, Task Decomposition, Knowledge-Based Analysis, Entity–Relationship-Based Techniques, Sources of Information and Data Collection (Documentation, Observation, Interviews, Initial Analysis, Sorting and Classification), Uses Of Task Analysis	CO5
B	Dialog Notations and Design Introduction, Dialog: Structured Human Dialogs, Dialog Design Notations, Diagrammatic Notations (State Transition Networks, Hierarchical State Transition Nets, Concurrent Dialogs and Combinatorial Explosion of States, Escapes, Petri Nets, State Charts, Flow Charts, JSD Diagrams), Textual Dialog Notations, Dialog Semantics, Dialog Analysis and Design	CO5, CO6
C	Standard Formalisms, Formal Notations, Model-Oriented Notations and Issues, Algebraic Notations, Temporal Logics, Interaction Models (Pie Model, Predictability, Observability, Reachability), Continuous Behavior, Modeling Rich Interaction, Status–Event Analysis, Rich Contexts (Collaboration, Information, Triggers, Artifacts, Placeholders), Low Intention and Sensor-Based Interaction	CO5, CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	7. Alan dix, janet finlay, gregory d. Abowd, russell beale, "human–computer interaction" third edition, pearson education limited	
Other References	1. Rajiendra Kumar, " Human Computer Interaction" Second Edition, Firewall Media New Delhi. 2. Ben Shneiderman, "Design the User Interface: Strategies for Effective Human-Computer Interaction" Pearson Education.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the capabilities of both humans and computers from the viewpoint of human information processing.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	CO2: Explain typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

3.	CO3: Apply HCI design principles, standards and guidelines.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO4: Analyse and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5	CO5:Analyse the tasks of HCI systems.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6	CO6:Adopt a variety of simple methods for evaluating the quality of a user interface.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Human Computer Interaction **(Course Code** CSA-021**)**

Subject	PO's / PSO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Human Computer Interaction **(Course Code** CSA-021**)**	CO1	3	3	2	2	1	1	1	1	1	2	1	3	2	2	1
	CO2	3	3	3	3	2	1	1	1	1	2	1	3	2	3	2
	CO3	3	3	3	3	2	1	1	1	1	2	1	3	3	3	2
	CO4	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO5	3	3	3	3	2	2	1	1	1	2	1	3	3	3	2
	CO6	3	3	3	3	2	1	1	1	1	2	1	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA -021	Human Computer Interaction	3.00	3.00	2.83	2.83	1.83	1.33	1.00	1.00	1.00	2.00	0.00	3.00	2.67	2.83	2.00

Total- 30.33

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**

3. Addressed to **Substantial (High=3) extent**

School: SET	**Batch : 2019-2023**	
Program: B-TECH	**Current Academic Year: 2019-20**	
Branch: CSE	**Semester: V**	
1	**Course Code**	**CSA-022** **Course Name: Introduction to Cloud Computing with ML**
2	**Course Title**	**Introduction to Cloud Computing with ML**
3	**Credits**	**3**
4	**Contact Hours (L-T-P)**	**3-0-0**
	Course Status	Specialization Elective
5	**Course Objective**	This introductory course on Cloud computing will teach both the fundamental concepts of how and why Cloud systems works, as well as Cloud technologies that manifest these concepts.
6	**Course Outcomes (CO's)**	At the end of the course, students will have achieved the following learning objectives. CO1. Define the basics of cloud and recall the computer Science concepts which are helpful in understanding on demand service architecture. CO2. Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing. CO3. Apply the PAAS and SAAS to manage the workflow and use of cloud in scientific application. CO4. Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing. Examine the design of task and data parallel distributed algorithms for Clouds and use them to construct Cloud applications. CO5. Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances. CO6. Elaborate the design concept and formulate to build the solution using cloud service providers as AWS as EC2, LAMBDA, S3 and Machine Learning Service as AWS SageMaker.
7	**Course Description**	This course is an introductory course for cloud computing concepts and helps in understanding the core functionalities, algorithms, models and workflows in cloud environment. In this course Students will get demonstrations of real-time cloud services for better exposure and research understanding.

8 **Syllabus Outline**

		CO Mapping
Unit 1	**FOUNDATIONS**	
A	**Introduction to compute** Types of Computing, Grid computing, distributed computing, Client-server computing, Three Tier Architecture, use of Sockets and Remote Procedure Call, working of RMI and CORBA, Web services, Web Sockets, Message Queues and Message Brokers.	CO1
B	**Introduction to Cloud Computing** Cloud Computing definition, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks	CO1
C	**Migrating and Integrating into Cloud** Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Enriching the 'Integration as a Service' Paradigm for the Cloud Era, Evolution and Challenges of SaaS Paradigm, Integration Scenarios, The Integration	CO1

	Methodologies	
Unit 2	**ENTERPRISE CLOUD COMPUTING AND IAAS**	
A	**The Enterprise Cloud Computing Paradigm** Issues for Enterprise Applications on the Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers Toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain	CO1,CO2
B	**Virtual Machines Provisioning and Migration Services** Introduction to Virtual Machines,The Anatomy of Cloud Infrastructures, VM Provisioning and Manageability, Virtual Machine Migration Services, Management of Virtual Machines for Cloud Infrastructures,, Distributed Management of Virtual Infrastructures, Scheduling Techniques	CO1,CO2
C	**Enhancing Cloud Computing Environments Using a Cluster as a Service** Introduction and Related Work, RVWS Design, Cluster as a Service: The Logical Design, Secure Distributed Data Storage in Cloud Computing, Cloud Storage, Technologies for Data Security in Cloud Computing	CO1,CO2
Unit 3	**PLATFORM AND SOFTWARE AS A SERVICE**	
A	**Aneka and CometCloud** Aneka—Integration of Private and Public Clouds, Technologies and Tools for Cloud Computing, Aneka Cloud Platform, CometCloud: An Autonomic Cloud Engine, Introduction of CometCloud (Architecture, Autonomic Behavior, Applications overview)	CO1,CO3
B	**Business Solutions and WorkFlow** Cloud-Based Solutions for Business Applications (Introduction of Enterprises Demand and Cloud Computing, Dynamic ICT Services), Workflow Engine for Clouds, Workflow Management Systems, Architecture of Workflow Management Systems	CO1,CO3,CO6
C	**Scientific Applications and MapReduce Model** Scientific Application for Cloud Environments, Classification of Scientific Applications and Services in the Cloud, SAGA-based Scientific Applications, MapReduce Programming Model, MapReduce Impacts and Research Directions	CO1,CO3,CO6
Unit 4	**MONITORING, MANAGEMENT & GOVERNANCE**	
A	**SLA Management in Cloud Computing** Introduction of typical Use Cases, Model for Federated Cloud Computing, Security Considerations, SLA Management in Cloud Computing: A Service Provider's Perspective, Types of SLA, Life Cycle of SLA, Automated Policy-based Management	CO1,CO4
B	**Performance Predictions for HPC on Clouds** Introduction and Background of Grid and Cloud, HPC in the Cloud: Performance-related Issues, Game Hosting on Cloud Resources, Building Content Delivery Networks Using Clouds, Resource Cloud Mashups	CO1,CO4
C	**Security and Governance** Basic Concept of Organizational Readiness, Drivers for Changes: Common Change Management Models, Security and Risk in the Cloud, Cloud Computing and Identity, Content Level Security—Pros and Cons, Legal Issues in Cloud Computing(PCI DSS), Data Privacy and Security Issues	CO1,CO4

Unit 5	**AWS with Machine Learning**	
A	AWS Services:EC2, IAM, S3, Lambda, Introduction to Amazon SageMaker, Machine Learning with Amazon SageMaker, Explore, Analyze, and Process Data, Train a Model with Amazon SageMaker, Deploy a Model in Amazon SageMaker, Set Up Amazon SageMaker, Amazon SageMaker Notebook Instance	CO1,CO5,CO6
B	Amazon SageMaker Studio, Perform Common Tasks in Amazon SageMaker Studio, Amazon SageMaker API reference, Actions and Data Types, Use Autopilot to automate model development and Problem types, Create and Manage Workforces , Use Ground Truth for Labeling(Built-in Task Types, Auto-Segmentation Tool, Data Labeling, Input and Output Data,Creating Custom Labeling Workflows)	CO1,CO5,Co6
C	Process Data and Evaluate Models, Build Models and Choose an Algorithm, Train Models, Debugger, Perform Automatic Model Tuning, Tune Multiple Algorithms, Use Reinforcement Learning, Incremental Training, Deploy Models, Multi-Model Endpoints, Inference Pipelines, Use Batch Transform, Compile and Deploy Models with Neo , Elastic Inference, Automatically Scale Models, Monitoring and Security	CO1,CO5,CO6
Mode of examination	Theory	
Weightage Distribution	**CA** 30% **MTE** 20% **ETE** 50%	
Text Books	1. CLOUD COMPUTING Principles and Paradigms, Edited by Rajkumar Buyya, Jam 2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter	
Reference Books Online Materials	Amazon SageMaker, Developer Guide, https://docs.aws.amazon.com/sagemaker/latest/dg/sagemaker-dg.pdf#gs https://aws.amazon.com/getting-started/hands-on/build-train-deploy-machine-learning-model-sagemaker/ https://aws.amazon.com/machine-learning/	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define the basics of cloud and recall the computer Science concepts which are helpful in understanding on demand service architecture. Classify and describe the architecture and taxonomy of parallel and distributed computing, including shared and distributed memory, and data and task parallel computing.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	Define the basics of cloud and recall the computer	PO1,PO2,PO3,PO4,PO5,PO6,PO7, PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	Apply the PAAS and SAAS to manage the workflow and use of cloud in scientific application.	PO1,PO2,PO3,PO4,PO5,PO6,PO7, PO8,PO9,PO10, PSO1,PSO2,PSO3

4.	Categorize and Characterize between Infrastructure services, deployment models, and governance in cloud computing. Examine the design of task and data parallel distributed algorithms for Clouds and use them to construct Cloud applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	Evaluate the importance of cloud using monitoring and management of services for performance improvement of HPC and to follow the Governance and Compliances	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	Elaborate the design concept and formulate to build the solution using cloud service providers as AWS as EC2, LAMBDA, S3 and Machine Learning Service as AWS SageMaker.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Cloud Computing with Machine Learning

Course Code_ Course Name	**CO's**	**PO 1**	**PO 2**	**PO 3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO3**
Introduction to Cloud Computing with Machine Learning **CSA-022**	**CO1**	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO2	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO3	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO4	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3
	CO6	3	3	3	3	3	3	3	1	2	3	1	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSA-022	Introduction to Cloud Computing with Machine Learning	3.00	3.00	3.00	3.00	1.83	1.67	1.33	1.00	1.33	2.00	1.00	3.00	2.67	3.00	2.00

Total- 39.00
Strength of Correlation

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School SET	**Batch 2019-2023**	
Program B-TECH	**Academic Year 2019-20**	
Branch CSE	**Semester VI**	
1 Course Code	**CSA041** Course Name **Natural Language Processing**	
2 Course Title	**Natural Language Processing**	
3 Credits	3	
4 Contact Hours (L-T-P)	**3-0-0**	
Course Status	**Specialization Elective**	
5 Course Objective	**Students will try to learn** 8. Basics of natural language processing. 9. How to apply basic algorithms in natural language processing. 10. Algorithmic description of the main language levels morphology, syntax, semantics, and pragmatics. 11. Basics of knowledge representation, inference, and relations to the artificial intelligence. 12. Techniques such as tokenization, stemming, and lemmatization.	
6 Course Outcomes	Students will be able to CO-1. **Define** Computational Linguistics phenomena and making decisions using it. CO-2. **Explain** how to access Text Corpora and Lexical Resources. CO-3. **Apply** processing of raw text using NLP programming concepts. CO-4. **Analyze** tagging of words and Extracting Information from Text. CO-5. **Discuss** analysis of sentences using CFG and Propositional Logic. CO-6. **Design** NLP based applications for different business environment.	
7 Course Description	This course provides an introduction to the field of computational linguistics, aka natural language processing (NLP). We will learn how to create systems that can understand and produce language, for applications such as information extraction, machine translation, automatic summarization, question-answering, and interactive dialogue systems. The course will cover linguistic (knowledge-based) and statistical approaches to language processing in the three major subfields of NLP: syntax (language structures), semantics (language meaning), and pragmatics/discourse (the interpretation of language in context).	
8 Outline syllabus		CO Mapping
Unit 1	**Introduction and Computational Linguistics**	
A	What is Natural Language Processing, hands-on demonstrations. Ambiguity and uncertainty in language. The Turing test	CO1
B	Computing with Language Texts and Words Implementation of NLTK, Searching Text, Counting Vocabulary, A Closer Look at Python Texts as Lists of Words, Computing with Language	CO1

	Simple Statistics, Frequency Distributions, Fine-grained Selection of Words, Collocations and Bigrams,	
C	Making Decisions and Taking Control, Conditionals, Operating on Every Element, Nested Code Blocks, Looping with Conditions	CO1
Unit 2	**Accessing Text Corpora and Lexical Resources**	
A	Automatic Natural Language Understanding, Word Sense Disambiguation, Pronoun Resolution, Generating Language Output, Machine Translation, Spoken Dialog Systems, Textual Entailment, Limitations of NLP	CO2
B	Accessing Text Corpora, Gutenberg Corpus, Web and Chat Text, Brown Corpus, Reuters Corpus, Inaugural Address Corpus, Annotated Text Corpora, Corpora in Other Languages	CO2
C	Text Corpus Structure, Loading your own Corpus, Conditional Frequency Distributions, Conditions and Events, Counting Words by Genre, Plotting and Tabulating Distributions, Generating Random Text with Bigrams,	CO2
Unit 3	**Processing Raw Text**	
A	Lexical Resources,, Wordlist Corpora, A Pronouncing Dictionary, Comparative Wordlists, Shoebox and Toolbox Lexicons, WordNet, Senses and Synonyms, The WordNet Hierarchy, Lexical Relations, Semantic Similarity	CO3
B	Accessing Text from the Web and from Disk, Strings Text Processing at the Lowest Level, Text Processing with Unicode, Regular Expressions for Detecting Word Patterns, Useful Applications of Regular Expressions Normalizing Text, Regular Expressions for Tokenizing Text, Segmentation,Formatting From Lists to Strings	CO3
C	NLP Programming Sequences, Style, Functions for text processing, Program Development & Algorithm Design using, Python Libraries	CO3
Unit 4	**Tagging & Information Extraction**	
A	Categorizing and Tagging Words Using a Tagger,Tagged Corpora,Mapping Words to Properties Using Python Dictionaries, Automatic Tagging, N-Gram Tagging,Transformation-Based Tagging, Determine the Category of a Word	CO4
B	Text classification Supervised Classification, Examples of Supervised Classification,Evaluation,Decision Trees,Naive Bayes Classifiers,Maximum Entropy Classifiers,Modeling Linguistic Patterns	CO4
C	Extracting Information from Text Information Extraction,Chunking,Developing and Evaluating Chunkers,Recursion in Linguistic Structure,Named Entity Recognition,Relation Extraction	CO4
Unit 5	**Analysis of sentences**	
A	Analyzing Sentence Structure Grammatical Dilemmas,What's the Use of Syntax?,Context-Free Grammar,Parsing with Context-Free Grammar,Dependencies and Dependency Grammar,Grammar Development	CO5

B	Analyzing the Meaning of Sentences Natural Language Understanding,Propositional Logic,First-Order Logic,The Semantics of English Sentences,Discourse Semantics	CO5
C	Managing Linguistic DataCorpus Structure,The Life Cycle of a Corpus,Acquiring Data,Working with XML,Working with Toolbox Data,Describing Language Resources Using OLAC Metadata	CO5

Mode of examination	Theory		
Weightage	CA	MTE	ETE
Distribution	30%	20%	50%

Text book/s*

3. Speech and Language processing An introduction to Natural Language Processing, Computational Linguistics and speech Recognition by Daniel Jurafsky and James H. Martin (ISBN13: 978-0131873216)
4. Ruslan Mitkov, The Oxford Handbook of Computational Linguistics, Oxford University Press, 2005

Other References

3. Charu C. Aggarwal and Cheng Xiang Zhai, Mining Text Data, Springer, 2012
4. Hopcroft, J.E. and Ullman, J.D., Introduction to Automata, Theory and Languages, Addison-Wesley, 1979

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** Computational Linguistics phenomena and making decisions using it.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**Explain** how to access Text Corpora and Lexical Resources.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**Apply** processing of raw text using NLP programming concepts.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**Analyze** tagging of words and Extracting Information from Text.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**Discuss** analysis of sentences using CFG and Propositional Logic.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**Design** NLP based applications for different business environment.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Natural Language Processing **(Course Code CSA041)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	3	3	3	3	3	1	1	1	1	3	1	3	2	3	1
CO2	3	3	3	3	3	1	1	1	1	3	1	3	3	3	2
CO3	3	3	3	3	3	2	1	1	1	3	1	3	3	3	1
CO4	3	3	3	3	3	1	2	1	1	3	1	3	3	3	3
CO5	3	3	3	3	3	2	2	1	2	3	1	3	3	3	3
CO6	3	3	3	3	3	3	3	1	3	3	2	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA 041	Natural Language Processing	3.00	3.00	3.00	3.00	3.00	1.67	1.67	1.00	1.50	3.00	0.00	3.00	2.83	3.00	2.17

Total- 34.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET	**Batch : 2019-2023**	
Program: B.Tech.	**Current Academic Year: 2019-20**	
Branch: CSE	**Semester: VII**	
1 **Course Code**	**CSA051**	**Course Name- RECOMENDER SYSTEMS**
2 **Course Title**	**RECOMENDER SYSTEMS**	
3 **Credits**	**3**	
4 **Contact Hours (L-T-P)**	**3-0-0**	
Course Status	**Specialization Elective**	
5 Course Objective	To develop state-of-the-art recommender systems that automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations 1. To introduce fundamental techniques in recommender systems. 2. To introduce the ideas of Non-personalized and project-association recommenders through content-based and collaborative techniques. 3. To become familiar with to various approaches for building recommender systems including collaborative, content-based, knowledge-based, and hybrid methods.	
6 Course Outcomes	After Successful completion of this course the student will be able to: CO-1. **Define** the basics of Recommender Systems and its types. CO-2. **Explain** the similarity measures used in formation of neighbourhood of samples of data. CO-3. **Apply** various techniques of content and knowledge based recommendation for real life applications. CO-4. **Analyse** and categorize the various recommendation techniques for hybridization. CO-5. **Choose** the suitable type of Recommender systems for societal problems CO-6. **Design** the recommender system to support all online applications of folksonomies and Social Networking sites.	
7 Course Description	Recommender systems offer personalized access to online information in product catalogs, social media networks, and document collections, among other applications. It will introduce students to various approaches for building recommender systems including collaborative, content-based, knowledge-based, and hybrid methods.	
8 Outline syllabus		CO Mapping
Unit 1	**Introduction**	
A	Introduction to Recommender Systems, Neighbourhood-	CO1,

	based methods Recommendation, Applications of recommender systems, Case study of movie lens, group lens and amazon.com etc.	
B	Introduction to Information retrieval, Introduction to collaborative filtering	CO1,
C	Knowledge sources, Neighbourhood-based methods.	CO1
Unit 2	**Memory and Model-based Collaborative Recommendation**	
A	Similarity measures used in Collaborative Filtering, Model-based Collaborative Recommendation Dimensionality reduction. Regression: Slope1 and SLIM models. Association rules and Naïve Bayes models,	CO2, CO6
B	Factorization Methods of Collaborative Recommendation, Latent factor models.	CO2, CO6
C	Optimization techniques. Singular value decomposition, constrained matrix factorization.	CO2, CO6
Unit 3	**Content-based and Knowledge-based Recommendation**	
A	High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Content-based Recommendation Feature representation, extraction, and selection.	CO3, CO6
B	User profiles. Learning models, Item profiles, Discovering features of documents, Obtaining item features from tags	CO3, CO6
C	Knowledge-based Recommendation Constraint-based recommendation. Critiquing systems.	CO3, CO6
Unit 4	**Hybrid recommendation and Evaluation**	CO3, CO6
A	Hybrid Recommendation Complementarities between recommendation techniques and knowledge sources.	CO3, CO6
B	Combining recommendation methods. Types of evaluation for recommender systems	CO3, CO6
C	Evaluation design. Prediction metrics and ranking metrics. A/B Testing	CO3, CO6
Unit 5	**Context-aware recommendation**	
A	Context effects in recommendation. Types and representations of context.	CO5, CO6
B	Pre-filtering, post-filtering and contextual modelling, Temporal and location-sensitive models	CO5, CO6
C	Recommender Systems and communities: Communities, collaboration and recommender systems in personalized web search, Social tagging recommender systems, Trust and Recommendations, Group recommender systems and their applications in solving societal problems.	CO5, CO6
Mode of examinatio	Theory	

n			
Weightage Distributio n	CA	MTE	ETE
	30%	20%	50%
Text book/s*	Aggarwal, C. C. Recommender Systems: The Textbook. Springer 2019. ISBN 978-3-319-29657-9. Available through the DePaul library.		
Other References	http://www.deitel.com/ResourceCenters/Web20/RecommenderSystems/RecommenderSystemsCourseSyllabi/tabid/1321/Default.aspx		
Other References	Francesco Ricci, LiorRokach and BrachaShapira Recommender Systems Handbook, 2005		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** the basics of Recommender Systems and its types**.**	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
2.	**Explain** the similarity measures used in formation of neighbourhood of samples of data.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	**Apply** various techniques of content and knowledge based recommendation for real life applications.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	**Analyse** and categorize the various recommendation techniques for hybridization.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	**Choose** the suitable type of Recommender systems for societal problems	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	**Design** the recommender system to support all online applications of folksonomies and Social Networking sites.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for RECOMENDER SYSTEMS (Course Code CSA051)

Subject	Course Objectives	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
RECOMMENDER SYSTEMS CSA-051	CO1	3	3	2	3	2	1	1	1	2	1	-	3	3	2	2
	CO2	3	3	3	3	3	2	2	1	2	2	-	3	3	3	2
	CO3	3	3	3	3	3	3	3	1	3	2	-	3	3	2	2
	CO4	3	3	3	3	3	2	2	1	3	2	-	3	3	3	2
	CO5	3	3	3	3	3	3	3	1	3	2	-	3	3	3	2
	CO6	3	3	3	3	3	3	3	1	3	3	-	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSA-051	**RECOMMENDER SYSTEMS**	**3.00**	**3.00**	**2.83**	**3.00**	**2.83**	**2.33**	**2.33**	**1.00**	**2.67**	**2.00**	**0.00**	**3.00**	**3.00**	**2.67**	**2.17**

Total- 35.83
Strength of Correlation
1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

School: SET		**Batch : 2019-2023**
Program: B-TECH		**Current Academic Year: 2019-20**
Branch: CSE		**Semester: VII**
1	**Course Code**	**CSA061** **Course Name: Robotics and Intelligent Systems**
2	**Course Title**	**Robotics and Intelligent Systems**
3	**Credits**	**3**
4	**Contact Hours (L-T-P)**	**3-0-0**
	Course Status	**Specialization Elective**
5	Course Objective	**Students will try to learn:** 13. Fundamental principles of robot system design and operation. 14. How to apply concepts of translational and rotational motion, and gears to robot construction. 15. To design and program simple autonomous robots. 16. To implement algorithms that enables the use of sensors and actuators to facilitate intelligent behavior, learning and perception.
6	Course Outcomes	Students will be able to: CO-1. **Define** the concept and key components of robotics technologies. CO-2. **Classify** various robot sensors and their perception principles that enable a robot to analyze their environment, reason and take appropriate actions toward the given goal. CO-3. **Apply** the learned knowledge and skills in practical robotics laboratories and experiments. CO-4. **Analyze** problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning. CO-5. **Assess** stochastic control and multi agent systems for development of a robotic system. CO-6. **Adapt** intelligent system methodology suitable for a given type of real world application problem.
7	Course Description	Basic concepts of Robotics, Intelligent Systems and transformational modeling. This course provides students with a working knowledge of methods for design and analysis of robotic and intelligent systems. Particular attention is given to modeling dynamic systems, measuring and controlling their

behavior, and making decisions about future courses of action

8	Outline syllabus			CO Mapping
	Unit 1	**Overview and Preliminaries**		
	A	Mobile Robots, Position, and Orientation		CO1
	B	Translational and Rotational Dynamics		CO1, CO2
	C	Flying and Swimming Robots, Articulated Robots		CO1, CO2
	Unit 2	**Transformation**,		
	A	Path Planning, and Trajectories		CO1, CO2
	B	Time Response of Dynamic Systems		CO1, CO2
	C	Dynamic Effects of Feedback Control, Control Systems		CO1, CO2
	Unit 3	**Optimization**		
	A	Sensors and Actuators		CO1, CO2, CO4
	B	Numerical Optimization		CO1, CO2, CO4
	C	Dynamic Optimal Control		CO1, CO2, CO4
	Unit 4	**Formal Logic, Algorithms, and Incompleteness**		
	A	Computers, Computing, and Sets		CO3, CO5
	B	Probability and Statistics		CO3, CO5
	C	Machine Learning, Neural Networks		CO3, CO5
	Unit 5	**Information, Search and Expert Systems**		
	A	State Estimation, Stochastic Control		CO3, CO5, CO6
	B	Parameter Estimation and Adaptive Control		CO3, CO5, CO6
	C	Task Planning and Multi-Agent Systems		CO3, CO5, CO6
	Mode of examination	Theory		
	Weightage Distribution	CA 30%	MTE 20%	ETE 50%
	Text book/s*	5. http://www.princeton.edu/~stengel/RISVirText.html. 6. J. J. Craig, Introduction to Robotics, Addison Wesley Publishers, 2005, 7. Computational Principles of Mobile Robotics by Gregory Dudek and Michael Jenkin, Second Edition		
	Other References	5. M. Negnevitsky, Artificial Intelligence – A guide to intelligent systems Addison-Wesley, 2005, 6. Bharati A., Sangal R., ChaitanyaV..Natural language processing: a Paninian perspective, PHI, 2000		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1. **Define** the concept and key	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8,

	components of robotics technologies.	PO9,PO10, PSO1,PSO2,PSO3
2.	CO-2. **Classify** various robot sensors and their perception principles that enable a robot to analyze their environment, reason and take appropriate actions toward the given goal.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
3.	CO-3. **Apply** the learned knowledge and skills in practical robotics laboratories and experiments.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
4.	CO-4. **Analyze** problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
5.	CO-5. **Assess** stochastic control and multi agent systems for development of a robotic system.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3
6.	CO-6. Adapt intelligent system methodology suitable for a given type of real world application problem.	PO1,PO2,PO3,PO4, PO5,PO6,PO7,PO8, PO9,PO10, PSO1,PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Robotics and Intelligent Systems **(Course Code CSA061)**

Course Objectives	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	1	1	1	1	2	3	2	3	3	1
CO2	3	3	3	3	3	1	2	1	2	2	3	2	3	3	2
CO3	3	3	3	3	3	2	1	1	2	2	3	3	3	3	3
CO4	3	3	3	3	3	1	1	1	2	2	3	2	3	3	3
CO5	3	3	3	3	3	1	1	1	2	2	3	2	3	3	3
CO6	3	3	3	3	3	2	2	2	3	3	2	2	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O 1**	**PS O 2**	**PS O 3**
CSA06 1	Robotics and Intelligent Systems	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**1.33**	**1.33**	**1.17**	**2.00**	**2.17**	**0.00**	**2.17**	**3.00**	**3.00**	**2.5 0**

Total- 33.83
Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

SHARDA UNIVERSITY
Beyond Boundaries

B.Tech-Computer Science & Engineering with specialization in Internet of Things & Applications

Syllabus
B.Tech CSE with Specialization in Internet of Things & Applications

School:		**School of Engineering and Technology**
Department		**Department of Computer Science and Engineering**
Program:		**B.Tech**
Branch:		**CSE with Specialization in Internet of Things & Applications**
1	Course Code	CSI104
2	Course Title	Introduction to IoT
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	Core
5	Course Objective	In this course, student will explore various concepts of Internet of things such as things, enabling technologies, M2M to IoT and IoT architecture. In the end they will also be able to identify the challenges in IoT and its various areas of application.
6	Course Outcomes	CO1: Define the general concepts of Internet of Things. CO2: Recognize the basic M2M Ecosystem and change from M2M to IoT. CO3: Explore the IoT components and its architecture CO4: Analyze the interoperability protocol to any model. CO5: Explain the challenges in IoT specific application. CO6: Discuss the various domains where IOT can be applied successfully.
7	Course Description	This course introduces the concepts for internet of things and how we can embed it into our daily lives for the development of life style. It will also help students to understand the applications according to their problem statements.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to IoT**	
	A	Defining IoT, History of IoT, Importance of IoT , IoT Basic Characteristics	CO1
	B	About Objects / things in the IoT, Enabling Technologies of IoT	CO1
	C	About the Internet in IoT, IoT Advantages and Disadvantages	CO1
	Unit 2	**IoT & M2M**	
	A	Introduction to M2M, M2M Overview, M2M Features	CO1, CO2
	B	M2M Ecosystem: M2M Service Platform (M2SP), M2M Device Platform, M2M User Platform, M2M Application Platform, M2M Access Platform	CO1, CO2
	C	Comparison of the Main Characteristics of M2M and IoT, M2M Applications, Introduction to SDN, NVF for IoT.	CO1, CO2
	Unit 3	**IoT Architecture**	
	A	Basic Building blocks of IoT system: Sensors, Processors, gateways, Applications	CO1, CO3

B	Physical design of IoT: Things in IOT, IoT Protocols, Logical design of IoT: IoT Functional Blocks, IoT Communication Models. IoT Communication API's	CO1, CO3
C	IoT Service Oriented Architecture (SOA), API Oriented Architecture.	CO1, CO3
Unit 4	**Interoperability in Internet of Things**	
A	Current Challenges in IoT: Large Scale of Co-Operation, Global Heterogeneity, Unknown IoT Device Configuration, Semantic Conflicts	CO1, CO4, CO5
B	Different Types of Interoperability: User and Device Interoperability	CO1, CO4, CO5
C	IoT Working, Introduction to Arduino and Raspberry Pi	CO1, CO4, CO5
Unit 5	**Domain specific applications of IoT**	
A	Home automation concept and case study	CO1, CO3, CO6
B	Industry applications concept and case study	CO1, CO3, CO6
C	Surveillance applications concept and case study, Other IoT applications	CO1, CO3, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. The Internet of Things: Connecting Objects to the Web edited by Hakima Chaouchi, Reference for Unit-1. 2. Introduction to Internet of Things, Prof. Sudip Misra, NPTEL Lectures Notes, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur, Reference for Unit 2, 3 (c), 4. 3. Internet of Things, Rajkumar Buyya, Reference for Unit 3 (c) 4. Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hand-on Approach", Universities press, 2015, Reference for Unit 3 (B)	
Other References	1. Charalampos Doukas , "Building Internet of Things with the Arduino", Create space, April 2002 2. Dr. Ovidiu Vermesan and Dr. Peter Friess, "Internet of Things: From research and innovation to market deployment", River Publishers 2014. 3. Contiki : The open source for IOT, www.contiki-os.org	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the general concepts of Internet of Things.	PO1, PO2, PO3, PO6, PO7, PO12, PSO1
2.	CO2: Recognize the basic M2M Ecosystem and change from M2M to IoT.	PO1, PO2, PO3, PO6, PO7, PO12, PSO1
3.	CO3: Explore the IoT components and its architecture	PO1, PO2, PO3, PO4, PO6, PO7, PO12, PSO1
4.	CO4: Analyze the interoperability protocol to any model.	PO1, PO2, PO3, PO4, PO6, PO7, PO12, PSO1
5.	CO5: Explain the challenges in IoT specific application.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO12, PSO1
6.	CO6: Discuss the various domains where IOT can be applied successfully.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO12, PSO1

PO and PSO mapping with level of strength for Course Name Introduction to IoT (Course Code CSI104)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI104_Introduction to IoT	CO1	3	1	1	-	-	2	1	-	-	-	-	3	3	-	-
	CO2	2	2	1	-	-	1	3	-	-	-	-	3	3	-	-
	CO3	3	1	1	2	-	2	1	-	-	-	-	3	3	-	-
	CO4	3	2	3	2	-	1	2	-	-	-	-	3	3	-	-
	CO5	3	3	3	3	3	2	3	-	-	-	-	3	3	-	-
	CO6	2	2	2	2	3	2	3	-	-	-	-	3	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI104	Introduction to IoT	2.7	1.8	1.8	2.3	3.0	1.7	2.2	-	-	-	-	3.0	3.0	-	-

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CSI201	
2	Course Title	Embedded System	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	To train the students for finding right microcontroller for a particular application and to program it. They will also be taught interfacing of different input/output devices with microcontrollers. Finally, an introduction of basics of real time systems and architecture of advanced microcontrollers will be provided.	
6	Course Outcomes	CO1: Understand architecture and instructions set of microcontroller CO2: Illustrate programming of microcontroller CO3: Apply knowledge of interfacing techniques CO4: Build knowledge of developing small projects CO5: Compare various communication protocols of microcontrollers CO6: Take part in writing assembly language programs of microcontrollers for various applications.	
7	Course Description	This subject is for the small projects development knowledge. The industry standard 8 bit microcontroller will be taught. It is not only establishes a foundation of assembly & embedded C language programming but also provides a comprehensive treatment of standard interfacings for engineering students. It is an ideal source for those building stand-alone projects.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction & Architecture of 8051 Microcontroller**	
	A	Review of architecture and instruction set of 8085 microprocessor and 8 bit microcontroller.	CO1
	B	Overview of 8 bit architecture and compare with 8085 and other 8 bit microcontroller.	CO1
	C	CISC & RISC processors.	CO1
	Unit 2	**Industry Standard microcontroller Instructions set**	CO2,CO6
	A	Addressing modes, data transfer arithmetic and logical instructions.	
	B	Bit instructions, jump, loop and call instructions.	CO2,CO6
	C	Time delay using instructions.	CO2,CO6
	Unit 3	**Programming of industry standard controller**	
	A	Input/output port programming, Timer/counter programming for different modes.	CO3, CO6
	B	Serial communication and programming for different modes.	CO3, CO6
	C	Programming of interrupts and priority of interrupts; power down mode programming; programming in C	CO3, CO6

	language.	
Unit 4	**Interfacing to industry standard microcontroller**	
A	Interfacing of 7 segment display, LCD and keyboard.	CO3, CO4, CO6
B	Interfacing of DC motor, stepper motor and relay.	CO3, CO4, CO6
C	Interfacing of ADC, DAC, RFID	CO3, CO4, CO6
Unit 5	**Advanced Topics**	
A	Accessing of EEPROM and interfacing of sensors	CO5
B	On board buses for embedded systems-I2C & SPI; Wireless module interfacings like BT, ZigBee	CO5
C	Real time tasks and types, real time systems, real time operating systems; Hardware software co-design, embedded product development lifecycle management.	CO5
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% — MTE 20% — ETE 50%	
Text book/s*	1. Muhammad Ali Mazidi, J G Mazidi and R D.Mchinlay, " The 8051 Microcontroller and Embedded Systems" using assembly and C, second edition, Pearson Education.	
Other References	1. Lyla B. Das, "Embedded Systems" an integrated approach, Pearson 2. Ajay V Deshmukh, "Microcontrollers (Theory and Applications)", The McGraw-Hill	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand architecture and instructions set of microcontroller	PO1, PO6, PO7, PO12, PSO2
2.	CO2: Illustrate programming of microcontroller	PO1, PO2, PO5, PO9, PO10, PO11, PO12, PSO1, PSO2
3.	CO3: Apply knowledge of interfacing techniques	PO1, PO2, PO4, PO5, PO7, PO9, PO10, PO12, PSO1
4.	CO4: Build knowledge of developing small projects	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Compare various communication protocols of microcontrollers	PO1, PO3, PO4, PO9, PO10, PO12
6.	CO6: Take part in writing assembly language programs of microcontrollers for various applications.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Embedded System (Course Code CSI201)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI201 _Embedded System	CO1	3	-	-	-	-	1	1	-	-	-	-	3	-	1	-
	CO2	3	2	-	-	3	-	-	-	2	2	1	3	2	2	-
	CO3	3	3	-	2	2	-	2	-	2	2	-	3	2	-	-
	CO4	3	3	3	3	3	2	3	2	3	3	3	3	3	2	3
	CO5	3	-	2	2	-	-	-	-	2	2	-	3	-	-	-
	CO6	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI201	Embedded System	3	2.75	2.67	2.5	2.75	2	2.25	2	2.4	2.4	2	3	2.5	2	3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	

1	Course Code	CIP201	
2	Course Title	Embedded System Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Core	
5	Course Objective	To train the students for finding right microcontroller for a particular application and to program it. They will also be taught interfacing of different input/output devices with microcontrollers. Finally, an introduction of basics of real time systems and architecture of advanced microcontrollers will be provided.	
6	Course Outcomes	CO1: Understand architecture and instructions set of KEIL simulator CO2: Understand the process to embed HEX codes into Microcontroller to do the basic program CO3: Apply knowledge of interfacing with seven segment display CO4: Build the project to interface microcontroller with stepper motor CO5: Take part in interfacing microcontroller with DC motor CO6: Take part in writing assembly language programs of microcontrollers for various applications.	
7	Course Description	This subject is for the small projects development knowledge. The industry standard 8 bit microcontroller will be taught. It is not only establishes a foundation of assembly & embedded C language programming but also provides a comprehensive treatment of standard interfacings for engineering students. It is an ideal sources for those building stand-alone projects.	
8	Outline syllabus		CO Mapping
	Unit 1	**KEIL Simulator**	
		Familiarization with KEIL simulator environment	CO1, CO6
		Write and execute programs through KEIL for port programming	CO1, CO6
	Unit 2	**Flash Magic Software and Interface LED**	
		Familiarization with Flash Magic Software to embed HEX code in microcontroller	CO2, CO6
		Interface LEDs at PORT0 and make a pattern of Alternate ON-OFF LEDs with delay of 1 second	CO2, CO6
	Unit 3	**Interface one common anode SEVEN SEGMENT**	
		Interface one common anode SEVEN SEGMENT at any port and display 0 to 9 with infinite loop 6. Interface THREE common anode SEVEN SEGMENTs to Display CSE	CO3, CO6
		Interface one common anode SEVEN SEGMENT at any port and display 0 to 9 with infinite loop 6. Interface THREE common anode SEVEN SEGMENTs to Display CSE	CO3, CO6

Unit 4	**Interface LCD**	
	Interface LCD with port 0 to display SHARDA 8. Interface Stepper motor at port 3 to move clockwise 900 steps continuously	CO4, CO6
	Interface LCD with port 0 to display SHARDA 8. Interface Stepper motor at port 3 to move clockwise 900 steps continuously	CO4, CO6
Unit 5	**Interface DC Motor**	
	Interface DC motor to move one second clockwise and next one second anticlockwise continuously 10. Interface bidirectional DC motor controlled by two switches	CO5, CO6
	Interface DC motor to move one second clockwise and next one second anticlockwise continuously 10. Interface bidirectional DC motor controlled by two switches	CO5, CO6
Mode of examination	Jury/Practical/Viva	
Weightage Distribution	CA 60% MTE 0% ETE 40%	
Text book/s*	2. Muhammad Ali Mazidi, J G Mazidi and R D.Mchinlay, " The 8051 Microcontroller and Embedded Systems" using assembly and C, second edition, Pearson Education.	
Other References	3. Lyla B. Das, "Embedded Systems" an integrated approach, Pearson 4. Ajay V Deshmukh, "Microcontrollers (Theory and Applications)", The McGraw-Hill	

PO and PSO mapping with level of strength for Embedded System Lab (Course Code CIP201)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP201 _Embedded System Lab	CO1	3	-	-	1	1	1	1	-	3	1	-	3	1	1	1
	CO2	3	2	2	2	3	-	2	2	2	2	1	3	2	2	2
	CO3	3	3	2	2	2	-	2	2	2	2	3	3	2	-	3
	CO4	3	3	3	3	3	1	3	2	3	3	3	3	3	2	3
	CO5	3	-	2	2	-	-	1	1	2	2	3	3	2	-	-
	CO6	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP201	**Embedded System Lab**	3	2.8	2.4	2.2	2.4	1.7	2.0	1.8	2.5	2.2	2.4	3.0	2.2	2.0	2.4

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	

1	Course Code	CSI202	
2	Course Title	IoT: Architecture and Programming	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Core	
5	Course Objective	This course provides a preliminary view on Logical and Physical Design of IoT systems and gives an overview of Data analytics for IoT.	
6	Course Outcomes	CO1: Recall the basic concepts of Internet of Things CO2: Explain the concepts of logical design of IoT System using Python. CO3: Demonstrate the Raspberry Pi interfaces with Python CO4: Interpret the IoT Physical Servers and Cloud Offerings CO5: Make use of data analytics for IoT using Apache Hadoop CO6: Utilize the IoT reference architecture required in building IoT based solutions.	
7	Course Description	The course focuses on understanding the vision of IoT from a global perspective, understand its applications, and determine its market perspective, using gateways, devices and data management, building a state of art architecture in IoT and its applications in commercial building automation and real world design constraints.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to IoT**	
	A	Introduction, Physical Design of IOT, Logical design of IoT, IoT Levels & Development Templates	CO1
	B	Difference between IoT and M2M, SDN and NFV for IoT, Need for IoT systems management, Simple Network Management Protocol (SNMP)	CO1
	C	Network operator requirements, NETCONF, YANG, IoT systems Management with NETCONF, YANG	CO1
	Unit 2	**IoT Systems- Logical Design using Python**	
	A	Language features of Python, Data types, data structures, Control of flow	CO1, CO2
	B	Functions, modules, packaging, file handling, data/time operations, classes	CO1, CO2
	C	Python packages for Internet of Things	CO1, CO2
	Unit 3	**IoT Physical Devices and Endpoints**	
	A	Basic building blocks of an IoT device, Exemplary Device: Raspberry Pi	CO1, CO2, CO3
	B	About the board, Raspberry Pi interfaces	CO1, CO2, CO3
	C	Programming Raspberry Pi with Python	CO1, CO2, CO3
	Unit 4	**IoT Physical Servers and Cloud Offerings**	

A	Introduction to Cloud Storage models and communication APIs	CO1, CO2, CO4
B	Webserver – Web server for IoT, Cloud for IoT	CO1, CO2, CO4
C	Python web application framework, Amazon Web services for IoT	CO1, CO2, CO4
Unit 5	**Data analytics for IoT**	
A	Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis	CO5, CO6
B	Apache Oozie, Apache Spark, Apache Storm	CO5, CO6
C	Using Apache Storm for Real-time Data Analysis	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Arshdeep Bahga and Vijai Madisetti : A Hands-on Approach "Internet of Things", Universities Press 2015. 2. "Internet of Things with Python" Gastón C. Hillar,Published by Packt Publishing Ltd. Livery Place 35 Livery Street Birmingham B3 2PB, UK. ISBN 978-1-78588-138-1	
Other References	1. Kamal, R., (2017), Internet of Things - Architecture and Design Principles, 1st Edition, Mcgraw Hill. 2. Misra, S., Introduction to Internet of Things, NPTEL Course Material, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur, https://nptel.ac.in/courses/106105166/ 3. Samuel Greengard, " The Internet of Things", The MIT press, 2015. 4. Adrian McEwen and Hakim Cassimally"Designing the Internet of Things "Wiley,2014.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Recall the basic concepts of Internet of Things	PO1, PO9, PO12, PSO2
2.	CO2: Explain the concepts of logical design of IoT System using Python.	PO1, PO9, PO12, PSO1, PSO2
3.	CO3: Demonstrate the Raspberry Pi interfaces with Python	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PO12, PSO1, PSO2
4.	CO4: Interpret the IoT Physical Servers and Cloud Offerings	PO1, PO4, PO5, PO7, PO9, PO10, PO12, PSO2
5.	CO5: Make use of data analytics for IoT using Apache Hadoop	PO1, PO2, PO5, PO9, PO10, PO12, PSO2, PSO3
6.	CO6: Utilize the IoT reference architecture required in building IoT based solutions.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name IoT: Architecture and Programming (Course Code CSI202)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI202 _IoT: Architecture and Programming	CO1	2	-	-	-	-	-	-	-	1	-	-	2	-	2	-
	CO2	2	-	-	-	-	-	-	-	2	-	-	2	2	2	-
	CO3	2	3	2	3	3	-	2	1	2	3	-	2	3	2	-
	CO4	2	-	-	2	2	-	2	-	2	2	-	2	-	2	-
	CO5	2	2	-	-	3	-	-	-	2	3	-	2	-	2	2
	CO6	3	3	3	3	3	2	3	3	3	3	2	2	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI202	IoT: Architecture and Programming	2.2	2.7	2.5	2.7	2.8	2.0	2.3	2.0	2.0	2.8	2.0	2.0	2.7	2.2	2.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CIP202	
2	Course Title	IoT: Architecture and Programming Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Core	
5	Course Objective	This course provides a preliminary view on Logical and Physical Design of IoT systems and gives an overview of Data analytics for IoT.	
6	Course Outcomes	CO1: Demonstrate the concepts of IoT for home automation and security. CO2: Develop of logical design of IoT System using Python. CO3: Construct the Raspberry Pi interfaces with Python CO4: Interpret the IoT Physical Servers and Cloud Offerings CO5: Evaluate data analytics for IoT using Apache Hadoop CO6: Utilize the IoT reference architecture required in building IoT based solutions.	
7	Course Description	The course focuses on understanding the vision of IoT from a global perspective, understand its applications, and determine its market perspective, using gateways, devices and data management, building a state of art architecture in IoT and its applications in commercial building automation and real world design constraints.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to IoT**	
		Sending e-mail from IoT kit.	CO1
		Internet based home automation and home security system	CO1
	Unit 2	**IoT Systems- Logical Design using Python**	
		Python-Based Multicolored-LED control	CO1, CO2
		Water level monitoring using Python and Moisture sensing and logging using python.	CO1, CO2
	Unit 3	**IoT Physical Devices and Endpoints**	
		Touchscreen photo-booth with a Raspberry Pi	CO1, CO2, CO3
		Raspberry Pi weather forecast display and Programming Raspberry Pi for Home automation system.	CO1, CO2, CO3
	Unit 4	**IoT Physical Servers and Cloud Offerings**	
		Internet or intranet controlled motor	CO1, CO2, CO4
		Design IoT-Enabled Embedded Web Server and Server-less based web application.	CO1, CO2, CO4
	Unit 5	**Data analytics for IoT**	
		Improvement of smart city technologies to reduce pollution levels	CO5, CO6

	Enhance traffic conditions and Internet-based street light control		CO5, CO6
Mode of examination	Jury/Practical/Viva		
Weightage Distribution	CA 60%	MTE 0%	ETE 40%
Text book/s*	1. Arshdeep Bahga and Vijai Madisetti : A Hands-on Approach "Internet of Things", Universities Press 2015. 2. "Internet of Things with Python" Gastón C. Hillar,Published by Packt Publishing Ltd. Livery Place 35 Livery Street Birmingham B3 2PB, UK. ISBN 978-1-78588-138-1		
Other References	1. Kamal, R., (2017), Internet of Things - Architecture and Design Principles, 1st Edition, Mcgraw Hill. 2. Misra, S., Introduction to Internet of Things, NPTEL Course Material, Department of Computer Science and Engineering, Indian Institute of Technology Kharagpur, https://nptel.ac.in/courses/106105166/ 3. Samuel Greengard, " The Internet of Things", The MIT press, 2015. 4. Adrian McEwen and Hakim Cassimally"Designing the Internet of Things "Wiley,2014.		

PO and PSO mapping with level of strength for IoT: Architecture and Programming Lab (Course Code CIP202)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP202_IoT: Architecture and Programming Lab	CO1	2	2	1	2	2	2	2	-	2	1	3	3	2	2	-
	CO2	2	2	2	1	2	-	-	-	2	-	2	3	2	2	-
	CO3	2	2	2	1	2	-	-	-	2	-	3	3	2	2	-
	CO4	2	2	2	1	2	-	-	2	2	-	3	3	2	2	-
	CO5	2	2	2	2	2	-	-	2	2	-	3	3	3	3	-
	CO6	2	2	2	2	2	3	2	2	3	1	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP202	IoT: Architecture and Programming Lab	2.0	2.0	1.8	1.5	2.0	2.5	2.0	2.0	2.2	1.0	2.8	3.0	2.3	2.3	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	
1 Course Code	CSI301	
2 Course Title	Programming with SENSEnuts IoT Platform	
3 Credits	2	
4 Contact Hours (L-T-P)	2-0-0	
Course Status	Core	
5 Course Objective	The objective of the course is to deploy a network for statistical analysis or control applications. This course can help in connecting the sensors to platform to get the desired readings using extender.	
6 Course Outcomes	CO1: Outline the concepts of SENSEnut platform CO2: Explain basic sensor functions available with SENSEnuts devices CO3: Explain advance sensor functions available with SENSEnuts devices. CO4: Discuss simulation study of Sensory Range, Transmission Range. CO5: Identify localization of the event area and Send and Receive Data from a node. CO6: Design embedded applications using SENSEnut Platform	
7 Course Description	SENSEnuts platform can be used to test newly developed routing and application layer algorithms. It provides a flexible mac with around 9 parameters that can be controlled at mac and 4 at physical giving user the kind of flexibility to control their network environment.	
8 Outline syllabus		CO Mapping
Unit 1	**Introduction to SENSEnut Platform**	
A	The SENSEnut Platform, Hardware List, Installing the Software	CO1, CO6
B	Peripheral Hardware Specific Calls: DIO Functions, I^2C Functions	CO1, CO6
C	MAC functions: General Functions, Coordinator Functions, genMac Functions	CO1, CO6
Unit 2	**Sensor Functions**	
A	Phy Layer Functions, Routing Functions	CO1, CO2, CO6
B	Sensor Functions: Light Sensor Functions, Temperature Sensor Functions, Humidity Sensor Functions	CO1, CO2, CO6
C	Pressure and Temperature sensor Functions, GPS Functions, Passive Infrared Functions	CO1, CO2, CO6
Unit 3	**Advanced Functions**	
A	Task Management Functions	CO1, CO2, CO3, CO6
B	Gateway Communication Functions	CO1, CO2, CO3, CO6
C	Node Functions, Application Functions	CO1, CO2, CO3, CO6

Unit 4	**Simulation Studies-I**	
A	Sensory Range, Transmission Range	CO1, CO2, CO4, CO6
B	Defining the Sensory Range of a Sensor using SENSEnuts	CO1, CO2, CO4, CO6
C	Setting the Transmission Range of a Sensor using SENSEnuts	CO1, CO2, CO4, CO6
Unit 5	**Simulation Studies-II**	
A	Localization of the event area of a Sensor using SENSEnuts	CO5, CO6
B	Send and Receive Data from a Single Node	CO5, CO6
C	Embedded Applications Case Study	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. API REFERENCE GUIDE: SENSEnuts WSN sensation	
Other References		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Outline the concepts of SENSEnut platform	PO1, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
2.	CO2: Explain basic sensor functions available with SENSEnuts devices	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Explain advance sensor functions available with SENSEnuts devices.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Discuss simulation study of Sensory Range, Transmission Range.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Identify localization of the event area and Send and Receive Data from a node.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Design embedded applications using SENSEnut Platform	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Programming with SENSEnuts IoT Platform (Course Code CSI301)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI301 _Programming with SENSEnuts IoT Platform	CO1	2	-	-	1	2	2	-	-	1	1	1	2	2	1	1
	CO2	2	2	2	1	2	2	2	-	1	1	1	2	2	1	1
	CO3	2	2	2	2	3	2	2	-	2	2	2	2	3	2	1
	CO4	2	3	2	2	3	2	2	-	2	2	2	2	3	2	1
	CO5	2	3	3	3	3	2	2	2	2	2	2	2	3	3	1
	CO6	3	3	3	3	3	2	2	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI301	Programming with SENSEnuts IoT Platform	2.2	2.6	2.4	2.0	2.7	2.0	2.0	2.5	1.8	1.8	1.8	2.2	2.7	2.0	1.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	
1 Course Code	CIP301	
2 Course Title	Programming with SENSEnuts IoT Platform Lab	
3 Credits	1	
4 Contact Hours (L-T-P)	0-0-2	
Course Status	Core	
5 Course Objective	The objective of the course is to deploy a network for statistical analysis or control applications. This course can help in connecting the sensors to platform to get the desired readings using extender.	
6 Course Outcomes	CO1: Outline the concepts of SENSEnut platform CO2: Demonstrate Blink application using SENSEnuts devices CO3: Experiment with environment sensors on SENSEnuts GUI. CO4: Make use of broadcast function. CO5: Identify different channel frequencies supported by 802.15.4. CO6: Design embedded applications using SENSEnut Platform	
7 Course Description	SENSEnuts platform can be used to test newly developed routing and application layer algorithms. It provides a flexible mac with around 9 parameters that can be controlled at mac and 4 at physical giving user the kind of flexibility to control their network environment.	
8 Outline syllabus		CO Mapping
Unit 1	**Sensenut Platform** Introduction to SENSEnuts Platform, the components that make up an SENSEnuts board and their functions. Installing and working with SENSEnuts.	
Unit 2	**Working with SENSEnuts device** To develop a code for LED blinks operation for SENSEnuts device. To develop a code for RGB blinks operation for SENSEnuts device.	
Unit 3	**Working with Environment Sensors** To develop a code to read temperature and light sensor data from sensor module attached To develop a code to program the temperature and light sensor with threshold values, and catch the interrupt generated by them when threshold is passed.	
Unit 4	**Broadcast Function** To develop a code to broadcast the temperature and light sensor data in the network, catch it at destination and display it in GUI. For the previous experiment, check the change in link quality as the distance between two nodes increase.	
Unit 5	**Communication Protocol**	

	To check previous experiment at three different channel frequencies supported by 802.15.4. To check the impact of dynamic channel selection by PAN coordinator on the network when Pan Coordinator is switched off and then on while the network is running in a non-acknowledged broadcast network.
Mode of examination	Jury/Practical/Viva
Weightage Distribution	CA 60% MTE 0% ETE 40%
Text book/s*	-
Other References	

PO and PSO mapping with level of strength for Course Name Programming with SENSEnuts IoT Platform (Course Code CIP301)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP301 _Programming with SENSEnuts IoT Platform Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CIP301	Programming with SENSEnuts IoT Platform Lab	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***
3. Addressed to ***Substantial (High=3)*** ***extent***

School: **School of Engineering and technology**
Department **Department of Computer Science and Engineering**
Program: **B.Tech**
Branch: **CSE with Specialization in Internet of Things & Applications**

1	Course Code	CSI302
2	Course Title	IoT: Sensing & Actuator Devices
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Core
5	Course Objective	The objective of this course is to introduce the students the fundamental principles of sensing technology. Also to explain the characteristics and interfacing techniques with different types of sensors and actuators.
6	Course Outcomes	CO1: Define the general concepts of sensors used in IoT CO2: Classify proximity, ultrasound and motion sensors based on knowledge and principles of working. CO3: Compare various environmental sensors. CO4: List the various optical device drivers and displays actuators for IoT. CO5: Examine the mechanical drivers, DC motor and servo motor actuators for IoT. CO6: Develop the small IoT projects based on sensors & actuators.
7	Course Description	This course gives an overview of sensors used in IoT with sampling frequency and bandwidth requirements for different sensors. The course also describes the interface common sensors and actuators to IoT development kits.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Sensors and Sensing**	
	A	Understanding and classification of sensors and actuators, Characteristics of Sensors, Touch sensors: Button, Force sensor Capacitive sensor	CO1
	B	Light sensors: Photoresistor, Photodiode, Phototransistor	CO1
	C	Electrical characteristic sensors: Voltage sensor Current sensor	CO1
	Unit 2	**Sensors and Sensing-I**	
	A	Proximity and distance sensors: Optocoupler, Infrared sensor	CO1, CO2, CO6
	B	Ultrasound sensor, Motion detector	CO1, CO2, CO6
	C	Angle sensors: Potentiometer, The inertial measurement unit (IMU), Hall sensor, Global positioning system	CO1, CO2, CO6
	Unit 3	**Sensors and Sensing-II**	
	A	Environment sensors: Temperature sensor	CO1, CO3, CO6
	B	Humidity sensor, Sound sensor	CO1, CO3, CO6
	C	Chemical/smoke and gas sensor Level sensor	CO1, CO3,

		CO6
Unit 4	**Actuator-I**	
A	Optical device drivers and their devices: Light-emitting diode	CO1, CO4, CO6
B	Displays: Liquid-crystal display (LCD),	CO1, CO4, CO6
C	Organic light-emitting diode display (OLED), Electronic ink display (E ink)	CO1, CO4, CO6
Unit 5	**Actuator-II**	
A	Mechanical drivers, Relay, Solenoid, Speaker	CO1, CO5, CO6
B	DC motor (one direction)	CO1, CO5, CO6
C	Stepper motor, Servomotor	CO1, CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Internet of Things, by the IOT-OPEN.EU consortium: 2016–2019, Erasmus+ 2. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies &Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Development Copyrights ,2014. 3. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015	
Other References	1. Editors OvidiuVermesan Peter Friess,'Internet of Things – From Research and Innovation to Market.Deployment', River Publishers, 2014. 2. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the general concepts of sensors used in IoT	
2.	CO2: Classify proximity, ultrasound and motion sensors based on knowledge and principles of working.	
3.	CO3: Compare various environmental sensors.	
4.	CO4: List the various optical device drivers and displays actuators for IoT.	
5.	CO5: Examine the mechanical drivers, DC motor and servo motor actuators for IoT.	
6.	CO6: Develop the small IoT projects based on sensors & actuators.	

PO and PSO mapping with level of strength for Course Name IoT: Sensing & Actuator Devices (Course Code CSI302)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI302 _IoT: Sensing & Actuator Devices	CO1	2	1	1	1	1	1	1	1	-	1	-	2	1	-	-
	CO2	2	2	1	1	1	2	2	1	2	2	2	2	2	1	1
	CO3	2	2	1	1	1	2	3	1	2	2	2	2	2	1	1
	CO4	2	2	1	1	1	2	1	1	2	2	2	2	2	1	1
	CO5	2	2	1	1	1	2	1	1	2	2	2	2	2	1	1
	CO6	3	3	3	3	2	3	2	1	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI302	IoT: Sensing & Actuator Devices	2.2	2.0	1.3	1.3	1.2	2.0	1.7	1.0	2.2	2.0	2.2	2.2	2.0	1.4	1.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CIP302	
2	Course Title	IoT: Sensing & Actuator Devices Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	The objective of this course is to introduce the students the fundamental principles of sensing technology. Also to explain the characteristics and interfacing techniques with different types of sensors and actuators.	
6	Course Outcomes	CO1: Demonstrate the use of general sensors in IoT CO2: Illustrate the use of electrical, proximity and distance sensors. CO3: Experiment with various ultrasound and motion sensors CO4: Examine the use of various environmental sensors and optical devices. CO5: Design the IoT application using mechanical drivers, DC motor and servo motor actuators. CO6: Develop the small IoT projects based on sensors & actuators.	
7	Course Description	This course gives an overview of sensors used in IoT with sampling frequency and bandwidth requirements for different sensors. The course also describes the interface common sensors and actuators to IoT development kits.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Sensors and Sensing**	
		Touch sensors: Button, Force sensor Capacitive sensor	CO1, CO6
		Light sensors: Photoresistor, Photodiode, Phototransistor	CO1, CO6
	Unit 2	**Sensors and Sensing-I**	
		Electrical characteristic sensors: Voltage sensor Current sensor	CO2, CO6
		Proximity and distance sensors: Optocoupler, Infrared sensor	CO2, CO6
	Unit 3	**Sensors and Sensing-II**	
		Ultrasound sensor, Motion detector	CO3, CO6
		Angle sensors: Potentiometer, The inertial measurement unit (IMU), Hall sensor, Global positioning system	CO3, CO6
	Unit 4	**Actuator-I**	
		Implementation of Environment sensors	CO4, CO6
		Implementation of LCD, LED, OLED	CO4, CO6
	Unit 5	**Actuators-II**	
		Mechanical drivers, Relay, Solenoid, Speaker	CO5, CO6
		DC motor (one direction), Stepper motor, Servomotor	CO5, CO6
	Mode of	Jury/Practical/Viva	

examination			
Weightage Distribution	CA 60%	MTE 0%	ETE 40%
Text book/s*	4. Internet of Things, by the IOT-OPEN.EU consortium: 2016–2019, Erasmus+ 5. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies &Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Development Copyrights ,2014. 6. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015		
Other References	3. Editors OvidiuVermesan Peter Friess,'Internet of Things – From Research and Innovation to Market.Deployment', River Publishers, 2014. 4. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.		

PO and PSO mapping with level of strength for IoT: Sensing & Actuator Devices Lab (Course Code CIP302)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP302 _IoT: Sensing & Actuator Devices Lab	CO1	3	2	2	2	3	1	1	-	3	3	3	2	1	-	-
	CO2	3	3	2	2	3	2	2	-	3	3	3	2	2	2	-
	CO3	3	3	2	2	3	2	3	-	3	3	3	2	2	2	-
	CO4	3	3	2	2	3	2	1	-	3	3	3	2	2	2	-
	CO5	3	3	2	2	3	2	1	2	3	3	3	2	2	2	-
	CO6	3	3	3	3	3	3	2	2	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP302	IoT: Sensing & Actuator Devices Lab	3.0	2.8	2.2	2.2	3.0	2.0	1.7	2.0	3.0	3.0	3.0	2.2	2.0	2.2	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	

1	Course Code	CSI303	
2	Course Title	Wireless Technologies for IoT	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	This aim of this course is to introduce relevant concepts and emerging trends in wireless technology and its applications.	
6	Course Outcomes	CO1: Develop the basic concept of RF signals and wireless communication CO2: Identify the concepts of cellular network and generations of mobile communication CO3: List the various organization protocols of WLAN CO4: Interpret Wi-Fi hardware and software for appropriate functions CO5: Explain the functions of wireless PAN with Bluetooth, wifi and 6LoPAN CO6: Design IoT based solutions using the wireless technologies.	
7	Course Description	Wireless and mobile systems have become ubiquitous; playing a significant role in our everyday life. However, the increasing demand for wireless connectivity and the emergence of new areas such as the Internet of Things present new research challenges.	
8	Outline syllabus		CO Mapping
	Unit 1	**RF Basics: Radio Frequency (RF) Fundamentals:**	
	A	Introduction to RF & Wireless Communications Systems, RF and Microwave Spectral Analysis, Communication Standards	CO1
	B	Understanding RF & Microwave Specifications. Spectrum Analysis of RF Environment, Protocol Analysis of RF Environment, Units of RF measurements	CO1
	C	Factors affecting network range and speed, Environment, Line-of-sight, Interference, Defining differences between physical layers- OFDM.	CO1
	Unit 2	**Cellular Standards**	
	A	Cellular carriers and Frequencies, Channel allocation, Cell coverage, Cell Splitting, Microcells, Picocells	CO1, CO2
	B	Handoff, 1st, 2nd, 3rd and 4th Generation Cellular Systems (GSM, CDMA, GPRS, EDGE,UMTS),	CO1, CO2
	C	Mobile IP, WCDMA, Data Protocols (MQTT, CoAP)	CO1, CO2
	Unit 3	**WLAN**	
	A	Wi-Fi Organizations and Standards: IEEE, Wi-Fi Alliance, WLAN Connectivity	CO1, CO2, CO3
	B	WLAN QoS & Power-Save, IEEE 802.11 Standards	CO1, CO2, CO3

C	IEEE 802.11 Standards: 802.11- 2007, 802.11a/b/g, IEEE 802.11e/h/i,802.11n	CO1, CO2, CO3
Unit 4	**Wi-Fi Hardware & Software**	
A	Access Points, WLAN Routers, WLAN Bridges, WLAN Repeaters,	CO1, CO2, CO4
B	Direct-connect Aps, Distributed connect Aps, PoE Infrastructure	CO1, CO2, CO4
C	Endpoint, Client hardware and software, Wi-Fi Applications	CO1, CO2, CO4
Unit 5	**WSN & WPN**	
A	Wireless Personal Area Networks, Bluetooth, Bluetooth Standards, BlueTooth Protocol Architecture,	CO5, CO6
B	UWB, IEEE 802.15.4 standards, ZigBee, 6LoWPAN, Sub GHz, Sensor Networks,	CO5, CO6
C	Coexistence strategies in Sensor Networks, Routing protocols in Wireless Sensor Networks.	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Rappaport Theodore S "Wireless Communication, Principle and Practice", Second Edition, Pearson, 2015.	
Other References	1. Aditya K Jagannatham , Principles of Modern Wireless Communication Systems' .1st Edition, Mcgraw Hill.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Develop the basic concept of RF signals and wireless communication	PO1, PO3, PO9, PO10, PO12
2.	CO2: Identify the concepts of cellular network and generations of mobile communication	PO1, PO2, PO8, PO9, PO10, PO12
3.	CO3: List the various organization protocols of WLAN	PO1, PO2, PO4, PO8, PO9, PO10, PO11, PO12
4.	CO4: Interpret Wi-Fi hardware and software for appropriate functions	PO1, PO2, PO3, PO8, PO9, PO10, PO11, PO12
5.	CO5: Explain the functions of wireless PAN with Bluetooth, wifi and 6LoPAN	PO1, PO2, PO4, PO5, PO7, PO8, PO9, PO10, PO11, PO12, PSO1
6.	CO6: Design IoT based solutions using the wireless technologies.	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Wireless Technologies for IoT (Course Code CSI303)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI303 _Wireless Technologies for IoT	CO1	3	-	2	-	-	-	-	-	1	2	-	1	-	-	-
	CO2	3	2	-	-	-	-	-	1	1	2	-	1	-	-	-
	CO3	3	2	-	2	-	-	-	2	2	2	2	2	-	-	-
	CO4	3	2	2	-	-	-	-	2	2	2	2	2	-	-	-
	CO5	3	2	-	2	3	-	3	2	3	2	3	3	2	-	-
	CO6	3	3	3	3	3	-	3	3	3	3	3	3	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI303	Wireless Technologies for IoT	3.0	2.2	2.3	2.3	3.0	-	3.0	2.0	2.0	2.2	2.5	2.0	2.0	3.0	3.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	

1	Course Code	CIP303	
2	Course Title	Wireless Technologies for IoT Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Core	
5	Course Objective	Study the wireless channel characteristics and performance issues. • Discuss cellular communication and modulation schemes. • Review next generation cellular standards.	
6	Course Outcomes	CO1: Utilize the path loss model to find the losses CO2: Experiment with Communication Tool box in MATLAB CO3: Inspect WLAN Multipath Channel CO4: Make use of Simulink in MATLAB CO5: Develop Spread spectrum schemes on Simulink CO6: Utilize the wireless technologies for IoT based solutions.	
7	Course Description	This course reviews the various communication standards in wireless domain. This course will provide students an understanding about the wireless standards, modes of communication and efficiency criteria	
8	Outline syllabus		CO Mapping
	Unit 1	**Free space Propagation**	
		Path Loss model to determine the free space loss.	CO1,CO6
		Path Loss model to determine the power received using Matlab program	CO1,CO6
	Unit 2	**Introduction to the IEEE80211.a WLAN PHY Communication Toolbox in MATLAB**	
		What is IEEE 802.11a WLAN PHY? Briefly explain the functions of each blue block in the model diagram.	CO2,CO6
		What type of shadowing is IEEE802.11 WLAN based on.	CO2,CO6
	Unit 3	**Investigation on WLAN Multipath Channel**	
		Plot BER-SNR and Bit Rate-SNR graphs for different types of fading channel i. No Fading ii. Flat Fading iii. Dispersive Fading	CO3,CO6
		Plot BER-SNR and Bit Rate-SNR graphs for different types of fading channel for Dispersive Fading	CO3,CO6
	Unit 4	**Introduction to Simulink**	
		Familiarize with the block components of Simulink in MATLAB	CO4,CO6
		Setup a basic integrator for a square wave input and note the parameters like amplitude, frequency etc	CO4,CO6
	Unit 5	**Implementation of Spread spectrum Simulink**	
		Implement a Direct Sequence Spread Spectrum with Matlab Simulink	CO5,CO6
		Implement a simple steganography system which can	CO5,CO6

	send a hidden text message enveloped by a speech signal using DSSS
Mode of examination	Jury/Practical/Viva
Weightage Distribution	CA 60% MTE 0% ETE 40%
Text book/s*	Rappaport Theodore S "Wireless Communication, Principle and Practice", Second Edition, Pearson, 2015.
Other References	Aditya K Jagannatham , Principles of Modern Wireless Communication Systems' .1st Edition, Mcgraw Hill.

PO and PSO mapping with level of strength for Course Name Wireless Technologies for IoT Lab (Course Code CIP303)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP303 _Wireless Technologies for IoT Lab	CO1	3	3	-	-	2	-	-	-	2	-	-	3	-	-	-
	CO2	3	3	2	-	3	3	-	-	2	-	-	3	3	2	-
	CO3	3	3	3	2	3	3	-	-	3	-	2	3	3	2	-
	CO4	3	3	3	2	3	3	-	-	3	-	2	3	3	2	-
	CO5	3	3	3	2	3	3	-	-	3	-	3	3	3	3	-
	CO6	3	3	3	3	3	3	-	-	3	-	3	3	3	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CIP303	Wireless Technologies for IoT Lab	3.0	3.0	2.8	2.3	2.8	3.0	-	-	2.7	-	2.5	3.0	3.0	2.4	-

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	

1	Course Code	CSI401	
2	Course Title	Internet of Things Security	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	The aim of this course is to educate students on key areas in IoT security. This also discusses the security challenges and then provides answers on how to successfully manage IoT security and build a safe infrastructure for smart devices.	
6	Course Outcomes	CO1: Define the concepts to IoT security in enterprise. CO2: Outline IoT security and vulnerability threats. CO3: Compare different IoT protocols and their security measures. CO4: Examine how to secure an IoT development CO5: Explain the Identity and Access Management (IAM) Solutions for the IoT CO6: Choose individual components that can affect the security posture of the entire system	
7	Course Description	This course describes how to implement cybersecurity solutions, IoT design best practices, and risk mitigation methodologies to address device and infrastructure threats to IoT solutions.	
8	Outline syllabus		CO Mapping
	Unit 1	**IoT in the Enterprise**	
	A	Defining the IoT, Cybersecurity versus IoT security and cyber-physical systems, IoT uses today	CO1
	B	IoT device lifecycle, The hardware, Operating systems, IoT communications, Messaging protocols, Transport protocols, Network protocols	CO1
	C	Data link and physical protocols, IoT data collection, storage, and analytics, IoT integration platforms and solutions, Need to secure IoT	CO1
	Unit 2	**Vulnerabilities, Attacks, and Countermeasures**	
	A	Primer on threats, vulnerability, and risks (TVR)	CO2, CO6
	B	Common IoT attacks, Today's IoT attacks	CO2, CO6
	C	Threat modeling an IoT system	CO2, CO6
	Unit 3	**Security Engineering for IoT Development**	
	A	Building security in to design and development, Security in agile developments, Focusing on the IoT device in operation	CO3, CO6
	B	Safety and security design, Processes and agreements	CO3, CO6
	C	Technology selection – security products and services	CO3, CO6
	Unit 4	**Cryptography and its role in securing the IoT**	
	A	Types and uses of cryptographic primitives in the IoT,	CO4, CO6

	Encryption and decryption, Hashes, Digital Signatures, Random number generation, Cipher suites	
B	Cryptographic key management fundamentals	CO4, CO6
C	Cryptographic controls built into IoT communication and messaging protocols	CO4, CO6
Unit 5	**Identity and Access Management (IAM) Solutions for the IoT**	
A	The identity lifecycle, Establish naming conventions and uniqueness requirements	CO5, CO6
B	Authentication credentials: Passwords, Symmetric Keys, Certificates, Biometrics	CO5, CO6
C	IoT IAM infrastructure, Authorization and access control	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Practical Internet of Things Security, Brian Russell, Drew Van DurenCopyright © 2016 Packt Publishing	
Other References	1. A Beginner's Guide to Internet of Things Security, Attacks, Applications, Authentication, and Fundamentals, B. B. Gupta and Aakanksha Tewari, CRC Press 2. Internet of Things Security, Challenges, Advances, and Analytics, Chintan Patel and Nishant Doshi, CRC Press	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the concepts to IoT security in enterprise.	PO1, PO2, PO3, PO4, PO8, PO12
2.	CO2: Outline IoT security and vulnerability threats.	PO1, PO2, PO3, PO4, PO8, PO12
3.	CO3: Compare different IoT protocols and their security measures.	PO1, PO2, PO3, PO4, PO5, PO8, PO12
4.	CO4: Examine how to secure an IoT development	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Explain the Identity and Access Management (IAM) Solutions for the IoT	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO11, PO12, PSO1
6.	CO6: Choose individual components that can affect the security posture of the entire system	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Internet of Things Security (Course Code CSI401)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI401 _Internet of Things Security	CO1	3	1	2	1	-	-	-	2	-	-	-	2	-	-	-
	CO2	3	1	1	1	-	-	-	2	-	-	-	2	-	-	-
	CO3	3	2	2	2	2	-	-	2	-	-	-	2	-	-	-
	CO4	3	3	3	3	2	2	-	3	3	3	3	3	2	2	3
	CO5	3	3	3	3	2	2	-	1	2	-	2	3	2	-	-
	CO6	3	3	3	3	3	3	-	2	3	3	3	3	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI401	Internet of Things Security	3.0	2.2	2.3	2.2	2.3	2.3	--	2.0	2.7	3.0	2.7	2.5	2.0	2.5	3.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

SHARDA UNIVERSITY
Beyond Boundaries

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CSI011	
2	Course Title	Android with IoT	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	This course aim to give an overview of Android with IoT, its architecture, challenges and applications in different context.	
6	Course Outcomes	CO1: Define the basics of Android platform CO2: Outline the Components of Android CO3: Identify IoT ecosystem and role of the Android Things CO4: Analyze Android Things with IoT cloud platforms CO5: Evaluate Android Things in IoT projects CO6: Develop an Android App with IoT	
7	Course Description	The course is intended to know fundamentals of Android Platform, Android application components; integration of Android with IoT, The main focus is on implementing IoT projects using Android Things.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Android Platform**	
	A	Features of Android, Architecture of Android	CO1
	B	Configuration of android SDK	CO1
	C	Android application structure, Generation of APK Files for Android Projects	CO1
	Unit 2	**Components of Android**	
	A	Components of Android architecture	CO1, CO2
	B	Activity, Activity life cycle	CO1, CO2
	C	Service, Service life cycle, Concept of Intent	CO1, CO2
	Unit 3	**Android and IoT**	
	A	Internet of Things overview & its components	CO3
	B	Android Things overview, Android Things board compatibility	CO3
	C	Installation of Android Things	CO3
	Unit 4	**Integrate Android Things with IoT Cloud Platforms**	
	A	IoT cloud architecture & IoT cloud platform overview	CO3, CO4
	B	IoT cloud architecture overview	CO3, CO4
	C	Android with Android Things	CO3, CO4
	Unit 5	**Android Things**	
	A	Creating the first Android Things project	CO5, CO6
	B	Streaming data to the IoT cloud platform	CO5, CO6
	C	Developing an Android app to retrieves data from Android Things	CO5, CO6
	Mode of examination	Theory/Jury/Practical/Viva	

Weightage	CA	MTE	ETE
Distribution	30%	20%	50%

Text book/s*

1. Android Things Projects by Francesco Azzola Publisher: Packt Publishing
2. Anubhav Pradhan and Anil V. Deshpande , Composing Mobile Apps: Learn, Explore, Apply Using Android , 1st Edition, Wiley India.

Other References

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the basics of Android platform	PO1, PO5, PO10, PO11, PO12
2.	CO2: Outline the Components of Android	PO1, PO5, PO11, PO12
3.	CO3: Identify IoT ecosystem and role of the Android Things	PO1, PO2, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO3
4.	CO4: Analyze Android Things with IoT cloud platforms	PO1, PO2, PO4, PO5, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Evaluate Android Things in IoT projects	PO1, PO2, PO3,PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Develop an Android App with IoT	PO1, PO2, PO3,PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Android with IoT (Course Code CSI011)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI011 _Andro id with IoT	CO1	2	-	-	-	2	-	-	-	-	1	2	2	-	-	-
	CO2	2	-	-	-	2	-	-	-	-	-	2	2	-	-	1
	CO3	2	2	-	2	2	2	3	-	2	2	2	3	-	-	-
	CO4	2	2	-	2	2	-	-	-	2	2	2	3	1	1	3
	CO5	2	2	2	3	2	3	2	2	3	3	2	3	3	3	3
	CO6	2	3	3	3	2	3	2	2	3	3	2	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI011	Android with IoT	2.0	2.3	2.5	2.5	2.0	2.7	2.3	2.0	2.5	2.2	2.0	2.7	2.3	2.3	2.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	

1	Course Code	CIP011	
2	Course Title	Android with IoT Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Elective	
5	Course Objective	This course aim to give an overview of Android with IoT, its architecture, challenges and applications in different context.	
6	Course Outcomes	CO1: Demonstrate the basics of Android Things on Raspberry CO2: Build the Android Things project CO3: Construction of connecting control peripherals with Android Things CO4: Experiment with GPIO pins and PIR sensors using Android Things CO5: Develop a small Android App with IoT CO6: Build IoT application using Android Things	
7	Course Description	The course is intended to know fundamentals of Android Platform, Android application components; integration of Android with IoT, The main focus is on implementing IoT projects using Android Things.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
		Install Android Things on Raspberry	CO1, CO6
		Testing the installation: Connect Raspberry Pi to a video using the HDMI, Connect Raspberry Pi to your network using the LAN connection, Connect Raspberry Pi to your Mac/PC using a USB cable	CO1, CO6
	Unit 2	**Android Things Project**	
		Creating the first Android Things project	CO2, CO6
		Cloning the template project, Create the project manually	CO2, CO6
	Unit 3	**Connecting Control peripherals with Android Things**	
		Study the Android Things and how it works	CO3, CO6
		Create your first Android Things app	CO3, CO6
	Unit 4	**Android Things with IoT-I**	
		Creating an Alarm System Using Android Things	CO4, CO6
		Use GPIO pins and PIR sensors, handle events from a GPIO pin	CO4, CO6
	Unit 5	**Android Things with IoT-II**	
		Build an app that is independent of the board	CO5, CO6
		Implementation of notifying events from Android Things to Android	CO5, CO6
	Mode of	Jury/Practical/Viva	

examination			
Weightage Distribution	CA 60%	MTE 0%	ETE 40%
Text book/s*	1. Android Things Projects by Francesco Azzola Publisher: Packt Publishing 2. Anubhav Pradhan and Anil V. Deshpande , Composing Mobile Apps: Learn, Explore, Apply Using Android , 1st Edition, Wiley India.		
Other References			

PO and PSO mapping with level of strength for Android with IoT Lab (Course Code CIP011)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP011 _Android with IoT Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP011	Android with IoT Lab	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**
Department		**Department of Computer Science and Engineering**
Program:		**B.Tech**
Branch:		**CSE with Specialization in Internet of Things & Applications**
1	Course Code	CSI021
2	Course Title	**Sensor-Cloud for Internet of Things**
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	Elective
5	Course Objective	The objective of this course is to address the topic of resource management, virtualization, and green computation within cloud servers. It also covers the emergence and evolution of sensor-cloud directly that facilitates the growth of IoT through its architecture, functionalities, and life cycle.
6	Course Outcomes	CO1: Recall the history and evolution of Cloud-Computing with different cloud deployment and service models. CO2: Outline the challenges and constraints of sensor network CO3: Explain architecture and virtualization concept for Sensor-Cloud CO4: Analyze the data management concept for Sensor-Cloud CO5: Assess various contributions that enable IoT through Sensor-Cloud CO6: Design and develop small applications based on Sensor-Cloud
7	Course Description	SensorCloud is an IoT cloud that provides the Platform as a Service (PasS) to gather, visualize, monitor, and analyze the information coming into sensors connected by wire or wirelessly. The course describes the different challenges in realizing IoT in practice and presents the sensor-cloud paradigms.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	History and evolution of Cloud Computing, Classification of Cloud Computing, Cloud Computing Deployment Models, Cloud Computing Service Models	CO1, CO6
	B	Computation in Cloud, Resource Management, Virtualization, Green Computing	CO1, CO6
	C	Cloud Applications	CO1, CO6
	Unit 2	**Sensor Networks and the Cloud**	
	A	Background of Wireless Sensor Networks, Design of a Sensor Node	CO2, CO6
	B	Applications of Sensor Networks, Challenges and Constraints	CO2, CO6
	C	Unification of WSNs with Cloud, The Significance of Cloud Computing, Challenges	CO2
	Unit 3	**Sensor-Cloud Paradigm**	
	A	Sensor-Cloud, Architecture of the Sensor-Cloud	CO3
	B	Sensor Virtualization: Configurations and Characterization of Virtualization	CO3

C	Sensor-Cloud Applications	CO3
Unit 4	**Data Flow in the Sensor-Cloud**	
A	Composition of a Virtual Sensor	CO4
B	Data Management: Data Caching	CO4
C	Data Management: Data Transmission	CO4
Unit 5	**Sensor-Cloud for Internet of Things**	
A	Scenario and model for Pricing, pH: Pricing Attributed to Hardware and Infrastructure	CO5,CO6
B	Enabling IoT through Sensor-Cloud, Contributions through Architecture and Functionalities	CO5, CO6
C	Contributions through the Life Cycle	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things, Sudip Misra, Subhadeep Sarkar and Subarna Chatterjee, CRC Press	
Other References	1. The Internet of Things in the Cloud, A Middleware Perspective, Honbo Zhou, CRC Press 2. The Cloud in IoT-enabled Spaces, Fadi Al-Turjman, CRC Press	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Recall the history and evolution of Cloud-Computing with different cloud deployment and service models.	PO1, PO2, PO4, PO6, PO9, PO12, PSO2
2.	CO2: Outline the challenges and constraints of sensor network	PO1, PO2, PO4, PO6, PO9, PO12, PSO2
3.	CO3: Explain architecture and virtualization concept for Sensor-Cloud	PO1, PO2, PO3, PO4, PO6, PO9, PO10, PO12, PSO2
4.	CO4: Analyze the data management concept for Sensor-Cloud	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PO12, PSO2
5.	CO5: Assess various contributions that enable IoT through Sensor-Cloud	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PO11, PO12, PSO2
6.	CO6: Design and develop small applications based on Sensor-Cloud	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Sensor-Cloud for Internet of Things (Course Code CSI021)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI021 _Sensor -Cloud for Internet of Things	CO1	2	2	-	2	-	1	-	-	1	-	-	2	-	1	-
	CO2	2	2	-	2	-	1	-	-	1	-	-	2	-	1	-
	CO3	2	1	1	2	-	1	-	-	1	1	-	2	-	2	-
	CO4	2	2	1	2	-	1	2	-	2	1	-	3	-	2	-
	CO5	2	2	2	2	-	1	2	-	2	1	2	3	2	2	-
	CO6	3	3	3	2	3	2	2	2	2	2	2	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI021	Sensor-Cloud for Internet of Things	2.2	2.0	1.8	2.0	3.0	1.2	2.0	2.0	1.5	1.3	2.0	2.5	2.5	1.8	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: **School of Engineering and technology**
Department **Department of Computer Science and Engineering**
Program: **B.Tech**
Branch: **CSE with Specialization in Internet of Things & Applications**

1	Course Code	CIP021
2	Course Title	Sensor-Cloud for Internet of Things Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Elective
5	Course Objective	The objective of this course is use ThingSpeak to capture the real-time data of DHT11, Ultrasonic, and other sensors by Raspberry Pi and upload to the cloud for data forecasting.
6	Course Outcomes	CO1: Define the basic components of Raspberry Pi CO2: Demonstrate analog and actuators using Raspberry Pi CO3: Illustrate the use of ThingSpeak Server CO4: Build Data Logger using ThingSpeak Server CO5: Evaluate the case study with ThingSpeak Server CO6: Design and develop various applications using Raspberry Pi & ThingSpeak Server
7	Course Description	ThingSpeak is an open-source public cloud platform specially developed for IoT-based applications. Embedded IoT devices like Raspberry Pi can be connected to internet. These boards then can fetch data or upload data to Thing Speak storage using APIs.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Raspberry Pi**	
	A	Install Arduino IDE on Raspberry Pi	CO1
	B	Implement Digital Sensor with Raspberry Pi	CO1
	Unit 2	**Analog Sensors and Actuators**	
	A	Implement Analog Sensor with Raspberry Pi	CO1, CO2
	B	Implement Actuators Sensor with Raspberry Pi	CO1, CO2
	Unit 3	**ThingSpeak Server**	
	A	Introduction to DHT11 Data Logger with ThingSpeak Server	CO1, CO3
	B	Installation of DHT11 Library, Steps to Create a Channel in ThingSpeak	CO1, CO3
	Unit 4	**Sensors with ThingSpeak Server**	
	A	Ultrasonic Sensor Data Logger with ThingSpeak Server	CO1, CO3
	B	Air Quality Monitoring System and Data Logger with ThingSpeak Server	
	Unit 5	**Case Study with ThingSpeak Server**	
	A	Smart Motion Detector and Upload Image to gmail.com	
	B	Configuring Raspberry Pi with Camera and Gmail	
	Mode of examination	Theory/Jury/Practical/Viva	

Weightage Distribution	CA	MTE	ETE
	30%	20%	50%

Text book/s*	2.	Internet of Things with Raspberry Pi and Arduino, Rajesh Singh, Anita Gehlot, Lovi Raj Gupta et.al, CRC Press
	3.	Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things, Sudip Misra, Subhadeep Sarkar and Subarna Chatterjee, CRC Press
Other References	3.	The Internet of Things in the Cloud, A Middleware Perspective, Honbo Zhou, CRC Press
	4.	The Cloud in IoT-enabled Spaces, Fadi Al-Turjman, CRC Press

PO and PSO mapping with level of strength for Course Name Sensor-Cloud for Internet of Things Lab (Course Code CIP021)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP021 _Sensor -Cloud for Internet of Things Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CIP021	Sensor-Cloud for Internet of Things Lab	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CSI022	
2	Course Title	**Wireless Sensor Network**	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	This course aim to give knowledge of mobile ad hoc networks, design and implementation issues, and available solutions. This course also covers routing mechanisms and the three classes of approaches: proactive, on-demand, and hybrid, clustering mechanisms, 802.11 Wireless Lan (WiFi) and Bluetooth standards.	
6	Course Outcomes	CO1: Define the constraints and challenges of sensor networks CO2: Outline issues and challenges in various wireless sensor network CO3: Explain Wireless sensor network architecture and different communication standards used in WSN CO4: Categorize various routing protocols for WSN CO5: Assess various energy-aware routing protocols for wireless sensor networks CO6: Experiment with TinyOS platform for sensor networks	
7	Course Description	A wireless sensor network (WSN) generally consists of compact low power sensors, which collect information and pass the information via wireless networks to achieve a high level of desired monitoring and control in coordinated manners. WSN applications can be found in areas such as environmental monitoring, smart energy systems, battle field surveillance, home automation, medical monitoring, mobile computing, etc. WSN has integrated network engineering, embedded system engineering and sensor technology.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to Sensor Networks, Unique constraints and challenges	CO1, CO6
	B	Advantage of Sensor Networks, Applications of Sensor Networks	CO1, CO6
	C	Types of wireless sensor networks	CO1, CO6
	Unit 2	**Issues and challenges in Wireless Sensor Networks**	
	A	Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks	CO2, CO6
	B	Enabling technologies forWireless Sensor Networks	CO2, CO6
	C	Issues and challenges in wireless sensor networks	CO2
	Unit 3	**Wireless Sensor Network Architecture**	
	A	Network Protocol Stack	CO3
	B	Communication Standards: IEEE 802.11, IEEE 802.15.4	CO3

C	Communication Standards: ZigBee, 6LoWPAN	CO3
Unit 4	**Routing in WSN**	
A	Flat-based Routing Algorithms, Hierarchical Routing Algorithms	CO4
B	Information Gathering Based on Geographic Locations: Geographical Routing, Landmark-based Routing	CO4
C	Data Aggregation, Content-based Naming	CO4
Unit 5	**Energy Management in WSN**	
A	Duty Cycling, Independent and Dependent Strategies	CO5,CO6
B	Energy-aware Routing Protocols: Hierarchical Energy-aware Routing	CO5, CO6
C	Location-based Routing and Data Aggregation-based Routing	CO5, CO6

Mode of examination	Theory/Jury/Practical/Viva		
Weightage Distribution	CA 30%	MTE 20%	ETE 50%

Text book/s*

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications, 2011

Other References

1. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009
2. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
3. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
4. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the constraints and challenges of sensor networks	PO1, PO2, PO4, PO6, PO9, PO12, PSO2
2.	CO2: Outline issues and challenges in various wireless sensor network	PO1, PO2, PO4, PO6, PO9, PO12, PSO2
3.	CO3: Explain Wireless sensor network architecture and different communication standards used in WSN	PO1, PO2, PO3, PO4, PO6, PO9, PO10, PO12, PSO2
4.	CO4: Categorize various routing protocols for WSN	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PO12, PSO2
5.	CO5: Assess various energy-aware routing protocols for wireless sensor networks	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
6.	CO6: Experiment with TinyOS platform for sensor networks	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Wireless Sensor Network (Course Code CSI022)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI022 _Wireless Sensor Network	CO1	2	2	-	2	-	2	-	-	1	-	-	2	-	1	-
	CO2	2	2	-	2	-	2	-	-	1	-	-	2	-	1	-
	CO3	2	1	1	2	-	2	-	-	2	2	-	2	-	2	-
	CO4	2	2	1	2	-	2	2	-	2	2	-	3	-	2	-
	CO5	2	2	3	2	-	2	2	-	3	2	2	3	2	3	-
	CO6	3	3	3	2	3	2	2	2	3	2	2	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI022	Wireless Sensor Network	2.2	2.0	2.0	2.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CIP022	
2	Course Title	Wireless Sensor Network IoT Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Elective	
5	Course Objective	The aim of this course is to provide practical knowledge of wireless sensor network components with their design principles.	
6	Course Outcomes	CO1: Outline the basic wireless sensor network components. CO2: Demonstrate TinyOS required for compiling and executing example codes. CO3: Utilize TinyOS programming concepts required to gather and sending the data. CO4: Evaluate the simulation of WSN with Tiny OS. CO5: Interpret and visualize the data collected from sensors. CO6: Experiment with TinyOS platform for sensor networks	
7	Course Description	This lab is an introductory course for wireless sensor networks. Students will get hands-on experience working with sensor motes and TinyOS application development through simulation and implementation on the real hardware.	
8	Outline syllabus		CO Mapping
	Unit 1	**Basics of WSN components**	
		Practical study of all hardware components related to WSNs	CO1, CO6
		Basics of WSN programming concept, General overview of TinyOS	CO1, CO6
	Unit 2	**Practice with TinyOS**	
		Downloading, installing the most recent version of TinyOS	CO2, CO6
		Simple example code that compiles, Guide to getting going with TelosB motes	CO2, CO6
	Unit 3	**Getting Relevant Data**	
		An introduction to TinyOS programming	CO3, CO6
		Sensing data using WSN motes, Gathering relevant data only	CO3, CO6
	Unit 4	**Simulation in TinyOS**	
		Simulating WSNs made up of motes running TinyOS	CO4, CO6
		TinyOS simulation framework TOSSIM	CO4, CO6
	Unit 5	**Visualization**	
		Sensing audio data and interpreting results.	CO5, CO6
		Sensing positioning data using GPS and transmitting it.	CO5, CO6
	Mode of examination	Jury/Practical/Viva	
	Weightage	CA MTE ETE	

Distribution 60% 0% 40%

Text book/s* 1. Hands-On Artificial Intelligence for IoT, Amita Kapoor, Publisher: Packt Publishing

Other References

PO and PSO mapping with level of strength for Wireless Sensor Network IoT Lab (Course Code CIP022)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP022 _Wireless Sensor Network IoT Lab	CO1	2	1	-	-	2	-	-	-	-	-	-	2	-	-	-
	CO2	3	2	1	1	3	-	2	-	1	1	1	2	1	2	2
	CO3	3	1	2	2	3	1	3	-	2	2	2	2	3	2	2
	CO4	3	2	2	2	2	1	3	-	2	2	2	2	1	2	2
	CO5	3	2	2	2	3	2	3	-	3	3	3	3	2	3	3
	CO6	3	2	3	2	3	2	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP022	Wireless Sensor Network IoT Lab	2.8	1.7	2.0	1.8	2.7	1.5	2.8	2.0	2.2	2.2	2.2	2.3	2.0	2.4	2.4

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	

1	Course Code	CSI023	
2	Course Title	Micro-controller programming using Arduino	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Core	
5	Course Objective	This Course provides the basics of micro-controllers and sensors very quickly and can start building prototype with very little investment. This course is intended to make you comfortable in getting started with Arduino.	
6	Course Outcomes	CO1: Define Arduino programming language and IDE CO2: Illustrate the syntax and structure of Arduino Programming for IoT applications CO3: Explain various decision making statements and use with digital I/O functions available. CO4: Identify functions to read, interpret, and output analog signals. CO5: Determine the working of advance functions and interrupts with the Arduino's hardware interrupt pins. CO6: Design embedded applications using Arduino Platform	
7	Course Description	Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.	
8	Outline syllabus		CO Mapping
	Unit 1	**The Arduino Ecosystem**	
	A	The Arduino Platform, Hardware List, Installing the Software	CO1, CO6
	B	Connecting the Arduino, Opening a Sketch, Selecting the Board and Serial Port, Uploading a Sketch	CO1, CO6
	C	Sketching in Code: Uploading the Source Code	CO1, CO6
	Unit 2	**The Structure of Arduino C**	
	A	Using Comments, Basic Functions, Statements and Syntax	CO1, CO2, CO6
	B	Verifying and Uploading, Working with Variables: Variables, Declaring Variables, Variable Names, Data Types	CO1, CO2, CO6
	C	Variable Qualifiers, Predefined Constants, Variable Scope, Using Operators	CO1, CO2, CO6
	Unit 3	**Decision Making Statements & Digital I/O**	
	A	Comparative and Logical Operators, Control	CO1, CO2,

	Statements: If, For, While, Do, Control Statements: Switch, Break, Continue	CO3, CO6
B	Arduino I/O Demystified, Digital Functions: pinMode(), digitalWrite(), digitalRead()	CO1, CO2, CO3, CO6
C	State Changes, Toggle, Counting, Modality	CO1, CO2, CO3, CO6
Unit 4	**Analog I/O**	
A	Analog Demystified, Analog Functions: analogRead(), analogWrite(), analogReference()	CO1, CO2, CO4, CO6
B	Analog Serial Monitor: Reading Analog Values, Using the Serial Monitor	CO1, CO2, CO4, CO6
C	Mapping Values: map(), constrain()	CO1, CO2, CO4, CO6
Unit 5	**Advanced Functions**	
A	Timing Functions, Random Functions, Writing Functions	CO5, CO6
B	Declaring Functions, Calling Functions, Function Returns, Function Parameters	CO5, CO6
C	Hardware Interrupts: attachInterrupt(), detachInterrupt()	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Beginning Arduino Programming, Brian Evans, Apress	
Other References	1. Arduino: A Quick-Start Guide, Second Edition, Maik Schmidt	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define Arduino programming language and IDE	PO1, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
2.	CO2: Illustrate the syntax and structure of Arduino Programming for IoT applications	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Explain various decision making statements and use with digital I/O functions available.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Identify functions to read, interpret, and output analog signals.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Determine the working of advance functions and interrupts with the Arduino's hardware interrupt pins.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Design embedded applications using Arduino Platform	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Micro-controller programming using Arduino (Course Code CSI023)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI023 _Micro-controller programming using Arduino	CO1	2	-	-	1	2	2	-	-	1	1	1	2	2	1	1
	CO2	2	2	2	1	2	2	2	-	1	1	1	2	2	1	1
	CO3	2	2	2	2	3	2	2	-	2	2	2	2	3	2	1
	CO4	2	3	2	2	3	2	2	-	2	2	2	2	3	2	1
	CO5	2	3	3	3	3	2	2	2	2	2	2	2	3	3	1
	CO6	3	3	3	3	3	2	2	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI023	Micro-controller programming using Arduino	2.2	2.6	2.4	2.0	2.7	2.0	2.0	2.5	1.8	1.8	1.8	2.2	2.7	2.0	1.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CIP023
2	Course Title	Micro-controller programming using Arduino Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Core
5	Course Objective	With Arduino, the student can get to know the basics of micro-controllers and sensors very quickly and can start building prototype with very little investment. This course is intended to make you comfortable in getting started with Arduino.
6	Course Outcomes	CO1: Demonstrate Arduino programming language and IDE CO2: Experiment with variables in Arduino Programming CO3: Construct various decision making statements and use with digital I/O functions available. CO4: Implement functions to read, interpret, and output analog signals. CO5: Elaborate the working of advance functions with the Arduino's CO6: Design embedded applications using Arduino Platform
7	Course Description	Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.

8	Outline syllabus		CO Mapping
	Unit 1	**Arduino Platform** Introduction to Arduino Platform, the components that make up an Arduino board and their functions. Installing and working with Arduino.	
	Unit 2	**Working with Variables** Implement RGB Blink: Uploading the Source Code Implement 7-Color Blink: Uploading the Source Code	
	Unit 3	**Digital Ins and Outs** Implement Tilt Blink: Uploading the Source Code Implement Noisy Cricket: Uploading the Source Code	
	Unit 4	**Analog Ins and Outs** Implement Telematic Breath: Uploading the Source Code Implement Ambient Temps: Uploading the Source Code	
	Unit 5	**Advanced Functions** Implement HSB Color Mixer: Uploading the Source Code	

	Implementing a case study based on the above concepts.
Mode of examination	Jury/Practical/Viva
Weightage Distribution	CA 60% | MTE 0% | ETE 40%
Text book/s*	-
Other References	

PO and PSO mapping with level of strength for Course Name Micro-controller programming using Arduino Lab (Course Code CIP023)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP023 _Micro-controller programming using Arduino Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CIP023	Micro-controller programming using Arduino Lab	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***
3. Addressed to ***Substantial (High=3)*** ***extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	

1	Course Code	CSI024	
2	Course Title	Raspberry Pi and its Programming	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	The primary objective of this course to provide a platform to get started with the Internet of Things with Raspberry Pi along with the basic knowledge of programming and interfacing of the input/output devices.	
6	Course Outcomes	CO1: List the hardware components of Raspberry Pi CO2: Demonstrate the programming concepts using Raspberry Pi CO3: Build Relay, DC Motor and LCD interfaces using Raspberry Pi CO4: Construct interfaces for DHT11, ultrasonic sensor and camera using Raspberry Pi CO5: Implementation of various analog and digital sensors using Raspberry Pi CO6: Design and develop various applications using Raspberry Pi	
7	Course Description	This course provides a gradual pace of basic concepts to advanced interfacing and programming of Raspberry Pi for IoT based projects.	
8	Outline syllabus		CO Mapping
	Unit 1	**Basics of Raspberry Pi**	
	A	Introduction to Raspberry Pi, Raspberry Pi Components	CO1, CO6
	B	Installation of NOOBS on SD Card and Raspbian on SD Card, Terminal Commands, Installation of Libraries on Raspberry Pi	CO1, CO6
	C	Getting the Static IP Address of Raspberry Pi, Run a Program on Raspberry Pi, Installing the Remote Desktop Server	CO1, CO6
	Unit 2	**Programming with Raspberry Pi**	
	A	Installation of I2C Driver on Raspberry Pi, Serial Peripheral Interface with Raspberry Pi	CO2, CO6
	B	Implementation of LED and Raspberry Pi, LED Blink Using Function, Reading the Digital Input	CO2, CO6
	C	Reading an Edge-Triggered Input: Reading Switch in Pull-Down Configuration, Reading Switch in Pull-Up Configuration	CO2
	Unit 3	**Interfacing with Raspberry Pi - I**	
	A	Interfacing of Relay with Raspberry Pi	CO3
	B	Interfacing of DC Motor with Raspberry Pi	CO3
	C	Interfacing of LCD with Raspberry Pi	CO3
	Unit 4	**Interfacing with Raspberry Pi - II**	
	A	Interfacing of DHT11 Sensor with Raspberry Pi	CO4
	B	Interfacing of Ultrasonic Sensor with Raspberry Pi	CO4

C	Interfacing of Camera with Raspberry Pi	CO4
Unit 5	**Interfacing with Raspberry Pi and Arduino**	
A	Install Arduino IDE on Raspberry Pi	CO5,CO6
B	Implementation of Digital and Analog Sensor	CO5, CO6
C	Implementation of Actuators	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	

Weightage Distribution	CA	MTE	ETE
	30%	20%	50%

Text book/s*

1. Internet of Things with Raspberry Pi and Arduino, Rajesh Singh, Anita Gehlot, Lovi Raj Gupta et.al, CRC Press

Other References

1. Programming the Raspberry Pi, Getting started with Python, Simon Monk, Mc Graw Hill
2. Python Programming for Raspberry Pi, Richard Blum, Christine Bresnahan, Pearson Education

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: List the hardware components of Raspberry Pi	PO1, PO2, PO3, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
2.	CO2: Demonstrate the programming concepts using Raspberry Pi	PO1, PO2, PO3, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
3.	CO3: Build Relay, DC Motor and LCD interfaces using Raspberry Pi	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Construct interfaces for DHT11, ultrasonic sensor and camera using Raspberry Pi	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Implementation of various analog and digital sensors using Raspberry Pi	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Design and develop various applications using Raspberry Pi	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Raspberry Pi and its Programming (Course Code CSI024)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI024 _Raspberry Pi and its Programming	CO1	2	1	1	-	3	1	1	-	1	1	2	2	1	1	-
	CO2	2	2	2	-	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CSI024	Raspberry Pi and its Programming	2.3	2.0	2.0	2.5	3.0	2.0	2.0	2.2	2.3	2.3	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***
3. Addressed to ***Substantial (High=3)*** ***extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CIP024	
2	Course Title	Raspberry Pi and its Programming Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Elective	
5	Course Objective	The primary objective of this course to provide a platform to get started with the Internet of Things with Raspberry Pi along with the basic knowledge of programming and interfacing of the input/output devices.	
6	Course Outcomes	CO1: List the basic components of Raspberry Pi CO2: Demonstrate the Face recognition and LED Blink using Raspberry Pi CO3: Demonstrate the Pull-Down and Pull-Up Configuration using Raspberry Pi CO4: Build Relay and DC Motor using Raspberry Pi CO5: Construct interfaces for LCD and ultrasonic sensor using Raspberry Pi CO6: Design and develop various applications using Raspberry Pi	
7	Course Description	This course provides a gradual pace of basic concepts to advanced interfacing and programming of Raspberry Pi for IoT based projects.	
8	Outline syllabus		CO Mapping
	Unit 1	**Basics of Raspberry Pi**	
		Installing the Remote Desktop Server	CO1, CO6
		Raspberry Pi Camera as a USB Video Device	CO1, CO6
	Unit 2	**Programming with Raspberry Pi-I**	
		Face Recognition Using Raspberry Pi	CO2, CO6
		LED Blink Using Function	CO2, CO6
	Unit 3	**Programming with Raspberry Pi-II**	
		Pull-Down Configuration	CO3, CO6
		Pull-Up Configuration	CO3, CO6
	Unit 4	**Interfacing with Raspberry Pi - I**	
		Interfacing of Relay with Raspberry Pi	CO4, CO6
		Interfacing of DC Motor with Raspberry Pi	CO4, CO6
	Unit 5	**Interfacing with Raspberry Pi - II**	
		Interfacing of LCD with Raspberry Pi	CO5, CO6
		Interfacing of Ultrasonic Sensor with Raspberry Pi	CO5, CO6
	Mode of examination	Jury/Practical/Viva	
	Weightage Distribution	CA 60% MTE 0% ETE 40%	
	Text book/s*	2. Internet of Things with Raspberry Pi and Arduino, Anita Gehlot, Lovi Raj Gupta et.al,	

CRC Press

Other References

3. Programming the Raspberry Pi, Getting started with Python, Simon Monk, Mc Graw Hill
4. Python Programming for Raspberry Pi, Richard Blum, Christine Bresnahan, Pearson Education

PO and PSO mapping with level of strength for Raspberry Pi and its Programming Lab (Course Code CIP024)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP024 _Raspberry Pi and its Programming Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CIP024	Raspberry Pi and its Programming Lab	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CSI031	
2	Course Title	Artificial Intelligence for IoT	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Elective	
5	Course Objective	The aim of this course is to cover various aspects of artificial intelligence (AI) and its implementation to make IoT solutions smarter.	
6	Course Outcomes	CO1: Understand the principles and foundations of IoT and AI CO2: Demonstrate different ML paradigms for IoT based applications CO3: Construct IoT based applications with Naïve Bayes, Decision tree and ensemble learning. CO4: Improving the model using various techniques CO5: Implementing AI from case study of Smart Cities CO6: Apply different AI techniques including machine learning using TensorFlow and Keras	
7	Course Description	This course describes basic understanding of machine learning concepts. This course also involves the AI and ML techniques to develop smart systems for IoT.	
8	Outline syllabus		CO Mapping
	Unit 1	**Principles and Foundations of IoT and AI**	
	A	IoT Reference Model, IoT platforms, IoT verticals	CO1
	B	Big data and IoT, Infusion of AI- data science in IoT	CO1
	C	Cross-industry standard process for data mining, AI platforms and IoT platforms	CO1
	Unit 2	**Machine Learning for IoT-I**	
	A	ML and IoT, Learning paradigms, Prediction using linear regression	CO2, CO6
	B	Logistic regression for classification: Cross-entropy loss function	CO2, CO6
	C	Classification using support vector machines, Maximum margin hyperplane, Kernel trick	CO2, CO6
	Unit 3	**Machine Learning for IoT-II**	
	A	Naive Bayes	CO3, CO6
	B	Decision trees: Decision trees in scikit, Decision trees in action	CO3, CO6
	C	Ensemble learning: Voting classifier, Bagging and pasting	CO3, CO6
	Unit 4	**Improving the model**	
	A	Feature scaling to resolve uneven data scale	CO4, CO6
	B	Overfitting: Regularization, Cross-validation	CO4, CO6
	C	No Free Lunch theorem	CO4, CO6
	Unit 5	**AI for Smart Cities IoT**	

A	Need of smart cities, Components of a smart city	CO5, CO6
B	Smart traffic management, Smart parking, Smart waste management	CO5, CO6
C	Smart policing, Smart lighting, Smart governance	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	

Weightage	CA	MTE	ETE
Distribution	30%	20%	50%
Text book/s*	1. Hands-On Artificial Intelligence for IoT, Amita Kapoor, Publisher: Packt Publishing		
Other References			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the principles and foundations of IoT and AI	PO1, PO8, PO12
2.	CO2: Demonstrate different ML paradigms for IoT based applications	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Construct IoT based applications with Naïve Bayes, Decision tree and ensemble learning.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Improving the model using various techniques	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Implementing AI from case study of Smart Cities	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO12, PSO1, PSO2, PSO3
6.	CO6: Apply different AI techniques including machine learning using TensorFlow and Keras	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Artificial Intelligence for IoT (Course Code CSI031)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI031 _Artificial Intelligence for IoT	CO1	3	-	-	-	-	-	-	2	-	-	-	2	-	-	-
	CO2	3	2	2	2	3	2	-	-	2	2	2	2	2	2	2
	CO3	3	2	2	2	3	2	3	2	2	2	2	2	2	2	-
	CO4	3	3	3	3	3	-	-	-	2	2	-	2	2	2	2
	CO5	3	3	3	3	3	3	3	2	2	2	3	3	2	3	2
	CO6	3	3	3	3	3	3	-	2	3	3	3	3	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI031	**Artificial Intelligence for IoT**	3.0	2.6	2.6	2.6	3.0	2.5	3.0	2.0	2.2	2.2	2.5	2.3	2.0	2.4	2.3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	

1	Course Code	CIP031	
2	Course Title	Artificial Intelligence for IoT Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Elective	
5	Course Objective	The aim of this course is to cover various aspects of artificial intelligence (AI) and its implementation to make IoT solutions smarter.	
6	Course Outcomes	CO1: Understand the special DL libraries, Access and process data from various distributed sources CO2: Perform regression and logistic regressor machine learning technique for IoT data CO3: Perform SVM and Gausian Naive Bayes learning for IoT data CO4: Improving the model using various techniques CO5: Implementing AI from case study of Smart Cities CO6: Apply different AI techniques including machine learning using TensorFlow and Keras	
7	Course Description	This course describes basic understanding of machine learning concepts. This course also involves the AI and ML techniques to develop smart systems for IoT.	
8	Outline syllabus		CO Mapping
	Unit 1	**Special DL libraries**	
		Installing Tensor Flow & Keras and download datasets	CO1, CO6
		Working with different dataset formats	CO1, CO6
	Unit 2	**Machine Learning for IoT-I**	
		Electrical power output prediction using regression	CO2, CO6
		Classifying wine using logistic regressor	CO2, CO6
	Unit 3	**Machine Learning for IoT-II**	
		Classifying wine using SVM	CO3, CO6
		Gaussian Naive Bayes for wine quality	CO3, CO6
	Unit 4	**Improving the model**	
		Feature scaling to resolve uneven data scale	CO4, CO6
		Hyperparameter tuning and grid search	CO4, CO6
	Unit 5	**AI for Smart Cities IoT**	
		Adapting IoT for smart cities and the necessary steps	CO5, CO6
		Detecting crime using city's crime data	CO5, CO6
	Mode of examination	Jury/Practical/Viva	
	Weightage Distribution	CA 60% MTE 0% ETE 40%	
	Text book/s*	1. Hands-On Artificial Intelligence for IoT, Amita Kapoor, Publisher: Packt Publishing	

Other
References

PO and PSO mapping with level of strength for Artificial Intelligence for IoT Lab (Course Code CIP031)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP031 _ Artificial Intelligence for IoT Lab	CO1	2	2	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	3	3	2	2	3	2	2	2	1	1	1	3	3	2	3
	CO3	3	2	2	2	3	2	2	2	3	3	3	3	3	2	3
	CO4	3	3	2	2	3	2	2	2	3	3	3	3	3	2	3
	CO5	3	3	2	3	3	2	2	2	3	3	3	3	3	2	3
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP031	Artificial Intelligence for IoT Lab	2.8	2.7	2.0	2.4	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.8	2.7	2.0	3.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CSI032
2	Course Title	Data Analytics for IoT
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	The objective of this course is to learn techniques to solve unique problems associated with IoT and examine and analyze data from your IoT devices
6	Course Outcomes	CO1: Identify the main challenges of IoT analytics systems development and deployment. CO2: Utilize IoT, Cloud and BigData Integration for IoT Analytics CO3: Evaluate the development tools for real-life applications using IoT analytics CO4: Explain the paradigm for on-demand IoT analytics as a service based on the open source framework. CO5: Analyze the data in smart buildings, including data stemming from sensors and IoT devices. CO6: Assess the popular tools for IoT data analytics, along with their use in practical projects and applications.
7	Course Description	Data Analytics has a significant role to play in the growth and success of IoT applications and investments. There are different types of data analytics that can be used and applied in the IoT investments to gain advantages.

8	Outline syllabus		CO Mapping
	Unit 1	**Introducing IoT Analytics**	
	A	Defining IoT analytics and IoT, The concept of constrained	
	B	IoT Data and BigData, Challenges of IoT Analytics Applications	
	C	IoT Analytics Lifecycle and Techniques	
	Unit 2	**IoT, Cloud and BigData Integration for IoT Analytics**	
	A	Cloud-based IoT Platform, Data Analytics for the IoT, Data Collection Using Low-power, Long-range Radios	
	B	WAZIUP Software Platform	
	C	iKaaS Software Platform	
	Unit 3	**Development Tools for IoT Analytics Applications**	
	A	Introduction, The VITAL Architecture for IoT Analytics Applications	
	B	VITAL Development Environment: Overview, VITAL Nodes	
	C	IoT Analytics Applications	

Unit 4	**An Open Source Framework for IoT Analytics as a Service**
A	Architecture for IoT Analytics-as-a-Service, Sensing-as-a-Service Infrastructure Anatomy
B	Scheduling, Metering and Service Delivery
C	From Sensing-as-a-Service to IoT-Analytics- as-a-Service
Unit 5	**Data Analytics in Smart Buildings**
A	Addressing Energy Efficiency in Smart Buildings
B	General Architecture for Management Systems of Smart Buildings
C	IoT-based Information Management System for Energy Efficiency in Smart Buildings
Mode of examination	Theory/Jury/Practical/Viva

Weightage	CA	MTE	ETE
Distribution	30%	20%	50%
Text book/s*			
Other References			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Identify the main challenges of IoT analytics systems development and deployment.	PO1, PO2, PO4, PO12, PSO2
2.	CO2: Utilize IoT, Cloud and BigData Integration for IoT Analytics	PO1, PO4, PO5, PO11, PO12, PSO1, PSO2
3.	CO3: Evaluate the development tools for real-life applications using IoT analytics	PO1, PO2, PO3, PO4, PO5, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: Explain the paradigm for on-demand IoT analytics as a service based on the open source framework.	PO1, PO4, PO10, PO11, PO12, PSO2
5.	CO5: Analyze the data in smart buildings, including data stemming from sensors and IoT devices.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
6.	CO6: Assess the popular tools for IoT data analytics, along with their use in practical projects and applications.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Data Analytics for IoT (Course Code CSI032)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI032_ Data Analytics for IoT	CO1	2	3	-	2	-	-	-	-	-	-	-	2	-	1	-
	CO2	3	-	-	2	2	-	-	-	-	-	2	2	2	1	-
	CO3	3	2	3	2	2	-	-	-	-	2	2	2	2	1	-
	CO4	2	-	-	2	-	-	-	-	-	2	2	2	-	1	-
	CO5	3	3	3	2	2	3	2	-	2	2	2	2	2	2	-
	CO6	3	3	3	2	3	3	2	2	2	2	2	2	3	2	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI032	Data Analytics for IoT	2.7	2.8	3.0	2.0	2.3	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.3	1.3	0.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CSI033	
2	Course Title	Image Processing with IoT	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The objective of this course is to explore multiple techniques, frameworks, and libraries for capturing, processing, and displaying digital images.	
6	Course Outcomes	CO1: Recall the list the basic components of Raspberry Pi CO2: Illustrate the concept of image processing using IoT platform CO3: Make use of different basic operations on Images CO4: Assess the different advance operations on Images CO5: Apply the transformations and filter methods on images CO6: Design and develop image processing applications using Raspberry Pi	
7	Course Description	The course describes the concept of image processing with the help of Python and Raspberry Pi. This course covers an interactive GUI for the image processing demos using Tkinter, scipy.misc and scipy.ndimage etc to process images.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Raspberry Pi & Python**	
	A	The Raspberry Pi, Raspberry Pi Setup, The Raspbian OS	CO1
	B	Connecting the Raspberry Pi to a Network and to the Internet, Updating the Pi, Shutting Down and Restarting Pi	CO1
	C	Features of Python, Running a Python Program and Python Modes, IDEs for Python	CO1
	Unit 2	**Introduction to Digital Image Processing**	
	A	Signal Processing, Image Processing, Using IoT Platform and Python for Digital Image Processing (DIP)	CO1, CO2
	B	Image Sources: Using the Webcam and The Pi Camera Module	CO1, CO2
	C	Working with Images, Build in Functions, Image Properties,	CO1, CO2
	Unit 3	**Basic Operations on Images**	
	A	Image Module: Splitting and Merging Image Channels, Image Mode Conversion, Image Blending	CO3, CO6
	B	Resizing an Image, Rotating an Image, Crop and Paste Operations, Copying and Saving Images to a File	CO3, CO6
	C	Knowing the Value of a Particular Pixel, ImageChops Module, ImageOps Module	CO3, CO6
	Unit 4	**Advanced Operations on Images**	

A	The ImageFilter Module			CO4, CO6
B	The ImageEnhance Module			CO4, CO6
C	Color Quantization, Histograms and Equalization			CO4, CO6
Unit 5	**Transformations and Filters**			
A	Transformations: shift(), zoom()			CO5, CO6
B	Measurements:			CO5, CO6
C	Filters: Low-Pass, High-Pass and Fourier Filters			CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva			
Weightage Distribution	CA 30%	MTE 20%	ETE 50%	
Text book/s*	1. Raspberry Pi Image Processing Programming, Ashwin Pajankar, Apress			
Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Recall the list the basic components of Raspberry Pi	PO1, PO5, PO8, PO12
2.	CO2: Illustrate the concept of image processing using IoT platform	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Make use of different basic operations on Images	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2
4.	CO4: Assess the different advance operations on Images	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO12, PSO1, PSO2, PSO3
5.	CO5: Apply the transformations and filter methods on images	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO12, PSO1, PSO2, PSO3
6.	CO6: Design and develop image processing applications using Raspberry Pi	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Image Processing with IoT (Course Code CSI033)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI033_Image Processing with IoT	CO1	3	-	-	-	2	-	-	2	-	-	-	2	-	2	-
	CO2	3	2	2	2	3	2	-	-	2	2	2	2	2	2	2
	CO3	3	2	2	2	3	2	-	2	2	2	-	2	2	2	-
	CO4	3	3	3	3	3	-	-	-	2	2	-	2	2	2	2
	CO5	3	3	3	3	3	3	-	2	2	2	-	3	2	3	2
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI033	**Image Processing with IoT**	3.0	2.6	2.6	2.6	2.8	2.5	3.0	2.0	2.2	2.2	2.5	2.3	2.0	2.3	2.3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CIP033	
2	Course Title	Image Processing with IoT Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Elective	
5	Course Objective	The objective of this course is to explore multiple techniques, frameworks, and libraries for capturing, processing, and displaying digital images.	
6	Course Outcomes	CO1: Recall the list the basic components of Raspberry Pi CO2: Demonstrate the Python IDEs for image processing CO3: Demonstrate the Tkinter Library to implement image properties CO4: Make use of Pillow library for image processing using Raspberry Pi CO5: Apply the transformations and filter methods on images CO6: Design and develop image processing applications using Raspberry Pi	
7	Course Description	The course describes the concept of image processing with the help of Python and Raspberry Pi. This course covers an interactive GUI for the image processing demos using Tkinter, scipy.misc and scipy.ndimage etc to process images.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Raspberry Pi**	
		Introduction and Setup of Raspberry Pi, The Raspbian OS	CO1, CO6
		Connecting the Raspberry Pi to a Network and to the Internet, Updating the Pi, Shutting Down and Restarting Pi	CO1, CO6
	Unit 2	**IDEs for Python**	
		Introduction and implementation of Geany, Set Build Commands window and Execute Commands	CO2, CO6
		Connect a Raspberry Pi to Webcam and Pi Camera Module to acquire images	CO2, CO6
	Unit 3	**Using Tkinter Library**	
		Implement Python’s built-in GUI module “Tkinter” for displaying images	CO3, CO6
		Implement different image properties	CO3, CO6
	Unit 4	**Pillow library for image processing**	
		Implement basic operations on images	CO4, CO6
		Implement advanced operations on images	CO4, CO6
	Unit 5	**Transformations and Filters**	
		Use the scipy.ndimage library for processing images	CO5, CO6
		Implement Low-Pass and High-Pass filters on images	CO5, CO6
	Mode of	Jury/Practical/Viva	

examination			
Weightage	CA	MTE	ETE
Distribution	60%	0%	40%
Text book/s*	1. Raspberry Pi Image Processing Programming, Ashwin Pajankar, Apress		
Other References			

PO and PSO mapping with level of strength for Image Processing with IoT Lab (Course Code CIP033)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP033 _Image Processing with IoT Lab	CO1	2	1	1	-	3	1	1	-	2	2	2	2	1	1	-
	CO2	2	2	2	1	3	2	2	2	1	1	1	2	3	2	2
	CO3	2	2	2	1	3	2	2	2	3	3	3	3	3	2	2
	CO4	2	2	2	2	3	2	2	2	3	3	3	3	3	2	2
	CO5	3	2	2	3	3	2	2	2	3	3	3	3	3	2	2
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PS O 3
CIP033	Image Processing with IoT Lab	2.3	2.0	2.0	2.0	3.0	2.0	2.0	2.2	2.5	2.5	2.5	2.7	2.7	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CSI041	
2	Course Title	Fog Computing in IoT	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The objective of this course is to provide the fundamentals and followed by the middleware and technological solutions to implement fog and edge-related applications.	
6	Course Outcomes	CO1: Define the IoT paradigm along with CIoT limitations CO2: Outline the integrated cloud-to-things system comprising cloud computing, fog computing, and the IoT CO3: Assess the different design aspects of middleware for Fog and Edge computing CO4: Evaluate the conceptual architecture for the data management in fog computing environments CO5: Explain the different IoT applications with fog computing CO6: Discuss the foundations, middleware, data management and applications of fog computing.	
7	Course Description	The course covers the state-of-the-art in fog and edge computing, their applications, architectures, and technologies.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Fog Computing**	
	A	IoT and New Computing Paradigms: Fog and Edge Computing Completing the Cloud, Advantages, Hierarchy of Fog and Edge Computing	CO1, CO6
	B	Business Models, Opportunities and Challenges	CO1, CO6
	C	Addressing the Challenges in Federating Edge Resources: Networking and Management Challenge	CO1, CO6
	Unit 2	**Integrating IoT and Fog**	
	A	Introduction and methodology	CO2
	B	Integrated C2F2T Literature by Modeling Technique: Analytical, Petri Net and Integer Linear Programming	CO2
	C	Integrated C2F2T Literature by Metrics: Energy Consumption, Performance, Resource Consumption, Cost, QoS	CO2, CO6
	Unit 3	**Middleware for Fog and Edge Computing**	
	A	Need for Fog and Edge Computing Middleware, Design Goals, State-of-the-Art Middleware Infrastructures	CO3, CO6
	B	System Model: Embedded Sensors or Actuators, Personal Devices, Fog Servers, Cloudlets, Cloud Servers, Proposed Architecture: API Code, Security, Device Discovery	CO3, CO6
	C	Middleware: Context Monitoring and Prediction, Selection of Participating Devices, Data Analytics, Scheduling and Resource Management, Network Management, Execution	CO3, CO6

	Management, Mobility Management, Sensor/Actuators	
Unit 4	**Data Management in Fog Computing**	
A	Introduction, Fog Data Management: Fog Data Life Cycle	CO4, CO6
B	Data Characteristics, Data Pre-Processing and Analytics	CO4, CO6
C	Data Privacy, Data Storage and Data Placement, Proposed Architecture	CO4, CO6
Unit 5	**Fog Computing Applications**	
A	Fog Applications: Healthcare and Well-being, Smart Vehicle Management	CO5, CO6
B	Fog Applications: Smart City Applications, Smart Data Management	CO5, CO6
C	Other Emerging Application Sectors	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% / MTE 20% / ETE 50%	
Text book/s*	1. Fog and Edge Computing: Principles and Paradigms, Editor Buyya, Srirama, JohnWiley & Sons 2. Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things, Sudip Misra, Subhadeep Sarkar, Subarna Chatterjee, CRC Press	
Other References	1. Fog Computing: Concepts, Frameworks and Technologies 1st Edition, Kindle Edition by Zaigham Mahmood 2. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Development Copyrights ,2014.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the IoT paradigm along with CIoT limitations	PO1, PO2, PO12
2.	CO2: Outline the integrated cloud-to-things system comprising cloud computing, fog computing, and the IoT	PO1, PO2, PO3, PO4, PO7, PO12
3.	CO3: Assess the different design aspects of middleware for Fog and Edge computing	PO1, PO2, PO3, PO4, PO5, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: Evaluate the conceptual architecture for the data management in fog computing environments	PO1, PO2, PO3, PO4, PO7, PO9, PO10, PO11, PO12, PSO1, PSO2
5.	CO5: Discuss various case studies of fog computing	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Develop real-life IoT applications with fog computing	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Fog Computing in IoT (Course Code CSI041)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI041 _Fog Computing in IoT	CO1	2	2	-	-	-	-	-	-	-	-	-	2	-	-	-
	CO2	3	2	2	2	-	-	1	-	-	-	-	2	-	-	-
	CO3	3	2	2	2	2	-	2	-	2	2	2	3	2	2	-
	CO4	3	2	2	2	-	-	2	-	2	2	2	3	2	2	-
	CO5	3	3	3	2	3	2	2	3	3	3	3	3	2	2	2
	CO6	3	3	3	2	3	3	2	3	3	3	3	3	2	2	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI041	Fog Computing in IoT	2.8	2.3	2.4	2.0	2.7	2.5	1.8	3.0	2.5	2.5	2.5	2.7	2.0	2.0	2.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and Technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	
1 Course Code	CSI042	
2 Course Title	Industrial IoT 4.0	
3 Credits	3	
4 Contact Hours (L-T-P)	3-0-0	
Course Status	Elective	
5 Course Objective	This course is designed to offer students an introduction to Industry 4.0 (or the Industrial Internet), its applications in the business world. Students will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.	
6 Course Outcomes	CO1: Define the concept of Industry 4.0 CO2: Identify design principles under the Industry 4.0 umbrella CO3: Explain the drivers and features of Servitization and Product Service-System (PSS). CO4: Analyze 5C Cyber Physical System architecture for Industry 4.0 CO5: Discuss the impact of digital transformation on transportation and logistics. CO6: Determine the opportunities, challenges brought about by Industry 4.0 to earn the benefits.	
7 Course Description	Industry 4.0 refers to fourth generation of industrial activity characterized by smart systems and internet-based solutions. Applicability of 4.0 in transportation, energy and infrastructure is explored, with effects on technology, organization and operations from a systems perspective.	
8 Outline syllabus		CO Mapping
Unit 1	**Fundamentals of IoT 4.0**	
A	Definition of Industry 4.0, Key Paradigm of Industry 4.0, Industry 4.0 Conception: Five Main Components of Networked Production	CO1
B	Framework of Industry 4.0: Conception and Technologies, Nine Pillars of Technological Advancement	CO1
C	Macro Perspective of Industry 4.0, Micro Perspective of Industry 4.0, Industry 4.0 Components	CO1
Unit 2	**Industry 4.0: Design Principles**	
A	Interoperability, Virtualization, Decentralization, Real-Time Capability, Service Orientation, Modularity, Impact of Industry 4.0	CO1, CO2
B	RAMI 4.0 (Reference Architecture Model Industry 4.0), Additional Details of RAMI 4.0: Function of Layers on	CO1, CO2

	Vertical Axis, Function of Layers on the Horizontal Left Axis, Hierarchical System Architecture in Industry 4.0	
C	Industry 4.0 Component Model: Specification of the Industry 4.0 Component Model	CO1, CO2
Unit 3	**Servitization and Product Service-System (PSS)**	
A	The concept of Servitization, Drivers and Features of Servitization, Current State of Servitization and Impacts from Industry 4.0, Industry 4.0 Services	CO1, CO2, CO3,CO6
B	Product Service-System (PSS), Definition, Features of a PSS: PoPSS, UoPSS, RoPSS	CO1, CO2, CO3, CO6
C	Pervasive Computing, Applications of Pervasive Computing, Pervasive Computing and Internet of Things (IoT)	CO1, CO2, CO3, CO6
Unit 4	**The Industry 4.0 Architecture and Cyber-Physical Systems**	
A	Concept and Characteristics of Cyber-Physical Systems, CPS 5C Level Architecture	CO1, CO2, CO4
B	Implementation of 5C CPS Architecture in Factories, Classification of CPS in Context of Industry 4.0	CO1, CO2, CO4, CO6
C	IT and OT Convergence in Industrial IoT, Industry 4.0 Principles: Horizontal and Vertical Integration, Basic Functions and Uses of CPS	CO1, CO2, CO4, CO6
Unit 5	**Industry 4.0 across the Sectors**	
A	Introduction, Transportation 4.0: Multimodal Transportation Systems	CO4, CO5, CO6
B	Rail 4.0, Digital Transformation of Railways	CO4, CO5, CO6
C	Logistics 4.0	CO4, CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Handbook of Industry 4.0 and SMART Systems by Diego Galar Pascual, Pasquale Daponte, Uday Kumar, CRC Press	
Other References	1. Industry 4.0: Managing The Digital Transformation, Duc Truong Pham, University of Birmingham, Birmingham, UK, Springer 2. The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics, Christoph Jan Bartodziej, Springer	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the concept of Industry 4.0	PO1, PO6, PO7, PO8, P012
2.	CO2: Identify design principles under the Industry 4.0 umbrella	PO1, PO2, PO4, PO6, PO7, PO8, PO9, PO12
3.	CO3: Explain the drivers and features of Servitization and Product Service-System (PSS).	PO1, PO2, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: Analyze 5C Cyber Physical System architecture for Industry 4.0	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
5.	CO5: Discuss the impact of digital transformation on transportation and logistics.	PO1, PO2, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Determine the opportunities, challenges brought about by Industry 4.0 to earn the benefits.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Industrial IoT 4.0 (Course Code CSI042)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI042 _Industrial IoT 4.0	CO1	1	-	-	-	-	1	2	2	-	-	-	2	-	-	-
	CO2	2	2	-	1	-	1	2	2	1	-	-	2	-	-	-
	CO3	2	1	-	1	2	1	2	2	2	1	2	2	1	2	-
	CO4	2	2	1	2	2	1	2	2	2	1	2	2	1	2	-
	CO5	2	2	-	2	2	1	2	2	2	2	2	2	2	3	2
	CO6	2	2	2	2	3	1	2	2	3	2	3	3	2	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI042	Industrial IoT 4.0	1.8	1.8	1.5	1.6	2.3	1.0	2.0	2.0	2.0	1.5	2.3	2.2	1.5	2.5	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**
Department		**Department of Computer Science and Engineering**
Program:		**B.Tech**
Branch:		**CSE with Specialization in Internet of Things & Applications**
1	Course Code	CSI051
2	Course Title	IoT in Healthcare
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	The objective of this course is to give an overview of a people-focused view on IoT by providing an outline of the components that may be included in an IoT-based smart health ecosystem and introduced a set of dimensions to consider in smart health applications. This course also discusses many challenges facing the wide spread adoption of smart IoT health care applications.
6	Course Outcomes	CO1: Outline the elements of IoT-based health care ecosystems. CO2: Explain the different types of applications that utilize IoT in Healthcare CO3: Discuss the IoT that enables the realization of smart ambulance CO4: Assesses the adoption of this model for diagnosis and prognosis of chronic obstructive pulmonary disease. CO5: Elaborate security, privacy and ethical issues in smart sensor health and well-being application CO6: Discuss the integration of the IoT in patient-focused health applications.
7	Course Description	IoT can automate patient care workflow with the help healthcare mobility solution and other new technologies, and next-gen healthcare facilities. IoT in healthcare enables interoperability, machine-to-machine communication, information exchange, and data movement that makes healthcare service delivery effective.

8	Outline syllabus		CO Mapping
	Unit 1	**IoT and People in Health Care**	
	A	Introduction to Smart Health Care Ecosystem, The patient at the centre, Health care providers	CO1
	B	Devices and sensors, Applications and Interfaces	CO1
	C	Other Stakeholders: Social Support, Connecting the components	CO1
	Unit 2	**Dimensions of IoT Applications in Health Care**	
	A	Well-being-Illness, Physical, Temporary-Cure, Prevent-Cure, Monitor-Manage , Internal-External Measures, Health Care Provider-Individual Dimensions	CO1, CO2
	B	Examples of IoT Related Health Care Applications and Their Dimensions	CO1, CO2
	C	Challenges, Lack of Standards,Data Issues, Changing the Health Care Provider-Patient Roles	CO1, CO2
	Unit 3	**Internet of Things in Smart Ambulance and**	

	Emergency Medicine	
A	IoT in Emergency Medicine, Point-of-CareEnvironment	CO3, CO6
B	Biosensing Network, Hierarchical Cloud Architecture, Weather Observation for Remote Rescue	CO3, CO6
C	Integration and Compatibility, Operational Consistency and Reliability Assurance, Electronic Patient Record Retrieval in Multihop Communication	CO3, CO6
Unit 4	**Case Study: Chronic Obstructive Pulmonary Disease**	
A	On-scene Diagnosis and Prognosis, Data Acquisition and Analytics	CO4, CO6
B	Decision and Selection Process, Patient and the Ambient Environment, Smart Ambulance Challenges, Reliability	CO4, CO6
C	Standards, Staff Training and Operating Procedures, Security and Privacy	CO4, CO6
Unit 5	**Security, Privacy and Ethical Issues**	
A	Smart Health and well-being Applications Risk Analysis	CO5, CO6
B	Cyber-Physical-Social Systems, Machine Ethics, Physical Safety	CO5, CO6
C	Software Quality, IT Security, Privacy, Risk of Technology Misuse	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	

Weightage Distribution	CA	MTE	ETE
	30%	20%	50%

Text book/s*

1. Internet of Things A to Z Technologies and Applications, Qusay F. Hassan
2. Intelligent Data Sensing and Processing for Health and Well-being Applications, Miguel Antonio Wister Ovando, Pablo Pancardo Garcia, Francisco Diego Acosta Escalante, Jose Adan Hernandez Nolasco

Other References

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Outline the elements of IoT-based health care ecosystems.	PO1, PO2, PO3, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
2.	CO2: Explain the different types of applications that utilize IoT in Healthcare	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
3.	CO3: Discuss the IoT that enables the realization of smart ambulance	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
4.	CO4: Assesses the adoption of this model for diagnosis and prognosis of chronic obstructive pulmonary disease.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
5.	CO5: Elaborate security, privacy and ethical issues in smart sensor health and well-being application	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
6.	CO6: Discuss the integration of the IoT in patient-focused health applications.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name IoT in Healthcare (Course Code CSI051)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI051 _IoT in Healthcare	CO1	3	2	2	-	2	3	3	2	2	2	2	3	2	2	-
	CO2	3	3	3	2	2	3	3	2	2	3	2	3	2	2	-
	CO3	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-
	CO4	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-
	CO5	3	3	3	3	2	3	3	2	3	3	3	3	3	3	-
	CO6	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI051	IoT in Healthcare	3.0	2.8	2.8	2.8	2.0	3.0	3.0	2.2	2.7	2.8	2.7	3.0	2.7	2.7	3.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CSI052	
2	Course Title	Drones in IoT	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The objective of this course is to addresses major issues and challenges in drone-based solutions proposed for IoT-enabled cellular/computer networks, routing/communication protocols, surveillances applications, secured data management, and positioning approaches.	
6	Course Outcomes	CO1: Define the concepts of UAV (Unmanned Aerial Vehicle) CO2: Explain the approaches of Drone path planning CO3: Apply the internet of things enabled UAV CO4: Categorize various data routing approaches in dynamic IoT CO5: Elaborate the common attacks and security aspect in UAV CO6: Discuss the issues and challenges of IoT-enabled UAV	
7	Course Description	The Internet of Things (IoT) is a system of inter-connected devices, objects, and organisms. Among these devices, drones are gaining lots of interest. Drones are expected to communicate with cellular networks in the next generation networks (5G and beyond) which opens the door for another exciting research area.	
8	Outline syllabus		CO Mapping
	Unit 1	**Drones in the IoT Era**	
	A	Intelligence in UAVs, Collaborative UAVs in Cloud	CO1
	B	Static Positioning of Drones	CO1
	C	Dynamic Positioning of Drones: Drones Repositioning Schemes	CO1
	Unit 2	**Drones Path Planning**	
	A	Static and Dynamic Approaches	CO1, CO2
	B	System Models: FANET Model, Cost and Communication Models and Power and Lifetime Model	CO1, CO2
	C	Least Cost Path Finder (LCPF) Approach	CO1, CO2
	Unit 3	**IoT-enabled UAVs**	
	A	For Multimedia Delivery: System Model	CO3, CO6
	B	PSO in IIoT	CO3, CO6
	C	Performance Evaluation	CO3, CO6
	Unit 4	**Data Routing in Dynamic IoT**	
	A	IoT System Model: IoT Model, IoT Node, Pricing and Communication Model	CO4, CO6
	B	Adaptive Routing Approach	CO4, CO6
	C	Use Case and Theoretical Analysis	CO4, CO6
	Unit 5	**Security in UAV/Drone**	
	A	PLS for UAV Systems: UAV as a Mobile Relay and	CO5, CO6

	Mobile Transmitter BS	
B	PLS for UAV Systems: Mobile Jammer, Flying UE	CO5, CO6
C	Common Attacks in UAV Systems	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	

Weightage	CA	MTE	ETE
Distribution	30%	20%	50%

Text book/s*
1. Drones in IoT-enabled Spaces, Fadi Al-Turjman, CRC Press, Taylor & Francis

Other References

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the concepts of UAV (Unmanned Aerial Vehicle)	PO1, PO2, PO3, PO5, PO6, PO7, PO8, PO9, PO10, PO12, PSO1, PSO2
2.	CO2: Explain the approaches of Drone path planning	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO12, PSO1, PSO2
3.	CO3: Apply the internet of things enabled UAV	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Categorize various data routing approaches in dynamic IoT	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Elaborate the common attacks and security aspect in UAV	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2
6.	CO6: Discuss the issues and challenges of IoT-enabled UAV	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Drones in IoT (Course Code CSI052)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI052 _Drones in IoT	CO1	3	2	2	-	3	2	2	2	2	2	-	3	2	2	-
	CO2	3	3	3	2	3	3	3	2	2	3	-	3	2	2	-
	CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	-
	CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI052	Drones in IoT	3.0	2.8	2.8	2.8	3.0	2.8	2.8	2.2	2.7	2.8	3.0	3.0	2.7	2.7	2.3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CSI061
2	Course Title	Industrial IoT: Smart Manufacturing
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	The objective of this course is to introduce numerous concepts related to Industrial IoT, which is concerned with the use of the IoT in an industrial environment.
6	Course Outcomes	CO1: Define the concepts of IIoT process management and protocols. CO2: Explain the adoption case studies of Industrial IoT and current technologies. CO3: Apply the Business Model Framework for IIoT CO4: List out the concerns and related business models in smart manufacturing. CO5: Elaborate the challenges and Inventory Consolidation for Industrial Logistics. CO6: Discuss the different business operations such as manufacturing, logistics for Industrial IoT smart manufacturing.
7	Course Description	A number of adoptions of the IoT concepts are visible in all walks of life globally and the number is all set to increase to billions of connected objects before the turn of the decade. This course presents some of the use cases of the IoT in different business facets and processes, focusing more on the manufacturing sector and, hence, there is a distinct coverage of Industrial IoT (IIoT) as well.

8	Outline syllabus		CO Mapping
	Unit 1	**Industrial IoT Paradigm**	
	A	Industrial IoT, IoT Challenges in Agile Manufacturing, Drivers for IIoT Adoption	CO1
	B	IIoT for Process Management, IIoT Protocols	CO1
	C	Product Development and IoT, Industry 4.0, IIoT, and Related Developments	CO1
	Unit 2	**IIoT Adoption**	
	A	Current Areas of Industrial IoT adoption, Emerging Areas of IoT Adoption	CO1, CO2
	B	IIoT Adoption Case Studies	CO1, CO2
	C	Overview of Current Technologies	CO1, CO2
	Unit 3	**Business Models**	
	A	Business Model Framework, The IoT Business Models	CO3, CO6
	B	The IoT Business Model Based on IT: Freemium, Digital Add-On Enhancements, Razor and Blade Digital Lock-In, Point of Sales (POS), Direct Selling Business Model or Solution Provider Model using	CO3, CO6

	Intelligent Objects Self-Service, Pay Per Use Business Model	
C	Digitally Charged Products Business Model Data Sale, Challenges	CO3, CO6
Unit 4	**Smart Manufacturing**	
A	Manufacturing Concerns	CO4, CO6
B	Industry 4.0 and Related Models	CO4, CO6
C	Smart Manufacturing, Smart Manufacturing: Indian Case Study	CO4, CO6
Unit 5	**Logistics Optimization**	
A	Introduction, Challenges in Logistics, Logistics Costs, Autonomous Logistics	CO5, CO6
B	The IoT-Enabled Activity-Based Costing, The IoT and Inventory Consolidation, The IoT and Consigned Inventory	CO5, CO6
C	Case Study: Industrial Logistics	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Internet of Things, Approach and Applicability in Manufacturing, Ravi Ramakrishnan, Loveleen Gaur, CRC Press	
Other References		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the concepts of IIoT process management and protocols.	PO1, PO2, PO3, PO4, PO6, PO7, PO10, PO12
2.	CO2: Explain the adoption case studies of Industrial IoT and current technologies.	PO1, PO2, PO3, PO4, PO6, PO7, PO11, PO12
3.	CO3: Apply the Business Model Framework for IIoT	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO12, PSO3
4.	CO4: List out the concerns and related business models in smart manufacturing.	PO1, PO2, PO3, PO4, PO6, PO7, PO10, PO11, PO12, PSO3
5.	CO5: Elaborate the challenges and Inventory Consolidation for Industrial Logistics.	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PO12
6.	CO6: Discuss the different business operations such as manufacturing, logistics for Industrial IoT smart manufacturing.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Industrial IoT: Smart Manufacturing (Course Code CSI061)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI061 _Industrial IoT: Smart Manufacturing	CO1	2	2	2	2	-	2	2	-	-	1	-	2	-	-	-
	CO2	2	2	2	3	-	2	2	-	-	-	2	2	-	-	-
	CO3	3	2	2	3	3	2	2	2	-	-	-	2	-	-	2
	CO4	3	2	2	3	-	2	2	-	-	2	2	2	-	-	2
	CO5	3	2	3	3	-	2	2	-	2	2	-	2	-	-	-
	CO6	3	3	3	3	3	2	2	3	2	2	2	3	3	2	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI061	Industrial IoT: Smart Manufacturing	2.7	2.2	2.3	2.8	3.0	2.0	2.0	2.5	2.0	1.8	2.0	2.2	3.0	2.0	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	
1	Course Code	CSI062
2	Course Title	IoT Applications
3	Credits	1
4	Contact Hours (L-T-P)	1-0-0
	Course Status	Elective
5	Course Objective	The objective of this course to build IoT projects. By building IoT projects, the students can understand the basic concepts and will be able to innovate using the basics to create their own IOT applications.
6	Course Outcomes	CO1: Build a simple smart gardening system with involved plant sensor devices CO2: Build a smart parking system by detecting a car plate and to count the car parking duration. CO3: Build a simple smart speaker machine CO4: Build a simple smart digital advertising which could detect people's presence CO5: Build a simple vending machine CO6: Build the Intelligent Internet of Things projects and bring a new degree of interconnectivity to the world.
7	Course Description	Internet of Things (IoT) is a ground-breaking technology that involves connecting numerous physical devices to the Internet and controlling them. Analyzing data from Internet of Things devices and converting it into something meaningful is currently driving the next level of IoT learning.

8 Outline syllabus

		CO Mapping
Unit 1	**Smart Gardening Systems**	
A	Introducing smart gardening systems, Exploring gardening system platforms	CO1, CO6
B	Watering your garden and farm, Sensor devices for a smart gardening system	CO1, CO6
C	Watering your garden and farm, Building a smart gardening system	CO1, CO6
Unit 2	**Smart Parking Systems**	
A	Introducing smart parking systems, Sensor devices for a smart parking system	CO1, CO6
B	Vehicle entry/exit detection, Vehicle plate number detection	CO1, CO6
C	Vacant parking space detection, Building a smart parking system	CO1, CO6
Unit 3	**Smart Speaker Machines**	
A	Introducing smart speaker machines, Exploring existing	CO3, CO6

	smart speaker machines	
B	Introducing ReSpeaker, Integrating your IoT boards with ReSpeaker	CO3, CO6
C	GPIO programming on ReSpeaker, Connecting to the Microsoft Bing Speech API, Building your own smart speaker machine	CO3, CO6
Unit 4	**Smart Digital Advertising Dashboards**	
A	Introducing smart digital advertising dashboards, Exploring digital signage platforms	CO4, CO6
B	Designing a smart digital advertising system, Detecting human presence	CO4, CO6
C	Displaying and delivering ad content, Building a smart digital advertising dashboard	CO4, CO6
Unit 5	**Vending Machines**	
A	Introducing vending machines, Designing a vending machine	CO5, CO6
B	Central control machine, Detecting coins for payments, Building UI and UX for user interaction	CO5, CO6
C	Designing a database model, Building the vending machine	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	3. Intelligent IoT Projects, Agus Kurniawan, Packt Publishing 4. Raspberry Pi IoT Projects, John C. Shovic, Apress	
Other References	1. Internet of Things (IoT), Systems and Applications, Jamil Y. Khan and Mehmet R. Yuce 2. Internet of Things (IoT), Technologies, Applications, Challenges, and Solutions, B.K. Tripathy and J. Anuradha	
Add-on Projects	Connecting an IOT Device to a Cloud Server Using IOT for RFID and MQTT Implement CitySense Lite for an Application Building a Solar Powered IOT Weather Station, Data Gathering	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Build a simple smart gardening system with involved plant sensor devices	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
2.	CO2: Build a smart parking system by detecting a car plate and to count the car parking duration.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Build a simple smart speaker machine	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Build a simple smart digital advertising which could detect people's presence	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	CO5: Build a simple vending machine	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: Build the Intelligent Internet of Things projects and bring a new degree of interconnectivity to the world.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name IoT Applications (Course Code CSI062)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CSI062 _IoT Applications	CO1	3	3	2	3	3	3	3	2	3	3	3	3	3	2	2
	CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2
	CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSI062	IoT Applications	3.0	3.0	2.8	3.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	3.0	2.7	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech**	
Branch:	**CSE with Specialization in Internet of Things & Applications**	

1	Course Code	CIP062	
2	Course Title	IoT Applications Lab	
3	Credits	2	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Elective	
5	Course Objective	The objective of this course to build IoT projects. By building IoT projects, the students can understand the basic concepts and will be able to innovate using the basics to create their own IOT applications.	
6	Course Outcomes	CO1: Build a simple smart gardening system with involved plant sensor devices CO2: Build a smart parking system by detecting a car plate and to count the car parking duration. CO3: Build a simple smart speaker machine CO4: Build a simple smart digital advertising which could detect people's presence CO5: Build a simple vending machine CO6: Build the Intelligent Internet of Things projects and bring a new degree of interconnectivity to the world.	
7	Course Description	Internet of Things (IoT) is a ground-breaking technology that involves connecting numerous physical devices to the Internet and controlling them. Analyzing data from Internet of Things devices and converting it into something meaningful is currently driving the next level of IoT learning.	
8	Outline syllabus		CO Mapping
	Unit 1	**Smart Gardening Systems**	
	A	Introducing smart gardening systems, Exploring gardening system platforms	CO1, CO6
	B	Watering your garden and farm, Sensor devices for a smart gardening system	CO1, CO6
	C	Watering your garden and farm, Building a smart gardening system	CO1, CO6
	Unit 2	**Smart Parking Systems**	
	A	Introducing smart parking systems, Sensor devices for a smart parking system	CO1, CO6
	B	Vehicle entry/exit detection, Vehicle plate number detection	CO1, CO6
	C	Vacant parking space detection, Building a smart parking system	CO1, CO6
	Unit 3	**Smart Speaker Machines**	
	A	Introducing smart speaker machines, Exploring existing smart speaker machines	CO3, CO6
	B	Introducing ReSpeaker, Integrating your IoT boards	CO3, CO6

	with ReSpeaker	
C	GPIO programming on ReSpeaker, Connecting to the Microsoft Bing Speech API, Building your own smart speaker machine	CO3, CO6
Unit 4	**Smart Digital Advertising Dashboards**	
A	Introducing smart digital advertising dashboards, Exploring digital signage platforms	CO4, CO6
B	Designing a smart digital advertising system, Detecting human presence	CO4, CO6
C	Displaying and delivering ad content, Building a smart digital advertising dashboard	CO4, CO6
Unit 5	**Vending Machines**	
A	Introducing vending machines, Designing a vending machine	CO5, CO6
B	Central control machine, Detecting coins for payments, Building UI and UX for user interaction	CO5, CO6
C	Designing a database model, Building the vending machine	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	5. Intelligent IoT Projects, Agus Kurniawan, Packt Publishing 6. Raspberry Pi IoT Projects, John C. Shovic, Apress	
Other References	3. Internet of Things (IoT), Systems and Applications, Jamil Y. Khan and Mehmet R. Yuce 4. Internet of Things (IoT), Technologies, Applications, Challenges, and Solutions, B.K. Tripathy and J. Anuradha	
Add-on Projects	Connecting an IOT Device to a Cloud Server Using IOT for RFID and MQTT Implement CitySense Lite for an Application Building a Solar Powered IOT Weather Station, Data Gathering	

PO and PSO mapping with level of strength for Course Name IoT Applications Lab (Course Code CIP062)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
CIP062 _IoT Applica tions Lab	CO1	3	3	2	3	3	3	3	2	3	3	3	3	3	2	2
	CO2	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2
	CO3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO4	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO5	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	P O 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CIP062	IoT Applicatio ns Lab	3.0	3.0	2.8	3.0	3.0	3.0	3.0	2.0	3.0	3.0	3.0	3.0	3.0	2.7	2.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

B.Tech-Computer Science & Engineering with specialization in Data Science & Analytics

School:		**School of Engineering and technology**
Department		**Department of Computer Science and Engineering**
Program		**B.Tech.**
Branch		**CSE**
1	Course number	**CSD102**
2	Course Title	**Introduction to Data Science**
3	Credits	**2**
4	Contact Hours	2 | 0 | 0
5	Course Objective	To introduce a range of topics and concepts related to the data science process
6	Course Outcomes	Having successfully completed this module, you will be able to: CO1: Define key concepts in data science, including tools, approaches, and application scenarios CO2: Explain topics in data collection, sampling, quality assessment and repair CO3: Identify topics in statistical analysis and machine learning CO4: Analyze topics in data processing at scale CO5: Determine state-of-the-art tools to build data-science applications for different types of data. CO6: Compile the basics of concept and tools in Data Science to apply on real world data.
7	Outline syllabus	

7.01	**Unit 1**	**Introduction: What is Data Science?**	
7.02	A	Big Data and Data Science hype; **Datafication**	CO1, CO2
7.03	B	Current Landscape of different perspectives	CO1
7.04	C	Relevant Case Study	CO1, CO2, CO4
7.05	**Unit 2**	**Exploratory Data Analysis and the Data Science Process**	
7.06	A	Philosophy of EDA - The Data Science Process, Basic tools of EDA (plots, graphs and summary statistics etc.)	CO1, CO2, CO3
7.07	B	Data Pre-processing, Data Cleaning, Data Integration, Data Transformation and Data Reduction	CO1, CO2, CO3, CO4
7.08	C	Data Generalization and Summarization Based Characterization	CO2, CO3
7.09	**Unit 3**	**Data Warehousing and Data Mining**	
7.10	A	Introduction to data warehousing, DW Lifecycle, Architecture, Evolution of decision support systems	CO1, CO2, CO3, CO4
7.11	B	Introduction to Data mining, Relation to Statistics. Steps in Data Mining Process, Architecture of a Typical Data Mining System.	CO1, CO3, CO4, CO5
7.12	C	Overview of few Data Mining Techniques, Applications and Social Impacts of Data Mining	CO3, CO4, CO5
7.13	**Unit 4**	**Classification and Prediction**	
7.14	A	Linear Regression, k-Nearest Neighbors (k-NN), k-means	CO1, CO3, CO5
7.15	B	Prediction, Cluster Analysis	CO1, CO3, CO5
7.16	C	Hierarchical Methods	CO1, CO3, CO5
7.17	**Unit 5**	**Data Visualization**	

7.18	A	Basic principles, ideas and tools for data visualization	CO1, CO4, CO5, CO6
7.19	B	Examples of inspiring (industry) projects	CO1, CO4, CO5, CO6
7.20	C	Exercise: create your own visualization of a complex dataset	CO1, CO2, CO4, CO5, CO6
8.1	Text book*	1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.	
8.2	Further Readings	1. W. H. Inmon, "Building the Data Warehouse", 3rd edition. 2. Anahory and Murray. Data warehousing in the real world, Pearson Education/Addison Wesley. 3. Margaret Dunham, Data Mining: Introductory and Advanced Topics, Published by Prentice Hall. 4. Jiawei Han, Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, 2002. (www.cs.sfu.ca/~han/DMbook.html). 5. Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining, & OLAP", Tata Mcgraw- Hill, 2004. 6. George M Marakas, Modern Data Warehousing, Mining and Visualization-, Peason Education.	
8.3		Internet as the resource for reference	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Key concepts in data science, including tools, approaches, and application scenarios	PO1, PO2, PO3, PO5, PO7, PO12, PSO1
2.	**CO2:** Topics in data collection, sampling, quality assessment and repair	PO1, PO2, PO3, PO5, PO6, PO7, PO8, PO9, PO12, PSO1, PSO2
3.	**CO3:** Topics in statistical analysis and machine learning	PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO12, PSO1, PSO2, PSO3
4.	**CO4:** Topics in data processing at scale	PO1, PO2, PO4, PO5, PO6, PO11, PO12, PSO1, PSO3
5.	**CO5:** State-of-the-art tools to build data-science applications for different types of data.	PO1, PO2, PO5, PO9, PO11, PO12, PSO3
6.	**CO6:** Compile the basics of concept and tools in Data Science to apply on real world data.	PO1, PO2, PO3, PO5, PO9, PO11, PO12, PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Data Science (Course Code CSD 102)

	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1	3	2	3	2	2	----	1	---	1	1	---	----	3	1	1
	CO2	3	1	1	2	2	--	---	3	2	1	1	1	1	1	---
CSE	CO3	2	1	3	2	2	----	1	---	1	1	---	----	3	2	2
	CO4	3	2	2	1	1	--	--	1	3	3	3	2	2	1	3
	CO5	3	2	1	-	2	-	-	-	2	-	3	3	-	-	3
	CO6	3	2	2	-	2	-	-	-	2	-	3	2	-	-	3

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program		**B.Tech.**		
Branch		**CSE**		
1	Course number	**CSD201**		
2	Course Title	**Data Collection and Pre-processing**		
3	Credits	**4**		
4	Contact Hours	**3**	**0**	**2**
5				
6	Course Objective	To introduce the concept of data collection and pre-processing that remains less touched as a subject for students.		
7	Course Outcomes (CO)	On successful completion of this module students will be able to: 1. Recall the motivation behind proper process of data collection and pre-processing. 2. Demonstrate the basic understanding of data behaviour using its statistical metrics. 3. Apply the tools and techniques vital to pre-processing of datasets for analysis once collected. 4. Analyse the various apparent and hidden attributes of acquired dataset and utilizing those attributes towards knowledge discovery. 5. Assess the various methodologies of data pre-processing and preparation on basis of their algorithmic complexities and accuracy in the due process. 6. Compile various data pre-processing methodologies with their respective outcomes on the legitimacy of knowledge discovered from acquired data.		
8	Outline syllabus			
	Unit 1	**Data Preparation**		
	A	Motivation behind Data Preparation, Need for preparing data	CO1	
	B	Raw and Processed Data, Components of Tidy Data	CO1	
	C	Various sources of different Data types	CO1	
	Unit 2	**Knowing your data**		
	A	Data attributes, Discrete vs Continuous Data attributes	CO1, CO2	
	B	Statistical description of Data- Central Tendency: Mean, Median, Mode; Data dispersion: Range, Quartile, Variance, SD, Interquartile Range	CO1, CO2	
	C	Data Similarity and Dissimilarity - Data Matrix versus Dissimilarity Matrix, Proximity Measures for Nominal & Binary Attributes, Dissimilarity of Numeric Data: Minkowski Distance; Proximity Measures for Ordinal Attributes, Dissimilarity for Attributes of Mixed Types, Cosine Similarity	CO1, CO2, CO4	
	Unit 3	**Data Pre-processing - Cleaning and Integration**		
	A	Data Pre-processing - Data Quality: Why Pre-process the Data? Major Tasks in Data Pre-processing	CO1, CO2	
	B	Data Cleaning – Finding Missing values, Noisy data, Data cleaning process.	CO3, CO4	
	C	Data Integration - Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Data Value Conflict Detection and Resolution	CO3, CO4, CO5	
	Unit 4	**Data Reduction**		
	A	Data Reduction Strategies, Wavelet Transforms, PCA	CO3, CO5	

	B	Attribute subset selection, Regression and Log-Linear Models: Parametric Data Reduction	CO3, CO5, CO6
	C	Histograms, Clustering, Sampling, Data Cube Aggregation	CO3, CO5, CO6
	Unit 5	**Data Transformation and Data Discretization**	
	A	Data Transformation Strategies Overview, Data Transformation by Normalization	CO3, CO5, CO6
	B	Discretization by Binning, Discretization by Histogram Analysis	CO3, CO5, CO6
	C	Discretization by Cluster, Decision Tree, and Correlation Analyses, Concept Hierarchy Generation for Nominal Data	CO3, CO5, CO6
	Weightage Distribution	CA 30% MTE 20% ETE 50%	
	Text book*	1. Han Jiawei, Kamber & Pei, Data Mining Concepts & Techniques 3rd Edition, Morgan Kaufman	
	Further Readings	1. M.H. Dunham, Data Mining Introductory and Advanced Topics, Pearson Education. 2. Adriaans, Data Mining, Pearson Education 3. Vikram Pudi; P. Radhakrishnan, "Data Mining", Oxford University Press	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Recall the motivation behind proper process of data collection and pre-processing.	PO1, PO2, PO4, PO6, PO8, PO10, PO11, PO12,
2.	Demonstrate the basic understanding of data behaviour using its statistical metrics.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1
3.	Apply the tools and techniques vital to pre-processing of datasets for analysis once collected.	PO1, PO2, PO3, PO5, PSO12, PSO2,
4.	Analyse the various apparent and hidden attributes of acquired dataset and utilizing those attributes towards knowledge discovery.	PO3, PO4, PO5, PO9, PSO2, PSO3
5.	Assess the various methodologies of data pre-processing and preparation on basis of their algorithmic complexities and accuracy in the due process.	PO1, PO2, PO4, PO8, PSO1, PSO2, PSO3
6.	Compile various data pre-processing methodologies with their respective outcomes on the legitimacy of knowledge discovered from acquired data.	PO2, PO4, PO8, PO9, PO11, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Data Collection & Pre0-processing (Course Code CSD201)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO2	PSO3
CSD201 _ Data Collection and Pre-processing	CO1	3	2	-	2	-	2	-	1	-	2	1	3	-	-	-
	CO2	3	2	2	3	2	-	-	-	-	2	-	2	1	-	-
	CO3	2	3	3	2	3	-	-	-	-	-	-	2	-	-	2
	CO4	-	-	3	3	2	-	-	-		-	-	-	-	3	2
	CO5	2	3	-	-	-	-	-	2	-	-	-	-	1	3	2
	CO6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSD201		2.5	2.4	2.7	2.6	2.3	2	0	1.7	1	2	1	2.5	1	3	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B.Tech.**		
Branch:		**CSE**		
1	Course number	**CDP201**		
2	Course Title	**Data Collection and Pre-processing Lab**		
3	Credits	**1**		
4	Contact Hours (L-T-P)	0	0	2
5	Course Objective	To introduce the concept of data collection and pre-processing using tangible datasets. Students will gain the skills and project-based experience needed for data pre-processing in data analysis careers.		
6	Course Outcomes (CO)	On successful completion of this module students will be able to: CO1: Recall the motivation behind proper process of data collection and pre-processing. CO2: Demonstrate the basic understanding of data behaviour using its statistical metrics. CO3: Apply the tools and techniques vital to pre-processing of datasets for analysis once collected. CO4: Analyse the various apparent and hidden attributes of acquired dataset and utilizing those attributes towards knowledge discovery. CO5: Assess the various methodologies of data pre-processing and preparation on basis of their algorithmic complexities and accuracy in the due process. CO6: Compile various data pre-processing methodologies with their respective outcomes on the legitimacy of knowledge discovered from acquired data.		
7	Outline syllabus			
	1.	To determine the differences between raw and processed data with the help of test samples.		
	2.	To analyse statistical description of a given sample dataset using Central Tendency estimation measures		
	3.	To analyse statistical description of a given sample dataset using Data dispersion estimation measures.		
	4.	To analyse the effect of a) outliers and b) noisy data in a dataset.		
	5.	Creating data matrices and dissimilarity matrices for a given sample dataset.		
	6.	To evaluate numeric data dissimilarity using minkowski distance.		
	7.	To evaluate dissimilarity for attributes of mixed types using Cosine Similarity.		
	8.	To find and replace missing values in a given dataset on contextual basis.		
	9.	To analyse entity identification problem, redundancy and correlation analysis on a given sample dataset.		
	10.	To implement wavelet transforms and PCA (principal component analysis) for data reduction.		
	11.	To implement parametric data reduction using Regression models and Log-linear models		
	12.	To implement Clustering on a given dataset.		

	13.	To implement data transformation using normalization.
	14.	To implement data discretization by binning and histogram analysis
	15.	Discretization by Cluster, Decision Tree, and Correlation Analyses
8.1	Text book*	2. Han Jiawei, Kamber & Pei, Data Mining Concepts & Techniques 3rd Edition, Morgan Kaufman
8.2	Further Readings	4. M.H. Dunham, Data Mining Introductory and Advanced Topics, Pearson Education. 5. Adriaans, Data Mining, Pearson Education 6. Vikram Pudi; P. Radhakrishnan, "Data Mining", Oxford University Press

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Recall the motivation behind proper process of data collection and pre-processing.	PO1, PO2, PO4, PO6, PO8, PO10, PO11, PO12,
2.	Demonstrate the basic understanding of data behaviour using its statistical metrics.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1
3.	Apply the tools and techniques vital to pre-processing of datasets for analysis once collected.	PO1, PO2, PO3, PO5, PSO12, PSO2,
4.	Analyse the various apparent and hidden attributes of acquired dataset and utilizing those attributes towards knowledge discovery.	PO3, PO4, PO5, PO9, PSO2, PSO3
5.	Assess the various methodologies of data pre-processing and preparation on basis of their algorithmic complexities and accuracy in the due process.	PO1, PO2, PO4, PO8, PSO1, PSO2, PSO3
6.	Compile various data pre-processing methodologies with their respective outcomes on the legitimacy of knowledge discovered from acquired data.	PO2, PO4, PO8, PO9, PO11, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Data Collection & Pre0-processing (Course Code CSD201)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO2	PSO3
CDP201 _ Data Collection and Pre-processing LAB	CO1	3	2	-	2	-	2	-	1	-	2	1	3	-	-	-
	CO2	3	2	2	3	2	-	-	-	-	2	-	2	1	-	-
	CO3	2	3	3	2	3	-	-	-	-	-	-	2	-	-	2
	CO4	-	-	3	3	2	-	-	-		-	-	-	-	3	2
	CO5	2	3	-	-	-	-	-	2	-	-	-	-	1	3	2
	CO6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**		
Department:		**Department of Computer Science and Engineering**		
Program:		**Data Sciences**		
Branch:		**Department of Computer Science and Engineering**		
1	Course Code	CSD202		
2	Course Title	Data Warehouse		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core/Elective/Open Elective		
5	Course Objective	• Make the students understand the utility and importance of data warehouses in general and in context of enterprises. Provide students with an overview of the methodologies used in and approaches used to build data warehouses for enterprises. • Make students gain insights into the challenges and limitations of different data warehouse architectures • Provide the students with implementation of alternatives of data warehouses.		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1: Recall the necessary prerequisites to understand warehousing CO2: Explain the basics of warehouse architecture and component and establish its utility. CO3: Apply the acquired knowledge of warehouses to various avenues of application CO4: Identify the architecture suitable for implementation CO5: Apply the basic and advanced modelling techniques CO6: Integrating and interpreting the data sets and improving effectiveness, efficiency and quality for data analysis.		
7	Course Description	This course introduces advanced aspects of data warehousing encompassing the principles, to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction to Data Warehousing**		
	A	The Need for Data Warehousing; Increasing Demand for Strategic Information		CO1
	B	Inability of Past Decision Support Systems, Operational V/s Decision Support System		CO1
	C	Role of Metadata, Classification of Metadata		CO1
	Unit 2	**Data Warehouse Architecture**		
	A	Data warehouse lifecycle, Top down vs Bottom Up approach, Data Warehouse vs Data Marts, OLAP vs OLTP		CO2

B	Different Types of Architecture, Centralized data warehouse, Independent data marts, Federated, Hub and spoke, Data Mart Bus	CO2
C	Data Extraction, Transformation and Loading (ETL)	CO2
Unit 3	**Data Warehouse Modeling**	
A	Introduction to data cube, drill down, roll up, slice and dice	CO3
B	ER vs Dimensional Modeling, Dimension Modelling: Star Schema	CO3
C	Snowflake and fact constellation schema, fact less tables.	CO3
Unit 4	**Dimensional Modeling Advance topics**	
A	Slowly changing dimensions: Type 1, Type 2, Type 3 changes, Junk dimensions, large dimensions	CO4, CO5
B	Modeling: Descriptive attributes, cross dimensional attributes, convergence, shared hierarchies, incomplete hierarchies, recursive hierarchies	CO4, CO5
C	Aggregation-additive, non-additive, convergence,	CO4, CO5
Unit 5	**Index for data warehouse**	
A	B+ tree index, Bitmap index, Projection Index	CO5, CO6
B	Join and Star index, spatial index	CO5, CO6
C	Optimizers, index dimension table, physical design elements	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% / MTE 20% / ETE 50%	
Text book/s*		
Other References		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Recall the necessary prerequisites to understand warehousing	PO1, PO2, PO4, PO6, PO8, PO10, PO11, PO12,
2.	Explain the basics of warehouse architecture and component and establish its utility.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1
3.	Apply the acquired knowledge of warehouses to various avenues of application	PO1, PO2, PO3, PO5, PSO12, PSO2,
4.	Identify the architecture suitable for implementation	PO3, PO4, PO5, PO9, PSO2, PSO3
5.	Apply the basic and advanced modeling techniques	PO1, PO2, PO4, PO8, PSO1, PSO2, PSO3
6.	Integrating and interpreting the data sets and improving effectiveness, efficiency and quality for data analysis.	PO2, PO4, PO8, PO9, PO11, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Data Warehouse (Course Code CSD202)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Data Warehouse CSD 202	CO1	3	2	-	2	-	2	2	1	-	2	1	3	-	-	-
	CO2	3	2	2	3	2	-	-	-	1	2	-	2	1	-	-
	CO3	2	3	3	2	3	-	1	-	-	-	-	2	-	-	2
	CO4	-	-	3	3	2	-	-	-	2	-	-	-	-	3	2
	CO5	2	3	-	-	-	-	1	2	-	-	-	-	1	3	2
	CO6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**		
Department	**Department of Computer Science and Engineering**		
Program:	**B.Tech.**		
Branch:	**CSE**		
1	Course Code		
2	Course Title	Data Mining	
3	Credits	4	
4	Contact Hours (L-T-P)	3 0 2	
	Course Status	Core /Elective/Open Elective	
5	Course Objective	1. Provide students with an overview of the methodologies and approaches to data mining. 2. Gain insight into the challenges and limitations of different data mining techniques. 3. Provide the students with practice on applying data mining solutions. 4. Prepare students for research in the area of data mining and related applications.	
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	**CO1:** To Recall the basic data analysis process flow and data pre-processing techniques **CO2:** To Explain the interpretation, integration and preparation of data sets towards improving effectiveness, efficiency and quality for data analysis. **CO3:** To Apply the mining of datasets towards knowledge discovery from real world tangible scenarios **CO4:** To Analyse different data mining and knowledge discovery processes over a variety of real-word application areas **CO5:** To Compare and contrast and determine the data mining algorithms fit for an open variety of real-world, tangible data source **CO6:** To Adapt the acquired data mining methodologies towards societal, scientific and financially relevant outcomes.	
7	Course Description	This course introduces advanced aspects of data warehousing and data mining, encompassing the principles, to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Data Mining**	
	A	Evolution of the data mining process, revision of introductory concepts, Knowledge Discovery Process	CO1, CO2
	B	Central Tendency, Box Plots, introduction to Data Mining Techniques.	CO1
	C	Introduction to outliers, Effect of outliers on analysis outcome, handling the outliers	CO1
	Unit 2	**Data Pre-processing**	
	A	Descriptive Data Summarization, Data Cleaning	CO1, CO2
	B	Data Integration and Transformation	CO1, CO2

C	Data Reduction, Discretization and Concept Hierarchy Generation.	CO1, CO2
Unit 3	**Frequent Pattern Mining**	
A	Efficient and Scalable Frequent Itemset Mining Methods: A-priori Algorithm, Naïve Algorithm	CO3, CO4, CO5
B	FPGrowth, ECLATS	CO3, CO5
C	Correlation Analysis, regression analysis	CO3, CO4, CO5
Unit 4	**Classification & Prediction**	
A	What is classification, requirements of classification, Decision Tree-ID3 Algorithm	CO3, CO4, CO5
B	Naive Bayes Classifier, Rule Based Classification, Backpropagation	CO4
C	Support Vector Machine for linearly separable data. Prediction: - Linear Regression, Model Evaluation Techniques	CO4, CO5
Unit 5	**Clustering & Data Mining Applications**	
A	Requirements of cluster analysis, Partitioning methods-k-means and k-mediods, Hierarchical Methods-Agglomerative and divisive, Density based methods- DBSCAN	CO4, CO5
B	Data Mining for: Financial Data Analysis, Intrusion Detection and Prevention, Retail and Telecommunication Industries, Science & Engineering, Recommender Systems	CO5, CO6
C	DM for Privacy, Security, and Social Impacts of Data Mining, Data Mining Trends	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. J. Han, M. Kamber, J. Pei "Data Mining Concepts and Techniques", Edition:3, Morgan Kaufmann	
Other References	1. M.H. Dunham, Data Mining Introductory and Advanced Topics, Pearson Education. 2. Adriaans, Data Mining, Pearson Education 3. Vikram Pudi & P. Radhakrishnan, "Data Mining", Oxford University Press	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: To Recall the basic data analysis process flow and data pre-processing techniques	PO1, PO2, PO4, PO6, PO8, PO10, PO11, PO12,

2.	CO2: To Explain the interpretation, integration and preparation of data sets towards improving effectiveness, efficiency and quality for data analysis.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1
3.	CO3: To Apply the mining of datasets towards knowledge discovery from real world tangible scenarios	PO1, PO2, PO3, PO5, PSO12, PSO2,
4.	CO4: To Analyse different data mining and knowledge discovery processes over a variety of real-word application areas	PO3, PO4, PO5, PO9, PSO2, PSO3
5.	CO5: To Compare and contrast and determine the data mining algorithms fit for an open variety of real-world, tangible data source	PO1, PO2, PO4, PO8, PSO1, PSO2, PSO3
6.	CO6: To Adapt the acquired data mining methodologies towards societal, scientific and financially relevant outcomes.	PO2, PO4, PO8, PO9, PO11, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Data Mining (CSD301)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Data Mining (CSD 301)	CO1	3	2	-	2	-	2	2	1	-	2	1	3	-	-	-
	CO2	3	2	2	3	2	-	-	-	1	2	-	2	1	-	-
	CO3	2	3	3	2	3	-	1	-	-	-	-	2	-	-	2
	CO4	-	-	3	3	2	-	-	-	2	-	-	-	-	3	2
	CO5	2	3	-	-	-	-	1	2	-	-	-	-	1	3	2
	CO6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B.Tech.**		
Branch:		**CSE**		
1	Course Code			
2	Course Title	Data Mining LAB		
3	Credits	1		
4	Contact Hours (L-T-P)	0	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	5. Provide students with an overview of the methodologies and approaches to data mining. 6. Gain insight into the challenges and limitations of different data mining techniques. 7. Provide the students with practice on applying data mining solutions. 8. Prepare students for research in the area of data mining and related applications.		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	**CO1:** To Recall the basic data analysis process flow and data pre-processing techniques **CO2:** To Explain the interpretation, integration and preparation of data sets towards improving effectiveness, efficiency and quality for data analysis. **CO3:** To Apply the mining of datasets towards knowledge discovery from real world tangible scenarios **CO4:** To Analyse different data mining and knowledge discovery processes over a variety of real-word application areas **CO5:** To Compare and contrast and determine the data mining algorithms fit for an open variety of real-world, tangible data source **CO6:** To Adapt the acquired data mining methodologies towards societal, scientific and financially relevant outcomes.		
7	Course Description	This course introduces advanced aspects of data warehousing and data mining, encompassing the principles, to analyze the data, identify the problems, and choose the relevant models and algorithms to apply.		
8	Outline syllabus			

1	Analyzing statistical description of given dataset central tendency measures.	CO1, CO2
2	Analyzing statistical description of given dataset using data dispersion estimation measures.	CO1, CO2
3	Analyze the effects of outliers on the analysis outcome. Differences in the outcomes.	CO1, CO2
4	Analyze the dataset for missing values, noisy data values in the given dataset.	CO1, CO2
5	Demonstrate frequent itemset pattern mining using Naïve algorithm from retail dataset.	CO3
6	Demonstrate frequent itemset pattern mining using the	CO3

	A-priori algorithm from retail dataset.	
7	Demonstrate frequent itemset pattern mining from the given dataset using FP growth algorithm.	CO3
8	Demonstrate association rule mining in a given dataset using the ECLAT algorithm. Compare the results with A-priori.	CO3, CO4
9	Demonstrate correlation analysis, regression analysis for a bivariate to multivariate dataset.	CO3, CO4
10	Demonstrate decision tree-based classification of a given dataset using the ID3 algorithm.	CO3, CO4
11	Demonstrate the use Naive Bayes Classifier for a given dataset classification.	CO5
12	Demonstrate the use of SVMs for linearly separable dataset.	CO5
13	Demonstrate the prediction using Linear regression on a given dataset.	CO5
14	Demonstrate the use of density based clustering methods using DBSCAN.	CO5
15	Case Study: Retail and Telecommunication Industry data analysis for patterns and relatable outcomes.	CO6

Mode of examination	Theory/Jury/Practical/Viva		
Weightage Distribution	CA 30%	MTE 20%	ETE 50%
Text book/s*	1. J. Han, M. Kamber, J. Pei "Data Mining Concepts and Techniques", Edition:3, Morgan Kaufmann		
Other References	1. M.H. Dunham, Data Mining Introductory and Advanced Topics, Pearson Education. 2. Adriaans, Data Mining, Pearson Education 3. Vikram Pudi & P. Radhakrishnan, "Data Mining", Oxford University Press		

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: To Recall the basic data analysis process flow and data pre-processing techniques	PO1, PO2, PO4, PO6, PO8, PO10, PO11, PO12,
2.	CO2: To Explain the interpretation, integration and preparation of data sets towards improving effectiveness, efficiency and quality for data analysis.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1
3.	CO3: To Apply the mining of datasets towards knowledge discovery from real world tangible scenarios	PO1, PO2, PO3, PO5, PSO12, PSO2,
4.	CO4: To Analyse different data mining and knowledge discovery processes over a variety of real-word application areas	PO3, PO4, PO5, PO9, PSO2, PSO3
5.	CO5: To Compare and contrast and determine the data	PO1, PO2, PO4, PO8,

	mining algorithms fit for an open variety of real-world, tangible data source	PSO1, PSO2, PSO3
6.	CO6: To Adapt the acquired data mining methodologies towards societal, scientific and financially relevant outcomes.	PO2, PO4, PO8, PO9, PO11, PO12, PSO2, PSO3

PO and PSO mapping with level of strength for Data Mining (CSD301)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Data Mining LAB (CDP 301)	CO1	3	2	-	2	-	2	2	1	-	2	1	3	-	-	-
	CO2	3	2	2	3	2	-	-	-	1	2	-	2	1	-	-
	CO3	2	3	3	2	3	-	1	-	-	-	-	2	-	-	2
	CO4	-	-	3	3	2	-	-	-	2	-	-	-	-	3	2
	CO5	2	3	-	-	-	-	1	2	-	-	-	-	1	3	2
	CO6	-	2	-	3	-	-	-	2	1	-	1	3	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**			
Department	**Department of Computer Science and Engineering**			
Program:	**B.Tech. DS**			
Branch:	**CSE**			
1	Course Code			
2	Course Title	Data Exploration and Visualization		
3	Credits	3		
4	Contact Hours (L-T-P)	2	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	• To understand what is in a dataset and the characteristics of the data • To design and create data visualizations based on data available and tasks to be achieved. • To evaluate the effectiveness of visualization designs, and think critically about each design decision, such as choice of color and choice of visual encoding. • Students will create their own data visualizations, and learn to use Open Source data visualization tools, especially D3.js.		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	CO1: Design an approach to leverage data using the steps in the machine learning process. CO2: Design and create data visualizations. CO3: Craft visual presentations of data for effective communication. CO4: Design and evaluate color palettes for visualization based on principles of perception. CO5: Apply data transformations such as aggregation and filtering for visualization. CO6: Use JavaScript with D3.js to develop interactive visualizations for the Web.		
7	Course Description	This course uses ecological datasets to discuss data exploration and visualization tools. It also explain how to visualize the results of statistical models. The course also includes the JavaScript with D3.js needed to construct, visualize, and explore the main features of the data step by step.		
8	Outline syllabus		CO Mapping	
	Unit 1	**INTRODUCTION**		
	A	Introduction to data exploration, Data Terminology,	CO1	
	B	Data Exploration through summary statistics, Exploring data with KNIME plots, Data Exploration in Spark	CO 2, CO3	
	C	Classification Techniques, Clustering Techniques, Regression Methods,	CO 1, CO2	
	Unit 2	**OVERVIEW OF DATA VISUALIZATION, INTRODUCTION TO WEB TECHNOLOGIES**		
	A	Why Visualize Data?, Introduction to SVG and CSS, Introduction to JavaScript, Introduction to VizHub,	CO3	

	Making a Face with D3.js	
B	Input for Visualization: Data and Tasks, Loading and Parsing Data with D3.js	CO2. CO3, CO4
C	Encoding Data with Marks and Channels, Rendering Marks and Channels with D3.js and SVG, Introduction to D3 Scales, Creating a Scatter Plot with D3.js	CO3, CO4
Unit 3	**DATA MANAGEMENT ISSUES**	
A	Integrity and Quality of Data - Data type issues, Exploratory data analysis, simple viz.	CO1, CO4,CO5
B	Handling missing data, Handling outliers, Attribute creation, modification conversion: categorical – numeric.	CO4, CO5
C	Understanding and naming the attributes and files, Replicability	CO3, CO4
Unit 4	**VISUALIZATION OF SPATIAL DATA, NETWORKS, AND TREES**	
A	Reusable Dynamic Components using the General Update Pattern:-Reusable Scatter Plot Common Visualization Idioms with D3.js:- Bar Chart, Vertical & Horizontal, Pie Chart and Coxcomb Plot, Line Chart, Area Chart	CO2, CO3
B	Making Maps, Visualizing Trees and Networks	CO3, CO4
C	Encoding Data using Color, Encoding Data using Size, Stacked & Grouped Bar Chart, Stacked Area Chart & Streamgraph, Line Chart with Multiple Lines	CO4, CO5
Unit 5	**INTERACTION TECHNIQUES**	
A	Adding interaction with Unidirectional Data Flow, Using UI elements to control a scatter plot, Panning and Zooming on a Globe, Adding tooltips	CO1,CO2, CO3, CO5
B	Small Multiples, Linked Highlighting with Brushing, Linked Navigation: Bird's Eye Map	CO4, CO5, CO6
C	Case Study: Covid19 Dashboard by joining interactive techniques and spatial data networks and trees	CO4, CO5, CO6

Mode of examination			
Weightage	CA	MTE	ETE
Distribution	30%	20%	50%

Text book/s*

1. Advanced Methods of Data Exploration and Modelling by Brian Everitt, Graham Dunn
2. Interactive Data Visualization for the Web by Scott Murray 2nd Edition (2017)

Other References

1. Visualizing Data: Exploring and Explaining Data with the Processing Environment by Ben Fry
2. Visualization Analysis and Design by Tamara Munzner

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Design an approach to leverage data using the steps in the machine learning process.	PO 1, PO2
2.	CO2: Design and create data visualizations	PO1, PSO2, PSO3
3.	CO3: Craft visual presentations of data for effective communication.	PO1, PO2, PO3, PSO2
4.	CO4: Design and evaluate color palettes for visualization based on principles of perception.	PO4, PO5, PO6
5.	CO5: Apply data transformations such as aggregation and filtering for visualization.	PO1, PO2, PSO2,PSO3
6.	CO6: Use JavaScript with D3.js to develop interactive visualizations for the Web.	PO2, PO3, PO5, PSO2, PSO3

PO and PSO mapping with level of strength for Data Exploration and Visualization

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
Data Exploration and Visualization	CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
	CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	3	2
	CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
	CO4	-	-	-	3	2	3	-	-	-	-	-	-	-	-	-
	CO5	2	3	-	-	-	-	-	-	-	-	-	-	-	2	3
	CO6	-	2	3	-	3	-	-	-	-	-	-	-	-	3	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and Technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in DS**		
1	Course Code	**CSD303**		
2	Course Title	**Big Data Analytics**		
3	Credits	3		
4	Contact Hours	2	0	2
	Course Status	Core		
5	Course Objective	Students should be able to learn about analytics techniques to handle the big data through Hadoop framework.		
6	Course Outcomes (CO) (Max of 4)	On successful completion of this module students will be able to: 1. Explore the fundamental concepts of Big Data analysis 2. Identify and successfully apply appropriate techniques and tools to solve actual Big Data problems (derive value from vast data sets) 3. Examine the distributed and parallel computing and its application for big data analysis 4. Analyse how to deal with huge amount of data and propose scalable solutions 5. Evaluate statistical packages and deriving intelligence from unstructured information 6. Compile and contrast among different big data analytics tools and how they can help solving Industry challenges		
7	**Prerequisite**	Knowledge of DBMS, Data Mining is essential		
8	**Course Contents**			
8.01	Unit A	**Introduction to Big Data**		
8.02	Unit A Topic 1	Introduction to Big Data, challenges of conventional systems		
8.03	Unit A Topic 2	Evolution of analytic scalability		
8.04	Unit A Topic 3	Modern data analytic tools		
8.05	Unit B	**Modelling techniques**		
8.06	Unit B Topic 1	Mining frequent itemsets, Apriori algorithm, Handling large data sets in main memory		
8.07	Unit B Topic 2	Clustering techniques, clustering for parallelism		
8.08	Unit B Topic 3	Classification and Prediction: Decision Tree induction, Developing models using Decision Tree Algorithms		
8.09	Unit C	**Frameworks**		
8.10	Unit C Topic 1	Overview of Hadoop, Hadoop Distributed File System, HDFS design and architecture		
8.11	Unit C Topic 2	Hadoop Map reduce Framework, HBASE		
8.12	Unit C Topic 3	Interacting HDFS using HIVE, sample programs in HIVE-PIG		
8.13	Unit D	**Data Analysis and mining data streams**		
8.14	Unit D Topic 1	Regression modelling, Rule Induction		
8.15	Unit D Topic 2	Fuzzy decision trees and neural networks		
8.16	Unit D Topic 3	Introduction to streams concepts, Real time analytics platform, case studies		
8.17	Unit E	**Visualization**		
8.18	Unit E Topic 1	Visual data analysis techniques, Interaction techniques		
8.19	Unit E Topic 2	Analytics using statistical packages, association intelligence from unstructured information		

8.20	Unit E Topic 3	Text analytics, industry challenges and application of analytics		
9	**Course Evaluation**			
		Continuous Assessment	Mid-Term Examination	End-Term Examination
9.11	Attendance	Mandatory	Mandatory	75%
9.12	Assignment	Yes	--	--
9.13	Quizzes	yes	--	--
9.14	Projects	Yes	--	--
9.15	Presentations	Yes	--	--
9.16	Exam	--	Yes	Yes
9.17	Total Marks	30	30	40
10	**Reading Content**			
9.1	Text book*	6. Bill Franks, "Taming the big data tidal wave: finding opportunities in huge data streams with advanced analytics", John Wiley & Sons,2012		
9.2	Other references	5. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press,2012 6. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer 2007 7. Jiwaei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Explore the fundamental concepts of Big Data analysis	PO1, PO6, PO7, PO9, PO10, PO12
2.	Identify and successfully apply appropriate techniques and tools to solve actual Big Data problems (derive value from vast data sets)	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO12, PSO2
3.	Examine the distributed and parallel computing and its application for big data analysis	PO3, PO4, PO5, PO8, PO9, PSO1, PSO2
4.	Analyse how to deal with huge amount of data and propose scalable solutions	PO2, PO3, PO4, PO5, PO6, PO7, PO10, PO11, PSO2, PSO3
5.	Evaluate statistical packages and deriving intelligence from unstructured information	PO3, PO4, PO5, PO11, PO12, PSO1, PSO2
6.	Compile and contrast among different big data analytics tools and how they can help solving Industry challenges	PO4, PO5, PO6, PO7, PO8, PO11, PO12, PSO1, PSO2

PO and PSO mapping with level of strength for Course Name Introduction to Artificial Intelligence & Machine Learning **(Course Code** CSA-102**)**

Course Code_ Course Name	**CO's**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CSD303_Big Data Analytics	**CO1**	3	2	-	-	-	1	1	-	2	2	-	3	-	-	-
	CO2	2	2	3	3	2	2	-	2	-	-	-	2	-	3	-
	CO3	-	-	3	3	2	-	-	2	3	-	-	-	2	3	-
	CO4	-	2	3	2	2	2	2	-	-	2	2	-	-	3	2
	CO5	-	-	3	2	2	-	-	-	-	-	2	2	2	3	-

	CO6	-	-	-	2	3	2	1	2	-	-	2	2	2	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Total 28

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

<table>
<tr><td colspan="2">School:</td><td colspan="3">School of Engineering and technology</td></tr>
<tr><td colspan="2">Department</td><td colspan="3">Department of Computer Science and Engineering</td></tr>
<tr><td colspan="2">Program:</td><td colspan="3">B.Tech.</td></tr>
<tr><td colspan="2">Branch:</td><td colspan="3">CSE</td></tr>
<tr><td>1</td><td>Course Code</td><td>New Code (major changes)</td><td colspan="2"></td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Business Intelligence</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="3">3</td></tr>
<tr><td>4</td><td>Contact Hours (L-T-P)</td><td>3</td><td>0</td><td>0</td></tr>
<tr><td></td><td>Course Status</td><td colspan="3">Core /Elective/Open Elective</td></tr>
<tr><td>5</td><td>Course Objective</td><td colspan="3">In this course, students are intended to have gained an understanding of how business professionals can use analytics techniques to formulate and solve relevant problems and how we can use analytics to support decision making. We will learn the principles of developing, reporting, and analyzing business data. In support of these activities selected analysis tools and methods will be utilized.</td></tr>
<tr><td>6</td><td>Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)</td><td colspan="3">CO1. Define and recall the importance of data in business by introducing Intelligence in business strategies.
CO2. Explain the process of data analytics and recognize the best practices for data mining and pitfalls of managing data analytics projects. Show how data can improve business performance and inform decisions for managing business application areas.
CO3. Identify the detailed account of and discuss fundamental concepts, theories, methods and models within Business Intelligence and Data Warehousing
CO4. Analyzing business intelligence using different categorization of operations such as extraction, cleansing, integrating, visualizing, and reporting to identify the functionalities of BI Life Cycle
CO5. Evaluate the impact of DM and DW and identify the Issues and challenges.in managing capabilities and cost in Business by decision analysis and decision processes.
CO6. Adapt the basics and learnings available to Build the relationship of data in production and operational systems for data Intelligence using BI.</td></tr>
<tr><td>7</td><td>Course Description</td><td colspan="3">After finishing the course the student will be able describe and comprehend all the concepts related with Business Intelligence, how to manage the internal and external information in order to make the best decisions for the purpose of giving the best service, and obtain a good profitability.</td></tr>
<tr><td>8</td><td colspan="3">Outline syllabus</td><td>CO Mapping</td></tr>
<tr><td></td><td>Unit 1</td><td colspan="2">Introduction to BI</td><td></td></tr>
<tr><td></td><td>A</td><td colspan="2">Introduction, Definition, History and Evolution, BI Segments, Difference between Information and Intelligence, Defining BI Value Chain, Factors of BI</td><td>CO1</td></tr>
</table>

		System, Real time BI, BI Applications	
	B	BI Essentials: Introduction, Creating BI Environment, BI Landscape, Types of BI, BI Platform, Dynamic roles in BI, Roles of BI in Modern Business	CO1
	C	BI Types: Introduction, Multiplicity of BI Tools, Types of BI Tools, Modern BI, the Enterprise BI, Information Workers	CO1
	Unit 2	**Data Mining (DM) Tools and Techniques**	
	A	Architecture of the Data: Introduction, Types of Data and Models (Enterprise Data, Enterprise Subject Area, Enterprise Conceptual, Enterprise Conceptual Entity), Granularity of data, Reporting and Query Tools, Data Partitioning, Metadata, TDQM.	CO2
	B	Introduction to DM, Definition, Mining parameters, How DM works? Types of relationships, Architecture of DM, Functionalities of DM, Classification on DM System, Various risks in DM, Advantages and disadvantages of DM,	CO2, CO6
	C	DM Techniques, Statistical Perspective on DM, Statistics-need, Similarity Measures, Decision Tree-Illustrations, Neural Network, Neural Network versus Conventional Computers, Genetic Algorithms, Applications of Genetic Algorithm	CO2, CO6
	Unit 3	**Data Warehouse (DW) and Knowledge Management (KM)**	
	A	Introduction to DW, Advantages and Disadvantages of DW, Data Mart, Aspects of Data Mart, Online Analytical Processing, Characteristics of OLAP, OLAP Data Modeling, Difference between OLAP and OLTP, Multidimensional Data Model, Data Modeling using Schema	CO3, CO6
	B	Different Ways of DW, Types of Business Models, B2B BI Model and Its Types, Electronic Data Interchange & E-Commerce Models, Advantages of E-Commerce for B2B, Systems for Improving B2B E-Commerce, B2C BI Model and its Need	CO3, CO6
	C	Introduction of KM, Characteristics, Knowledge Assets, Generic KM Process, KM Technologies, Essentials of KM Process	CO3, CO6
	Unit 4	**Data Extraction (DE) and BI Life Cycle (BILC)**	
	A	Introduction to DE, Role of ETL process, Importance of Source Identification, Various DE techniques, Logical and Physical extraction methods, Change data capture	CO4
	B	Introduction of BILC, Enterprise Performance Life Cycle (EPLC) Framework Elements, Life Cycle Phases, Human Factors in BI Implementation, BI Strategy and Objectives, BI Development Stages, Steps	CO4, CO6
	C	BI User Model, Evolution of BI, Content Management System, End User Segmentation, Basic Reporting and	CO4, CO6

		Querying, Online Analytical Processing, OLAP Techniques and Applications, Applying the OLAP to Data Warehousing, Future of Business Intelligence			
	Unit 5	**BI Issues and Challenges**			
	A	Critical Challenges for BI success, Cross-Organizational Partnership, Business Sponsors, Dedicated Business Representation, BI App Development methodology, Data Standardization, Business Profitability			CO5
	B	BI Strategy and Planning to implement BI Solution, Understand Limitations of BI, BI Usage, TCO, Managing the TCO of the BI, Factors that Affect TCO			CO5, CO6
	C	Implementation of BI, BI Platform, BI Platform Capability Matrix, BI Target Databases, Data Mart, BI Products and Vendor, The Big Four BI vendors			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Business Intelligence: A Managerial Approach (2014) Turban, Sharda, Delen, King, Publisher: Prentice Hall, Edition: 2nd, ISBN: 13-978-0-136-10066-9 2. Turban, Efraim, Ramesh Sharda, and Dursun Delen. Business intelligence and analytics: systems for decision support. Pearson Higher Ed, 2014. 3. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining Concepts and Techniques, Third Edition			
	Other References	1. Turban, Efraim, Ramesh Sharda, and Dursun Delen. "Decision support and business intelligence systems (required)." Google Scholar (2010). 2. Chen, Hsinchun, Roger HL Chiang, and Veda C. Storey. "Business intelligence and analytics: From big data to big impact." MIS quarterly 36.4 (2012). 3. Business Intelligence Guidebook: From Data In… (Kindle Edition)by Sherman, Rick 4. Business Intelligence For Dummies (Kindle Edition)by Scheps, Swain 5. Berry, M. y Linoff, G. (2004). Data Mining Techniques. For Marketing, Sales and Customer Relationship Management. Indianapolis: Wiley Publishing Inc			

SHARDA UNIVERSITY
Beyond Boundaries

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define and recall the importance of data in business by introducing Intelligence in business strategies.	PO1, PO2, PO3, PO4,, PO9, PO11, PSO2
2.	Learn and Explain the best practices for data mining and pitfalls of managing data analytics projects. Show how data can improve business performance.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO10, PO11, PSO1, PSO2, PSO3
3.	Identify and Use the tools to develop, implement and administrate wide range of BI artifacts	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PSO1, PSO2, PSO3
4.	Analyze various modeling techniques and apply business intelligence methods to various situations	PO1, PO2, PO3, PO4, PO5, PO6, PO11, PO12, PSO1, PSO2, PSO3
5.	Evaluate the impact of DM and DW and identify the issues and challenges.in managing capabilities and cost in Business by decision analysis and decision processes.	PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PSO2, PSO3
6.	Adapt the basics and learnings available to build the relationship of data in production and operational systems for data Intelligence using BI	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name xxxx (Course Code yyyy)

	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSD 401	**CO1**	3	2	2	1	1	1	1	1	1	1	1	1	2	3	2
	CO2	2	3	2	2	2	2	3	3	1	1	3	2	2	2	3
	CO3	2	3	3	2	3	3	3	1	2	2	2	1	3	2	3
	CO4	3	3	3	3	3	2	3	1	2	2	2	2	3	3	2
	CO5	2	2	2	3	2	3	3	2	1	3	2	1	2	2	3
	CO6	3	1	2	2	2	3	2	1	1	3	2	3	2	2	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School		**School of Engineering & Tech**			
Program		**B.Tech.**			
Branch		**CSE DS**			
1	Course Code	CSD021			
2	Course Title	Business Process Management			
3	Credits	3			
4	Contact Hours (L-T-P)	3	0	0	
	Course Status	UG			
5	Course Objective	Business Process Management course focuses on the essential skills business people require to analyze and redesign their processes			
6	Course Outcomes	After the successful completion of this course, students will be able to: **CO1:** Understand Process Designer and its objectives **CO2:** Understand Process Modeling and its relation to BPM **CO3:** Perform translation of workflow steps into business process activities **CO4:** Design complex process applications **CO5:** Create dashboards and reports **CO6:** Compile the tools on the basis of their performance in a said business process setup			
7	Course Description	Business Process Management (BPM) is a management discipline concerned with lifting an organization's performance through improvement, management and control of business processes. It encapsulates methods, techniques and software involved throughout all stages of the process lifecycle including analysis, design, enactment and control.			
8	**Outline syllabus**				**CO Mapping**
	Unit 1	**Introduction to BPM**			
	A	Business Process, Business Process Management, Themes of Business Process, Goals of Business Process, Principles of Business Process, Process Choreographies and its importance, Process Designer, Administration and stakeholders of business process, Classification of Business Processes, Organizational versus Operational.			CO1
	B	Intraorganizational Processes versus Process, Degree of Automation, Degree of Repetition, Degree of Structuring, Goals: Structure, and Organization, Business Process Modelling Foundation, Conceptual Model and Terminology, Abstraction Concepts, Horizontal Abstraction, Vertical Abstraction from Business Functions to Business Processes Business Analysis: Business Process Analysis, Object Oriented Analysis, Structure Analysis			CO1, CO2, CO4

	C	Process Models and Process instances, Process Models, Activity Models and Gateway Models, Activity Instances. Business Process Modeling Notations.	CO1, CO2, CO3
	Unit 2	**BPM Life Cycle Methodology**	
	A	Business Process Management Activities: Modelling, Execution, Monitoring, Optimization, Components of BPM suites, BPM Technology Workflow, Managing end-to-end, Customer-facing Processes	CO2, CO3
	B	Business Process Management Life Cycle , Programming Language for BPM, Establishing a common language for business-IT alignment, Cloud Computing BPM, Market, Benefits	CO1, CO2, CO3
	C	Interaction between Business Process and Data, Business Process Management tools and simulation, Business Process Integration and reengineering	CO2
	Unit 3	**Business Process Management Overview**	
	A	Overview of Business Process Management and Process Modelling, Process Designer, Overview of Business Process Management and Process Modelling. Artifacts in Business Process Designing, Process development with the Process Centre, Process applications: Overview, Process applications and business level applications.	CO3, CO4
	B	Various Notation used to create BPD, Creating BPD	CO3, CO4
	C	Building Services, Understanding service components, Business objects and variable, Modelling events, Business objects and variables, Modelling events, Modelling event gateways, Creating user interfaces, Designing process interactions for business users, Enabling processes for tracking and reporting, Running and debugging processes with the Inspector	CO3, CO4
	Unit 4	**Creating User Interfaces**	
	A	Creating user interfaces, Coaches - Difference between Coaches and Heritage Coaches. Developing reusable Coach Views - Coach Views, Templates, Stock controls - Button, Checkbox, Date Time Picker, Horizontal Section, Output Text, Select, Table Tabs, Text, Vertical Section. Stock content controls, Document List - Document Viewer. Advanced items for Coach Views - Content box, Custom HTML	CO1, CO3, CO4
	B	Boundary events. Binding views with data - Defining Coach View behavior. Architecting complex process applications - Designing process interactions for business users, Configuring a role-based business user interface. Developing flexible and efficient process applications, Integrating with other systems, Creating outbound integrations, Integration Service implementations, Web Service Integration step in an integration service.	CO1, CO3, CO4

	C	Business Process Manager SQL Integration services. Understanding the message structure, Passing complex variable types to Undercover Agents, Passing IBM BPM Structured types, Passing Record type, Passing Date/Time types, Passing Boolean type, Passing Map type etc.			CO1, CO3, CO4
	Unit 5	**Inferential Statistics and Prescriptive analytics**			
	A	Solution for Collaborative Lifecycle Management, Info Sphere Data Architect, WebSphere Operational Decision Management, and Business Process Manager Advanced, Integration. Designing process interactions for business users			CO4, CO5, CO6
	B	BPEL process interactions, Factors affecting BPEL process interactions, Defining reports in process Designer, Developing flexible and efficient process applications - Enabling processes for tracking and reporting.			CO4, CO5, CO6
	C	Case study on various Business Process Management tools i.e. IBM BPM			CO2, CO4, CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	7. Business Process Management (IBM ICE Publication) 8. Business Process Management Concepts, Languages, Architectures, Mathias Weske, Springer 9. Deliver Modern UI for IBM BPM with the Coach Framework and Other Approaches(E-Book)			
	Other References	1. Internet as a resource for reference			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand Process Designer and its objectives	PO1, PO3, PO6, PO8, PSO3
2.	CO2: Understand Process Modeling and its relation to BPM	PO1, PO2, PO3, PSO3
3.	CO3: Translation of workflow steps into business process activities	PO4, PO6, PO7, PO9, PSO3
4.	CO4: Architect complex process applications	PO1, PO3, PO4, PO5, PSO3
5.	CO5: Visibility through dashboards and reports	PO1, PO3, PO4, PO5, PSO3,
6.	CO6: Compile the tools on the basis of their performance in a said business process setup	PO1, PO3, PO4, PO5, PSO3

PO and PSO mapping with level of strength for Course Name Business Process Management CSD303

	Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
	CO1	1	1	1	1	1	1	1	1	-	-	1	1	-	-	3
	CO2	2	2	2	2	1	1	1	1	1	2	1	2	1	1	3
CSE	CO3	3	2	3	3	3	2	1	2	3	3	1	3	1	3	3
	CO4	3	1	3	3	3	1	1	2	3	3	1	3	-	-	3
	CO5	1	2	2	2	2	2	1	2	1	2	1	2	-	2	3
	CO6	3	1	3	3	3	1	1	2	3	3	1	3	-	-	3

School:	**School of Engineering and Technology**
Department	**Department of Computer Science and Engineering**
Program:	**B. Tech**
Branch:	**CSE with Specialization in DS**

1	Course Code			
2	Course Title	Introduction to Machine Learning for Data Science		
3	Credits	3		
4	Contact Hours (L-T-P)	2	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Machine Learning (ML) as well as to give a strong foundation of ML Techniques used in Data Science.		
6	Course Outcomes	CO-7. Define the requirement of Machine Learning CO-8. Classify the functionality and active environment For Machine Learning. CO-9. Apply the concepts of Propositional Logic for real-world AI based problems. CO-10. Analyse the various ML techniques and apply them to solve the real-world problems. CO-11. Explain the basic concepts of pythons to understand and Evaluate the Models and Applications. CO-12. Discuss the applicability of Machine learning in Data Science		
7	Course Description	Machine Learning (ML) are increasingly necessary to translate today's data into direct business value. This course introduces learners to the basic concepts of ML, and covers how learning algorithms work. It illustrates how ML fit in the data science ecosystem, and presents several real-world use cases that show how companies are implementing.		

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Machine Learning**	
	A	Introduction, Training, Rote Learning, Learning Concepts, A Simple Learning Algorithm, Types of learning (Supervised, Unsupervised, Reinforcement)	CO1
	B	Introduction to Regression and types of regression, Objective Function/Cost Function, Gradient Descent Learning Algorithm	CO1
	C	Concepts of Over-fitting and under-fitting, Application of Linear Regression in various application domains through case study.	CO1
	Unit 2	**Types of Learning**	
	A	Supervised Learning, Classification and Regression, Generalization, Overfitting, and Underfitting (Relation of Model Complexity to Dataset Size), Uncertainty Estimates from Classifiers (The Decision Function, Predicting Probabilities, Uncertainty in Multiclass Classification)	CO2
	B	Supervised Machine Learning Algorithms (Some Sample Datasets, k-Nearest Neighbors, Linear Models, Naive Bayes Classifiers, Decision Trees, Ensembles of Decision Trees, Kernelized Support Vector Machines, Neural Networks),	CO2
	C	Unsupervised Learning and Preprocessing, Types of Unsupervised Learning, Challenges in Unsupervised Learning	CO2
	Unit 3	**Preprocessing, Feature Extraction and Clustering**	

A	Preprocessing and Scaling (Different Kinds of Preprocessing, Applying Data Transformations, Scaling Training and Test Data the Same Way, The Effect of Preprocessing on Supervised Learning)	CO3
B	Dimensionality Reduction, Feature Extraction, and Manifold Learning (Principal Component Analysis (PCA), Non-Negative Matrix Factorization (NMF), Manifold Learning with t-SNE)	CO3
C	Clustering (k-Means Clustering, Agglomerative Clustering, DBSCAN, Comparing and Evaluating Clustering Algorithms)	CO3
Unit 4	**Data Representation and Modeling**	
A	Representing Data and Engineering Features, Categorical Variables (One-Hot-Encoding, Numbers Can Encode Categoricals, Binning, Discretization, Linear Models, and Trees	CO4
B	Interactions and Polynomials, Univariate Nonlinear Transformations, Automatic Feature Selection, Univariate Statistics, Model-Based Feature Selection, Iterative Feature Selection, Utilizing Expert Knowledge	CO4
C	Model Evaluation and Improvement, Cross-Validation(Cross-Validation in scikit-learn, Benefits of Cross-Validation, Stratified k-Fold Cross-Validation and Other Strategies)	CO4
Unit 5	**Model Evaluation and Pipelines**	
A	Grid Search (Simple Grid Search, The Danger of Overfitting the Parameters and the Validation Set, Grid Search with Cross-Validation)	CO5, CO6
B	Evaluation Metrics and Scoring (Keep the End Goal in Mind, Metrics for Binary Classification, Metrics for Multiclass Classification, Regression Metrics, Using Evaluation Metrics in Model Selection)	CO5, CO6
C	Algorithm Chains and Pipelines, Parameter Selection with Preprocessing, Building Pipelines, The General Pipeline Interface, Grid-Searching Preprocessing Steps and Model Parameters	CO5, CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	Andreas C. Müller and Sarah Guido, “Introduction to Machine Learning with Python A Guide for Data Scientists”, O’Reilly Media.	
Other References	8) Ethem Alpaydin, "Adaptive computation and machine learning, Introduction to machine learning, MIT Press 9)	

CO and PO Mapping

S.	Course Outcome	Program Outcomes (PO) & Program Specific

No.		Outcomes (PSO)
1.	Define the requirement of Machine Learning	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
2.	Classify the functionality and active environment For Machine Learning.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	Apply the concepts of Propositional Logic for real-world AI based problems.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
4.	Analyse the various ML techniques and apply them to solve the real-world problems.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5.	Explain the basic concepts of pythons to understand and Evaluate the Models and Applications.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	Discuss the applicability of Machine learning in Data Science	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name Introduction to Artificial Intelligence & Machine Learning **(Course Code** CSA-102**)**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Introduction to Artificial Intelligence & Machine Learning (CSA-102)	CO1	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
	CO2	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
	CO3	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
	CO4	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
	CO5	3	3	1	1	2	1	1	1	1	2	-	3	2	3	1
	CO6	3	3	1	1	2	1	1	1	1	2	1	3	2	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
		3	3	2	2	2	1	1	1	1	2	1	3	2	3	1

Total 28

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and Technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B. Tech**		
Branch:		**CSE with Specialization in Data Science**		
1	Course Code	**CSD 021**		
2	Course Title	**Neural Networks for Data Science**		
3	Credits	3		
4	Contact Hours (L-T-P)	2	0	2
	Course Status	Core		
5	Course Objective	6. To introduce the ideas of learning rule and implement them based on human experience. 7. To conceptualize the working of human brain using ANN. 8. To become familiar with neural networks that can learn from available examples and generalize to form appropriate learning rules for inference systems. 9. To provide the mathematical background for Neural Network and classification techniques. 10. To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.		
6	Course Outcomes	On successful completion of this module students will be able to: 7. **Define** biological significance of Neural Network and list ANN components. 8. **Classify** various learning paradigms based on real file problems 9. **Apply basic concepts to build** single and multi-layer feed-forward neural networks. 10. **Analyze** and train radial-basis function and recurrent networks; 11. **Explain** data preparation for analysis and decision using appropriate neural network model. 12. **Discuss** and adapt appropriate neural networks model for real life data mining applications.		
7	Course Description	This course introduces the basic models, learning algorithms, and some applications of neural networks. After this course, we should be able to know how to use neural networks for solving different problems related to pattern recognition, function approximation, data visualization, and so on.		
8				
	Unit 1	**Introduction**		
	A	Introduction, Motivation and History, Components of a Neuron-synapses, dendrite, cell nucleus, axon	CO1	
	B	Important Terminologies of ANNs: Propagation function, Activation function, output function,	CO1	

	Components of Artificial Neural Network: common activation functions, network topologies- feed forward, recurrent networks, completely linked networks	
C	Neuron Activation order: Synchronous activation, asynchronous activation, Communication with the outside world: input and output of data in and from neural networks	CO1
Unit 2	**Learning Paradigms**	
A	Learning Paradigms and their real Applications, Unsupervised learning and Supervised learning, Reinforcement learning, Offline and online learning and their applications based on real life problems.	CO2, CO6
B	Training patterns and teaching inputs, use of training samples, data set split into training, validation and testing data, Implication of splitting of data set, Learning curves and their importance in diagnostics	CO2, CO6
C	Gradient optimization procedures, Hebbian learning rule	CO2
Unit 3	**The Perceptron, Backpropagation and its variants**	
A	Single layer Perceptron network, Perceptron Learning Algorithm and convergence theorem, Delta rule as a gradient based learning strategy, Limitations of Single Layer Perceptron network	CO3
B	Multilayer Perceptron Network, Backpropagation learning and its applications	CO3
C	Analyzing effect of learning rate on learning process, Variants of Backpropagation algorithm	CO3
Unit 4	**Radial Basis Function Neural Networks & Decision Support Systems**	
A	Components & Structure of RBF networks, Information processing of RBF networks (neuron level), analytical thoughts prior to training, Equation system and gradient strategies for training, comparison of RBF Networks and Multilayer Perceptron	CO4
B	Data Pre-processing, Data Representations, Data Representation impact on training time, Managing Training Datasets, Data Quantity/Quality	CO4, CO5
C	Sensitivity Analysis, Visualization, Sifting through output using Domain Knowledge.	CO4, CO5
Unit 5	**Neural Network based Data Analysis Applications: Case Studies**	
A	Real Estate Pricing Model: Data Selection, Data Representation, Model and Architecture Selection, Training and Testing the Neural Network, Maintaining	CO5, CO6

	the Application, Related Applications & Discussion	
B	Customer Raking Model: Problem Definition, Data Selection, Data Representation, Model/Architecture selection, Training and Testing the Neural Network, Sensitivity Analysis, Maintaining the Application, Related Applications & Discussion	CO5, CO6
C	Sales Forecasting: Data Selection, Data Representation, Model/Architecture selection, Training and Testing the Neural Network, Maintaining the Application, Related Applications & Discussion	CO5, CO6
Mode of examination		
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. David Kriesel, 2007, "A Brief Introduction to Neural Networks", available at http://www.dkriesel.com 2. Joseph P. Bigus "Data mining with neural networks", McGraw Hill 3. Simon O. Haykin, **"Neural Networks and Learning Machines",** Pearson	
Other References	1. ANDERSON, JAMES A., AN INTRODUCTION TO NEURAL NETWORKS, PHI Learning. 2. Christopher M. Bishop & Geoffrey Hinton, Neural Networks for Pattern Recognition, Oxford University Press.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Define** biological significance of Neural Network and list ANN components.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
2.	**Classify** various learning paradigms based on real life problems	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
3.	**Apply basic concepts to build** single and multi-layer feed-forward neural networks.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
4.	**Analyze** and train radial-basis function and recurrent networks;	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8,

		PO9, PO10, PSO1, PSO2, PSO3
5.	**Explain** data preparation for analysis and decision using appropriate neural network model.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
6.	**Discuss** and adapt appropriate neural networks model for real life data mining applications	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name: Neural networks (Course Code- CSA-042)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Neural networks (Course Code- CSA-042)	CO1	3	3	3	3	2	1	1	1	1	3	1	3	3	3	1
	CO2	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO4	3	3	3	3	3	2	2	1	2	3	3	3	3	3	3
	CO5	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3
	CO6	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA-042	Neural networks	3.00	3.00	3.00	3.00	2.83	2.33	2.33	1.17	2.33	3.00	2.67	3.00	3.00	3.00	2.67

Total 40.3

Strength of Correlation

1. Addressed to **Slight (Low=1) extent** **2.** Addressed to **Moderate (Medium=2) extent**
3. Addressed to **Substantial (High=3) extent**

Business for Data Driven Companies

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech.**	
Branch:		**CSE DS**	
1	Course Code	New Subject	
2	Course Title	Business for Data driven companies	
3	Credits	3	
4	Contact Hours (L-T-P)	3 0 0	
	Course Status	Core /Elective/Open Elective	
5	Course Objective	Introduction to Data Analytics and its role in business decisions. Students will learn why data is important and how it has evolved. They will be introduced to "Big Data" and how it is used. They will also be introduced to a framework for conducting Data Analysis and what tools and techniques are commonly used.	
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	Having successfully completed this module, the student will be able to: CO1: Recall the basics of Data analytics, including requirements, various aspects and framework in context of businesses and enterprises. CO2: Explain the inevitability of big data as the future of data driven companies. CO3: Apply data analytics tools and techniques for handling and analyzing enterprise data for meaningful information. CO4: Analyze clearly the roles played by Business Analysts, Business Data Analysts, and Data Scientists in a data driven company. CO5: Evaluate the explorations performed by various data analytic techniques using visualization. CO6: Adapt the data analytic techniques for big data surge in data driven companies.	
7	Course Description	This course has been designed for the students to understand the best data analytics practices data driven companies follow to become more competitive and more profitable in the market. They will be able to recognize the most critical business metrics and distinguish them from mere data.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction: Data Analytics**	
	A	An overview of the specialization, introduction to data driven decision making	CO1
	B	What is Data Analytics? Solving common business problems using DA. Business defining decisions using DA	CO1
	C	Requirement of a DA framework, Aspects of a DA	CO1

	framework, Tools and techniques.	
Unit 2	**The emergence of Big data**	
A	What is Big Data? The marketplace and emerging trends in Big Data analytics, Business impacts of technology advancements and data trends	CO1, CO2
B	Companies' perspective on Big Data (Sample examples). Data and analytics examples at various companies.	CO2, CO3
C	Identification, organization and processing of various kinds of Big data addressed by companies in decision making (Structures, Semi-Structures and Unstructured)	CO2, CO3
Unit 3	**Data analytics: Tool and techniques**	
A	Variety of data-based business problems - predictive analysis, data management, statistical sampling, survey design.	CO3, CO4
B	Cluster analysis, Decision tree analysis, Factor analysis,	CO3, CO4
C	Regression Analysis (correlation, multivariate analysis), Segmentation analysis, sentiment analysis, Time series analysis	CO3, CO4
Unit 4	**Data visualization**	
A	Analyzing trends based on data visualization (e.g. stock market trends, area wise sales data)	CO3, CO5
B	Visual data analysis techniques, Interaction techniques	CO3, CO5
C	Analytics using statistical packages, association intelligence from unstructured information	CO3
Unit 5	**Big Data's Future for Industries**	
A	Case Study - How Companies (any two examples) have harnessed the Power of Data	CO2, CO4, CO6
B	Key trends defining big data's future	CO2, CO6
C	The human element in generation and usage of big data	CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*		
Other References		

SHARDA UNIVERSITY
Beyond Boundaries

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Recall the basics of Data analytics, including requirements, various aspects and framework in context of businesses and enterprises.	PO1, PO2, PO3, PO6, PO8, PO9, PO11, PO12, PSO1
2.	CO2: Explain the inevitability of big data as the future of data driven companies.	PO2, PO3, PO5, PO6, PO10, PO11, PSO1
3.	CO3: Apply data analytics tools and techniques for handling and analyzing enterprise data for meaningful information.	PO1, PO2, PO3, PO4, PO5, PO11, PO12, PSO2, PSO3
4.	CO4: Analyze clearly the roles played by Business Analysts, Business Data Analysts, and Data Scientists in a data driven company.	PO3, PO4, PO6, PO8, PO9, PO11
5.	CO5: Evaluate the explorations performed by various data analytic techniques using visualization.	PO2, PO3, PO5, PO6, PO10, PO11, PSO2
6.	CO6: Adapt the data analytic techniques for big data surge in data driven companies.	PO1, PO2, PO3, PO5, PO6, PO10, PO11, PO12, PSO2

PO and PSO mapping with level of strength for Course Name xxxx (Course Code yyyy)

Course Code _ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
Yyyy _xxxx	CO1	3	2	2	-	-	1	-	1	2	-	2	3	1	-	-
	CO2	-	3	2	-	3	2	-	-	-	2	2	-	2	-	-
	CO3	2	3	3	3	3	-	-	-	-	-	1	2	-	2	1
	CO4	-	-	2	2	-	2	-	2	3	-	2	-	-	-	-
	CO5	-	2	3	-	2	2	-	-	-	1	2	-	-	3	-
	CO6	2	2	3	-	2	1	-	-	-	2	2	2	-	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech. Data Science**	
Branch:	**CSE**	
1	**Course Code**	
2	**Course Title**	**Introduction to Deep Leaning**
3	**Credits**	3
4	**Contact Hours (L-T-P)**	2 0 2
	Course Status	Elective (AI/ML Core)
5	**Course Objective**	This course aims to present the mathematical, statistical and computational challenges of building stable representations for high-dimensional data, such as images, text and data. We will delve into selected topics of Deep Learning, discussing recent models from both supervised and unsupervised learning. Special emphasis will be on convolutional architectures, invariance learning, unsupervised learning and non-convex optimization.To understand and demonstrate how to solve general learning from a large series of data using computer based deep learning algorithms
6	**Course Outcomes (CO's)**	On successful completion of this module students will be able to: CO1: Recall Neural Networks and relate it with Deep Learning concepts. CO2: Compare and classify Regularization approaches for Deep Learning. CO3: Build Convolutional Neural Networks models for image analysis. CO4: Examine the Sequence models and analyse the relationships among them. CO5: Assess the different Deep learning models based on their design processes. CO6: Predict the behavior of Deep learning models and apply them.
7	**Course Description**	This course starts with introduction to Deep Learning and further build, train, and deploy real world applications such as object recognition and Computer Vision, image and video processing, text analytics, Natural Language Processing, recommender systems, and other types of classifiers.

8	**Syllabus Outline**		**CO Mapping**
	Unit 1	**Deep Feed forward Networks**	
	A	Recall Neural networks, Deep learning and its Practical aspects ,Introduction to Simple Deep Neural Networks, Platform for Deep Learning, Deep Learning Software Libraries	CO1
	B	Introduction to Deep Feed Forward Networks ,Learning XOR, Gradient-Based Learning, Activation	CO1

C	Functions, ReLU, Softmax, Sigmoid , Error Functions Architecture Design- Hidden Units Back-Propagation and Other Differentiation Algorithms	CO1
Unit 2	**Regularization for Deep Learning**	
A	Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multitask Learning, Early Stopping	CO2
B	Parameter Tying and Parameter Sharing, Bagging , Drop Out, Difficulty of training deep neural networks, Greedy layer wise training, Adversarial Training	CO2
C	How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms: Stochastic Gradient Descent, Momentum, Nesterov Momentum Parameter Initialization Strategies Algorithms with Adaptive Learning Rates, AdaGrad. RMSProp. Adam Choosing the Right Optimization Algorithm	CO2
Unit 3	**Convolutional Neural Networks**	
A	Why CNN?, Its role, significance, The Convolution Operation, Motivation, Pooling, The Neuroscientific Basis for Convolutional Networks	CO1, CO3
B	Prior probability distribution, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data types with different dimensionalities and number of channel	CO1, CO3
C	Efficient Convolution Algorithms, Random or Unsupervised Features of CNN , Normalization, Applications of CNN in Computer Vision – ImageNet, Sequence Modelling –VGGNet, LeNet	CO1, CO3
Unit 4	**Sequence Modelling: Recurrent Neural Networks**	
A	Sequence Learning Problems , Recurrent Neural Network and its significance in real world, RNN model, Backpropagation through time ,Bidirectional RNNs	CO4
B	Different types of RNNs, Gated Recurrent Unit (GRU) Recursive Neural Networks , The Challenge of Long-Term Dependencies	CO4
C	Introduction of Long Short Term Memory Neural Networks, Learning Algorithm of LSTM/ RNN Bidirectional LSTMs	CO4
Unit 5	**Deep Networks and design process**	
A	Introduction to Autoencoder, Undercomplete Autoencoder, Regularized Autoencoders, Representational Power, Layer Size and Depth.	CO5,CO6

	Stochastic Encoders and Decoders, Applications of Encoder Decoder models	
B	Introduction to Generative Adversarial Networks, Generative Adversarial Networks – Architecture, Applications of Generative Adversarial Networks	CO5, CO6
C	Practical design process for deep learning techniques: Performance Metrics , Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies	CO5, CO6

Mode of examination	Theory		
Weightage Distribution	**CA**	**MTE**	**ETE**
	30%	20%	50%

Text Books

4. Deep Learning, by Goodfellow I., Bengio Y. & Courville A. (2016)
5. Visualizing and Understanding Convolutional Networks, by Matt Zeiler, Rob Fergus
6. TensorFlow: a system for large-scale machine learning, by Martín A., Paul B., Jianmin C., Zhifeng C., Andy D. et al. (2019)

Reference Books

7. Deep learning in neural networks, by Juergen Schmidhuber (2015)
8. https://cs230.stanford.edu/syllabus/
9. https://towardsdatascience.com/september-edition-machine-learning-case-studies-a3a61dc94f23
10. Deep Learning: A Practitioner's Approach by Josh Patterson, O'reilly.

Online Materials

CO and PO Mapping

S. No.	**Course Outcome (CO)**	**Program Outcomes (PO) & Program Specific Outcomes (PSO)**
1	Recall Neural Networks relate it with Deep Learning concepts.	PO1, PO2, PO5, PO12, PSO1, PSO2
2	Compare and classify Regularization approaches for Deep Learning.	PO1, PO2, PO3, PO4, PO5, PO9, PO12, PSO1, PSO2, PSO3
3	Build Convolutional Neural Networks models for image analysis.	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2, PSO3
4	Examine the Sequence models and analyse the relationships among them.	PO2, PO3, PO10, PO12, PSO1, PSO2, PSO3
5	Assess the different Deep learning models based on their design processes.	PO2, PO3, PO4, PO5, PO6, PO10, PSO1, PSO2, PSO3
6	Predict the behavior of Deep learning models and apply them.	PO4, PO5, PO6, PO7, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength for Course Name: Neural networks (Course Code- CSA-042)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
Introduction to Deep Leaning (Course Code- CSA302)	CO1	3	3	-	-	3	-	-	-	-	3	-	2	3	3	-
	CO2	3	3	-	3	3	-	-	-	-	3	-	3	3	3	-
	CO3	3	3	3	3	3	2	-	-	3	3	-	3	3	3	-
	CO4	3	3	3	3	3	2	-	-	3	3	-	3	3	3	-
	CO5	3	3	3	3	3	2	3	-	3	3	-	2	3	3	-
	CO6	3	3	3	3	3	2	3	-	3	3	-	3	3	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSA302	**Introduction to Deep Leaning**	3	3	3	1.8	2	2	3	-	3	3	-	2.6	3	3	-

Total 32.4

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

WEB AND TEXT ANALYSIS

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B.Tech. Data Science**		
Branch:		**CSE**		
1	Course Code			
2	Course Title	Web and Text analysis		
3	Credits	3		
4	Contact Hours (L-T-P)	2	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	To understand the text and web data and used it for the information retrieval		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	The student should be able to CO1: Recall the basics of www and textual data in web. CO2: Explain the processing of textual data on/off web for prediction of intent. CO3: Apply relevant models for contextual information retrieval from texts towards socio-economic betterment. CO4: Analyze individual and combination of a variety of web search methods CO5: Explain the processes involved in information extraction from web based social networks. CO6: Design process based on prior information for web usage analysis.		
7	Course Description	This course provides a unique opportunity for you to learn key components of text and web analytics aided by the real world datasets and the web search and analysis methodologies.		

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	WWW, History of Web and Internet, Web analysis	CO1
	B	Text analysis, Types of problems solved using text analysis, Document classification and information retrieval	CO1
	C	Clustering and organizing documents, Information extraction, Prediction and Evaluation	CO1
	Unit 2	**NLP based Prediction**	
	A	Document Tokenization, Lemmatization, Vector Generation and Prediction, Boundary determination, Phrase Recognition, Parsing, Feature generation	CO2
	B	Term-Document Matrices (TDMs) from the Corpus, Problem specific novel patterns finding	CO2
	C	Keyword search, Nearest Neighbor Methods, Similarity measures, Web based document search, Document matching,	CO2
	Unit 3	**Text information retrieval**	
	A	Clustering methods for similarity, Cluster Label Mean,	CO3

	Patterns and Entities,	
B	Co-reference and relationship extraction, Template Filling	CO3
C	Applications: Information retrieval, commercial extraction systems, criminal justice, Intelligence	CO3, CO4
Unit 4	**Web Search**	
A	Meta search: combining multiple ranking, combination using similarity scores, Combination using rank position	CO4
B	Web Spamming: content spamming, Link spamming, Hiding techniques, Combating spam.	CO4
C	Social network analysis, co-citations and bibliographic coupling, Page rank, HITS, Community Discovery	CO4, CO5
Unit 5	**Web usage analysis**	
A	Data collection and preprocessing, data modelling for web usage	CO5, CO6
B	Discovery and analysis for web usage methods	CO6
C	Recommended system and collaborative filtering, Query Log Mining	CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% / MTE 20% / ETE 50%	
Text book/s*	1. Michael W. Berry, Jacob Kogan - Text Mining: Applications and Theory 2. Bing Liu - Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data	
Other References	1. Handbook of Research on Text and Web Mining Technologies edited by Song, Min, Brook Wu, Yi-Fang	

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	What is Web and Text analysis	PO1, PO2, PO3, PO4, PO5, PO6
2.	Explain the processing of text for prediction.	PO1, PO2, PO3, PO4, PO5, PO6
3.	Apply relevant models for text retrievals	PO1, PO2, PO3, PO4, PO5, PO6
4.	Analyze web search methods	PO1, PO2, PO3, PO4, PO5, PO6
5.	Explain the process of social networking	PO1, PO6, PSO1, PSO2
6.	Estimate the web usage	PO1, PO6, PSO1, PSO2

PO and PSO mapping with level of strength for Web and Text Analysis (Course Code yyyy)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Web and Text Ana lysis	CO1	3	2	2	2	3	1	1	1	1	1	1	1	1	2	1
	CO2	3	3	2	2	2	2	1	1	1	2	1	1	1	1	1
	CO3	2	3	3	3	2	2	1	1	2	1	1	1	1	1	1
	CO4	3	2	2	2	2	2	1	1	1	2	1	1	1	1	1
	CO5	3	1	1	1	1	2	1	1	1	1	1	1	3	3	1
	CO6	3	1	1	1	1	3	1	1	1	1	1	1	2	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

WEB AND TEXT ANALYSIS LAB

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:				
Branch:				
1	Course Code			
2	Course Title	Web and Text analysis LAB		
3	Credits	1		
4	Contact Hours (L-T-P)	0	0	2
	Course Status	Core /Elective/Open Elective		
5	Course Objective	To understand the text and web data and used it for the information retrieval		
6	Course Outcomes (must be 6 COs, following verbs given in Bloom's Taxonomy)	The student should be able to CO1: Recall the basics of www and textual data in web. CO2: Explain the processing of textual data on/off web for prediction of intent. CO3: Apply relevant models for contextual information retrieval from texts towards socio-economic betterment. CO4: Analyze individual and combination of a variety of web search methods CO5: Explain the processes involved in information extraction from web based social networks. CO6: Design process based on prior information for web usage analysis.		
7	Course Description	This course provides a unique opportunity for you to learn key components of text and web analytics aided by the real world datasets and the web search and analysis methodologies.		

8	Outline syllabus		CO Mapping
	1	Demonstrate Web based textual data acquisition for a generic social media network	
	2	Demonstrate the use of the y-TextMiner package.	
	3	Demonstrate textual data pre-processing such as normalization including tokenization and lemmatization.	
	4	Demonstrate Vector Generation and Prediction, Boundary determination for a given textual dataset.	
	5	Demonstrate keyword search, web-based document matching and similarity searches using nearest neighbor methods.	
	6	Demonstrate similarity matching and pattern matching between textual entities using clustering methods	
	7	Demonstrate the process of collection and organization of domain specific unstructured data for corpus.	
	8	Create a Term-document matrix for the established corpus	
	9	Demonstrate the reduction of Term by document	

	matrix for
10	Demonstrate a polarity analysis on the incoming textual data based on the relevant corpora.
11	Demonstrate classification and prediction based on web user transactions.
12	The recommender system problem: K-NN, Association Rules, Matric Factorization.
Mode of examination	Theory/Jury/Practical/Viva
Weightage Distribution	CA 30% MTE 20% ETE 50%
Text book/s*	3. Michael W. Berry, Jacob Kogan - Text Mining: Applications and Theory 4. Bing Liu - Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data
Other References	2. Handbook of Research on Text and Web Mining Technologies edited by Song, Min, Brook Wu, Yi-Fang

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	What is Web and Text analysis	PO1,PO2,PO3,PO4, PO5, PO6
2.	Explain the processing of text for prediction.	PO1,PO2,PO3,PO4, PO5, PO6
3.	Apply relevant models for text retrievals	PO1,PO2,PO3,PO4, PO5, PO6
4.	Analyze web search methods	PO1,PO2,PO3,PO4, PO5, PO6
5.	Explain the process of social networking	PO1,PO6, PSO1,PSO2
6.	Estimate the web usage	PO1, PO6, PSO1,PSO2

School:	**School of Engineering and technology**			
Department	**Department of Computer Science and Engineering**			
Program:	**B.Tech. Data Science**			
Branch:	**CSE**			
1 Course Code				
2 Course Title	**SOCIAL MEDIA ANALYTICS**			
3 Credits	3			
4 Contact Hours (L-T-P)	2	0	2	
Course Status				
5 Course Objective	The objective of this course is to teach students how to obtain, monitor, and evaluate digital traces from online social platforms. After finishing the course students will be prepared to approach future industry and academic problems with an understanding of how social media data can help to accomplish goals.			
6 Course Outcomes	CO1: *Illustrate* the basic concepts of social network analysis. CO2: *Formulate* fundamentals of graphs and networking theory. CO3: *Analyse* current approaches to social media data and data analytics. CO4: *Apply* social network analysis to real world problems. CO5: *Evaluate*, explore and analyse the uses of common social media analytics tools. CO6: *Examine* research and analysis that responds to the core ideas, uses tools and skill sets specific to social data analytics.			
7 Course Description	This course provides a thorough introduction to social data analysis, including influence and centrality in social media, information diffusion on networks, topic modeling and sentiment analysis, identifying social bots, and predicting behavior.			
8 Outline syllabus				CO Mapping
Unit 1	**Introduction to Social Media Analytics**			
A	Introduction, History of Social media Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations;			CO1
B	Types of social networks: friend, user-generated, content, affiliation, etc., Sociograms, Sociometric studies			CO1, CO6
C	Basics of Social Media and Business Models, Basics of Web Search Engines and Digital Advertising., Application of SMA in different areas			CO1, CO6
Unit 2	**Graph and Matrices**			
A	The Adjacency Matrix, Paths and Connectivity, Distance and Breadth-First Search, Network Datasets: An Overview			CO1, CO2
B	Nodes, ties and influencers, Making connections: Link analysis. Paths			CO1,CO2
C	Random graphs and network evolution. telephone call graph, Weighted Networks, Hypergraphs			CO1, CO2
Unit 3	**Network fundamentals**			
A	Network structures: equivalence, homophile, clustering, Snowball Sampling, Contact Tracing, And Random Walks,			CO1, CO2
B	Ego-centered network, dominance hierarchies, Third-Party Records, affiliation network,			CO1,CO2
C	Citation Networks, Peer-To-Peer Networks, Recommender Networks, Biological Networks, Genetic Regulatory Networks, Neural Networks			CO1, CO2
Unit 4	**Social Network and Modeling**			
A	Social contexts: Affiliation and identity. social capital,			CO3, CO4,

	structural holes, Structural balance, Predictive modeling, Descriptive modeling: community/anomaly detection	CO5,CO6
B	Diffusion in networks: information cascades, social influence, market experiments, Geospatial social data mining, Privacy in a Networked World, Predicting the future with social media	CO3, CO4, CO5,CO6
C	Facebook Analytics: Introduction, parameters, demographics. Analysing page audience. Reach and Engagement analysis. Google analytics.	CO3, CO4, CO5,CO6
Unit 5	**Processing, Visualization and Web analytics**	
A	Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics, Collecting and analysing social media data; visualization and exploration	CO3, CO4, CO5,CO6
B	Social network and web data and methods, Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing.	CO3, CO4, CO5,CO6
C	Natural Language Processing Techniques for Micro-text Analysis, Trend: social influences on judgments, opinion spread, sentiment.	CO3, CO4, CO5,CO6

Mode of examination	Theory		
Weightage Distribution	CA 30%	MTE 20%	ETE 50%
Text book/s*	• Network: An Introduction by MEJ Newman, Oxford Press		
Other References	• Networks, Crowds, and Markets: Reasoning About a Highly connected World By David Easley and Jon Kleinberg		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	*Illustrate* the basic concepts of social network analysis.	PO1, PO2, PO4, PO6, PO8, PO11, PO12, PSO1, PSO2, PSO3
2.	*Formulate* fundamentals of graphs and networking theory.	PO1, PO2, PO3, PO4, PO5, PO6, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	*Analyse* current approaches to social media data and data analytics.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO9, PO11, PO12, PSO1, PSO2, PSO3
4.	*Apply* social network analysis to real world problems.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5	*Evaluate*, explore and analyse the uses of common social media analytics tools.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO10, PO11, PO12, PSO1, PSO2, PSO3
6	*Examine* research and analysis that responds to the core ideas, uses tools and skill sets specific to social data analytics.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Social Media Analytics	**CO1**	2	1	-	1	-	1	-	2	-	-	1	3	1	2	1
	CO2	3	1	3	2	1	1	-	-	2	3	2	3	2	1	2
	CO3	2	3	2	3	3	2	3	-	2	-	2	1	2	3	1
	CO4	1	3	3	3	3	3	3	3	3	2	3	2	2	3	3
	CO5	2	3	2	3	3	3	3	2	-	2	3	1	3	3	2
	CO6	2	2	1	3	3	3	3	3	2	-	2	3	2	3	3
		2.0	**2.2**	**1.8**	**2.5**	**2.2**	**2.2**	**2.0**	**1.7**	**1.5**	**1.2**	**2.2**	**2.2**	**2.0**	**2.5**	**2.0**

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B. Tech.**		
Branch:		**CSE**		
1	Course Code	New Code		
2	Course Title	Healthcare and Analytics		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core /Elective/Open Elective		
5	Course Objective	This course is an introduction to healthcare analysis concepts and methods for students who have had little previous data analytics experience. Topics to be covered in this course include: creation of datasets, the structure of datasets, an introduction to data warehousing, working with large databases, an introduction to public health and healthcare datasets, methods for descriptive analytics, and an introduction to predictive analytics. Students will gain skills in data manipulation for program evaluation and analysis. In this course, students will gain an understanding of data analysis used in improvement of the healthcare system and help the professional to use information for analysis, formulate and solve relevant issues to support decision making. We will learn different tools, activities and methods to understand the principles of developing, reporting, and analyzing for Improvement of Healthcare Organizations.		
6	Course Outcomes	CO1. Define the role of data analytics in healthcare quality and performance improvement efforts. CO2. Explain the tools and techniques used for data analytics in healthcare organizations. CO3. Identify techniques to communicate insights gained from healthcare data analysis. CO4. Analyse the potential of, and challenges to, incorporating big data analytics to improve the development and testing of precision medicine / nursing interventions. CO5. Demonstrate and evaluate the knowledge of health data and undergirding the tools of big data analysis in health related research. CO6. Adapt the basics and learnings available to build the relationship of healthcare and data analytics in production and operational systems for data intelligence.		
7	Course Description	After completing the course the student will be able describe and comprehend all the concepts related with healthcare, how to manage the internal and external information in order to make the best decisions for the purpose of giving the best service, and obtain quick and reliable response.		
8	Outline syllabus			CO

			Mapping
	Unit 1	**Introduction to Quality Improvement and Data Analytics for healthcare**	
	A	Toward Healthcare Improvement Using Analytics, Healthcare Transformation—Challenges and Opportunities, Current State of Healthcare Costs and Quality	CO1, CO2
	B	Leveraging Information for Healthcare Improvement, Analytics Knowledge Gap, Beginning the Analytics Journey in Healthcare	CO1, CO2
	C	Fundamentals of Healthcare Analytics, How Analytics Can Improve Decision Making, Analytics, Quality, and Performance, Applications of Healthcare Analytics, Components of Healthcare Analytics	CO1, CO2
	Unit 2	**Healthcare Strategies, Quality and Governance**	
	A	Purpose of Analytics Strategy, Analytics and Business Intelligence, Strategic Development versus Development by Aggregation	CO1, CO3
	B	Analytics Strategy Framework, with a Focus on Quality/Performance Improvement, Strategies for Working Well with Stakeholders	CO1, CO4
	C	Data Quality, Management, and Governance, Developing an Analytics Strategy, Defining Healthcare Quality and Value, Components of Healthcare Quality Measurement	CO3, CO4
	Unit 3	**Working with Healthcare Data**	
	A	Data: The Raw Material of Analytics, Preparing Data for Analytics, Types of Data (Categorical, Ordinal, Interval and Ratio Data), Levels of Measurement, Getting Started with Analyzing Data, Summarizing Data Effectively	CO2, CO3, CO4
	B	The Need for Effective Data Management, Data Quality, Data Governance and Management, Data Stewardship, Enterprise-wide Visibility and Opportunity	CO3, CO4
	C	Overview of Healthcare QI, Common QI Frameworks in Healthcare, Six Sigma DMAIC Process and Methodology, Data Quality and Governance	CO3, CO4
	Unit 4	**Effective Indicators and Methods in Healthcare**	
	A	Measures, Metrics, and Indicators, Key Performance Indicators, Using Indicators to Guide Healthcare Improvement Activities, Leveraging Analytics in Quality Improvement Activities	CO4, CO5
	B	Moving from Analytics Insight to Healthcare Improvement, Analytics in the Problem Definition Stage, Using Analytics to Identify Improvement Opportunities, Analytics in the Project Execution Phase	CO4, CO5
	C	Using Analytics to Evaluate Outcomes and Maintain Sustainability, Basic Statistical Methods and Control Chart Principles, Statistical Methods for Detecting	CO4, CO5

		Changes in Quality or Performance, Graphical Methods for Detecting Changes in Quality or Performance			
	Unit 5	**Visualization and Advanced Analytics in Healthcare**			
	A	Presentation and Visualization of Information, Data Visualization, Quality and Performance Improvement, Agents and Alerts, Providing Accessibility to and Ensuring Usability of Analytics Systems			CO5, CO6
	B	Overview of Advanced Analytics, Applications of Advanced Analytics, Enablers of Predictive Analytics in Healthcare (Methods, Data and System), Developing and Testing Advanced Analytics in Healthcare, Advanced Analytics Modeling and Deployment Process			CO5, CO6
	C	Determine the Requirements of the Healthcare Organization, Understand and Prepare Health Data, Overview of Predictive Algorithms (Regression Modeling, Machine Learning and Pattern Recognition), Analytical Healthcare Organizational Challenges, objectives and requirements, Effective Analytical Teams			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Trevor L. Strome (2013). Healthcare Analytics for Quality and Performance Improvement. John Wiley & Sons, Inc. 2. Chandan K. Reddy and Charu C. Aggarwal, Healthcare Data Analytics, CRC Press ©2015			
	Other References	1. Big Data Analytics in Healthcare, edited by Anand J. Kulkarni, Patrick Siarry, Pramod Kumar Singh, Ajith Abraham, Mengjie Zhang, Albert Zomaya, Fazle Baki 2. Health Care Information Systems: A Practical Approach for Health Care Management By Karen A. Wager, Frances W. Lee, John P. Glaser 3. Statistics & Data Analytics for Health Data Management - E-Book By Nadinia A. Davis, Betsy J. Shiland			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	Define the role of data analytics in healthcare quality and performance improvement efforts.	PO2, PO3, PO4, PO5, PSO2
2.	Explain the tools and techniques used for data analytics in healthcare organizations.	PO1, PO3, PO5, PO7, PO8, PSO2
3.	Identify techniques to communicate insights gained from healthcare data analysis.	PO2, PO3, PO7, PO8, PSO2

4.	Analyse the potential of, and challenges to, incorporating big data analytics to improve the development and testing of precision medicine / nursing interventions.	PO2, PO4, PO5, PO8, PSO2
5.	Demonstrate and evaluate the knowledge of health data and undergirding the tools of big data analysis in health related research.	PO1, PO2, PO4, PSO2
6.	Adapt the basics and learnings available to build the relationship of healthcare and data analytics in production and operational systems for data intelligence.	PO1, PO2, PO3, PO4, PO5, PO8, PSO2

PO and PSO mapping with level of strength for Course Name Healthcare and Analytics **(Course Code yyyy)**

Course Code_ Course Name	COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
Health Care and Analytics	CO 1	-	2	3	1	2	-	-	-	2	3	1	2	-	3	-
	CO 2	2	-	3		1	-	3	2	-	3		1	-	3	-
	CO 3	-			-	-	-					-	-	-	3	-
	CO 4	-	2	-	3	2	-	-	2	2	-	3	2	-	3	-
	CO 5	2	2	-	3	-	-	-	-	2	-	3	-	-	3	-
	CO 6	2	2	3	2	3	-	-	2	2	3	2	3	-	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B.Tech. Data Science**		
Branch:		**CSE**		
1	Course Code			
2	Course Title	Predictive Analytics		
3	Credits	3		
4	Contact Hours (L-T-P)	2	0	2
	Course Status			
5	Course Objective	This course focuses on enabling students to master a scientific approach to solving problems with data. This course is designed to provide a comprehensive introduction to build models for prediction and classification.		
6	Course Outcomes	CO1: *Determine* the key concepts for predictive analytics CO2: *Apply* specific statistical and regression analysis methods applicable to predictive analytics CO3: *Interpret* the data and selecting appropriate features. CO4 : *Develop* and use various quantitative and classification predictive models CO5: *Identify* new trends and patterns, uncover relationships, create forecasts, predict likelihoods, and test predictive hypotheses. CO6: *Compare* the performance of different prediction and classification models		
7	Course Description	This course explores foundational concepts in analytics, statistical computing, data pre-processing, variable selection, dimensionality reduction, classification and prediction. After completing the course students will be able to prepare data to improve efficacy of predictive models, identify and implement a variety of predictive modeling techniques.Prerequisites of this course are: Algebra, Descriptive Statistics, and Excel		
8	Outline syllabus		CO Mapping	
	Unit 1	**Introduction to Analytics**		
	A	Descriptive, Predictive and Prescriptive Analytics, Analytics in Decision Making, The Analytics Life Cycle, Introduction to Predictive Analytics	CO1	
	B	Matrix Notation, Model, Method and Feature, Probability Distribution,	CO1, CO2	
	C	Covariance, Correlation, Hypothesis Testing, Analysis of Variance	CO1, CO2	
	Unit 2	**Linear Regression**		
	A	Review on Simple Linear Regression, Ordinary Least Squares (OLS), Model Diagnostics	CO2,CO3	
	B	Dummy, Derived and Interaction Variables, Multiple Linear Regression, Weighted Least Squares (WLS), Generalized Linear Models (GLM)	CO2, CO3	
	C	Multivariate Regression, Estimation of Regression Parameters, Multi-collinearity, Model Deployment	CO2,CO3	
	Unit 3	**Data Pre-processing**		
	A	Variable Types, Introduction to Data Transformations, Data Transformations: Categorical to Dummy, Variables Polynomials, Box-Cox Transformation	CO3	

	B	Log & Elasticity Models, Logit Transformation, Count Data Models, Centering, Standardization			CO3,CO4
	C	Rank Transformations, Lagging Data (Causal Models) basics of Data Reduction			CO3,CO4
	Unit 4	**Variable selection and Dimensionality reduction**			
	A	Variable Selection, Dimensionality Issues, Multi-Collinearity, Variable Selection Methods, Step Methods			CO3,CO4, CO5
	B	Regularization: Penalized or Shrinkage Models, Ridge Regression, LASSO			CO3,CO4, CO5
	C	Dimension Reduction Models, Principal Components Regression (PCR), Linear Discriminant Analysis, Quadratic Discriminant Analysis, Partial Least Squares (PLS)			CO3,CO4, CO5
	Unit 5	**Classification and Forecasting**			
	A	Machine Learning overview, Bias vs. Variance Trade-off, Error Measures, Cross-Validation			CO4,CO5,CO6
	B	Binomial Logistic Regression, Multinomial Logistic Regression,			CO4,CO5,CO6
	C	Forecasting: Time Series Analysis, Additive & Multiplicative models, Exponential smoothing techniques, Forecasting Accuracy, Auto-regressive and Moving average models			CO4,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	• Applied Predictive Modeling by Max Kuhn and Kjell Johnson			
	Other References	• Statistical and Machine-Learning Data Mining: Techniques for Better Predictive Modeling and Analysis of Big Data, Second Edition by Bruce Ratner • Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst by Dean Abbott			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	*Determine* the key concepts for predictive analytics	PO1, PO2, PO4, PO11, PO12, PSO1, PSO2, PSO3
2.	*Apply* specific statistical and regression analysis methods applicable to predictive analytics	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
3.	*Interpret* the data and selecting appropriate features.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO11, PO12, PSO1, PSO2, PSO3
4.	*Develop* and use various quantitative and classification predictive models	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
5	*Identify* new trends and patterns, uncover relationships, create forecasts, predict likelihoods, and test predictive hypotheses.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

6	*Compare* the performance of different prediction and classification models.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	-	2	-	-	-	-	-	-	2	2	1	2	1
CO2	3	2	2	2	3	3	3	2	2	1	2	3	1	1	2
CO3	2	3	2	3	2	1	1	2	2	-	1	2	2	1	1
CO4	3	2	3	3	3	3	2	2	1	2	3	2	2	3	2
CO5	2	3	2	3	3	3	2	1	2	1	2	2	3	2	2
CO6	2	2	2	2	2	2	1	2	2	1	2	3	1	3	2
	2.3	2.3	1.8	2.5	2.2	2.0	1.5	1.5	1.5	0.8	2.0	2.3	1.7	2.0	1.7

B.Tech-Computer Science & Engineering with specialization in Cyber Security & Forensics

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.tech**	
Branch:	**Computer Science & Engineering with Specialization in Cyber Security and Forensics**	
1	Course Code	CSC102
2	Course Title	Introduction to Cyber Security & Laws
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	CORE
5	Course Objective	This course will provide students exposure to the key legal and policy issues related to cybersecurity, including the legal authorities and obligations of both the government and the private sector with respect to protecting computer systems and networks, as well as the national security aspects of the cyber domain including authorities related to offensive activities in cyberspace.
6	Course Outcomes	On successful completion of this module students will be able to CO1: Illustrate why securing the Nation's computer systems, which has been a goal of multiple successive administrations and has broad bipartisan and public support, has proven to be so difficult to achieve. CO2: Analyze attack methodology and combat hackers from intrusion or other suspicious attempts at connection to gain unauthorized access to a computer and its resources CO3: Adapt Protection of data and respond to threats that occur over the Internet CO4: Construct and implement risk analysis, security policies, and damage assessment CO5:Plan, implement and audit operating systems' security in a networked, multi-platform and cross platform environment CO6: Demonstrate contingency operations that include administrative planning process for incident response, disaster recovery, and business continuity planning within information security
7	Course Description	This course introduces advanced aspects of Cyber Crime, encompassing the Laws and its domains comprising many activities such as data breaches and all, and choose the relevant countermeasures.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	**Introduction**
	A	Brief overview of Networking Concepts, Information Security Concepts	CO1
	B	Security Threats and Vulnerabilities	CO1, CO2
	C	Basics of Cryptography / Encryption	CO1, CO2,CO4
	Unit 2	**Information and Network Security Cyber Law-International Perspectives**	
	A	Security Management Practices, Access Control and Intrusion Detection	CO1, CO2
	B	Security for VPN and Next Generation Technologies	CO1, CO2
	C	Security Architectures and Models, System Security, Wireless Network and Security	CO1, CO2,CO5,CO6

Unit 3	**Cyber Law: Indian and International Perspectives**	
A	Need for Cyber Law, Cyber Jurisprudence at International and Indian Level	CO1,CO2,CO3
B	UN & International Telecommunication Union (ITU) Initiatives, GDPR (General Data Protection Regulation)	CO1,CO2,CO3
C	Council of Europe - Budapest Convention on Cybercrime, Asia-Pacific Economic Cooperation (APEC), GDPR, The Data Privacy Act 1998-2018	CO1,CO2,CO3
Unit 4	**Constitutional & Human Right Issues in CyberSpace, Cyber Torts**	
A	Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace – Access to Internet	CO2,CO3,CO4
B	Right to Privacy, Right to Data Protection	CO3,CO4
C	Cyber Defamation, Different Types of Civil Wrongs under the IT Act 2000, Different offences under IT Act 2000	CO2, CO4,CO5
Unit 5	**CyberCrime and Legal FrameWork**	
A	Cyber Crimes against Individuals, Institution and State	CO2,CO5,
B	Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud	CO3,CO5,CO6
C	Cyber terrorism, Cyber Defamation	CO4,CO5,CO6
Mode of examination	Theory	Theory

Weightage	CA	MTE	ETE
Distribution	30%	20%	50%

Text book/s*

1. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).
2. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi, (2012).
3. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)
4. JonthanRosenoer, Cyber Law, Springer, New York, (1997).
5. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York, (2011)

Other References

1. S. R. Bhansali, Information Technology Act, 2000, University Book House Pvt. Ltd., Jaipur (2003).
2. Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi, (2003).

<u>CO and PO Mapping</u>

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Illustrate why securing the Nation's computer systems, which has been a goal of multiple successive administrations and has broad bipartisan and public support, has proven to be so difficult to achieve.	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: Analyze attack methodology and combat hackers from	PO1, PO2, PO3, PSO3

	intrusion or other suspicious attempts at connection to gain unauthorized access to a computer and its resources	
3.	CO3: Adapt Protection of data and respond to threats that occur over the Internet	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Construct and implement risk analysis, security policies, and damage assessment	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Plan, implement and audit operating systems' security in a networked, multi-platform and cross platform environment	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: Demonstrate contingency operations that include administrative planning process for incident response, disaster recovery, and business continuity planning within information security	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Introduction to cyber security and laws CSC 102

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSC 102_Introduction to cyber security and laws	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSC102	Introduction to cyber security and laws	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to***Slight (Low=1)******extent2.*** Addressed to***Moderate (Medium=2)*** ***extent***
3. Addressed to***Substantial (High=3)*** ***extent***

School: **School of Engineering and technology**
Department **Department of Computer Science and Engineering**
Program: **B.Tech**
Branch: **Computer Science & Engineering with Specialization in Cyber Security and Forensics**

1	Course Code	CSC201
2	Course Title	**Digital Forensics**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	CORE
5	Course Objective	Provide the students with practice on applying digital forensics techniques and enhance their skills regarding practical applications of digital forensics.
6	Course Outcomes	On successful completion of this module students will be able to **CO1:**Demonstrate the principles of Digital Forensics and how resultant evidence can be applied within legal cases. **CO2:**Illustrate their competence in recovering files, network forensics, password cracking **CO3:**Evaluate the effectiveness of available digital forensics tools and use them in a way that optimizes the efficiency and quality of digital forensics investigations. CO4: apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity CO5: access and critically evaluate relevant technical and legal information and emerging industry trends CO6:Adapt effectively the results of a computer, network, and/or data forensic analysis verbally, in writing, and in presentations to both technical and lay audiences.
7	Course Description	This course introduces students to basics of Digital Forensics. Make them apply appropriate skills and knowledge in solving computer forensics problems.

8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO COMPUTER FORENSICS**	
	A	History of Forensics – Computer Forensic Flaws and Risks	CO1
	B	Rules of Computer Forensics – Legal issues – Digital Forensic Principles	CO1, CO2
	C	Digital Environments – Digital Forensic Methodologies	CO1, CO2,CO4
	Unit 2	**AN OVERVIEW OF DIGITAL FORENSICS INVESTIGATION**	
	A	Live forensics and investigation –digital evidence	CO1, CO2
	B	seizure methodology factors limiting the whole sale seizure of hardware- Demystifying computer/ cyber crime	CO1, CO2
	C	explosion of networking – explosion of wireless networks – interpersonal communication	CO1, CO2,CO5,CO6
	Unit 3	**DATA FORENSICS**	
	A	Recovering deleted files and deleted partitions – deleted	CO1,CO2,CO3

B	file recovery tools – deleted partitioned recovery tools – data acquisition and duplication	CO1,CO2,CO3
C	data acquisition tools – hardware tools – backing up and duplicating data.	CO1,CO2,CO3
Unit 4	**ROUTER FORENSICS AND NETWORK FORENSICS**	
A	overview of Routers – Hacking Routers – Investigating Routers	CO2,CO3,CO4
B	Investigating Wireless Attacks – Basics of wireless - Wireless Penetration Testing	CO3,CO4
C	Direct Connections to Wireless Access Point – Wireless Connect to a Wireless Access Point.	CO2, CO4,CO5
Unit 5	**E-MAIL FORENSICS AND STEGANOGRAPHY**	
A	Forensics Acquisition – Processing Local mail archives –	CO2,CO5,
B	Processing server level archives – classification of steganography	CO3,CO5,CO6
C	categories of steganography in Forensics – Types of password cracking.	CO4,CO5,CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% · MTE 20% · ETE 50%	
Text book/s*	• Anthony Reyes, Jack Wiles, "Cybercrime and Digital Forenscis", Syngress Publishers, Elsevier 2007. • John Sammons, "The Basics of Digital Forensics", Elsevier 2012	
Other References	• Linda Volonins, Reynalds Anzaldua, "Computer Forensics for dummies", Wiley Publishing 2008.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Demonstrate the principles of Digital Forensics and how resultant evidence can be applied within legal cases.	PO1,PO2, PO5, PO8,PO12,PSO3
2.	**CO2:** Illustrate their competence in recovering files, network forensics, password cracking	PO1, PO2, PO3, PSO3
3.	**CO3:** Evaluate the effectiveness of available digital forensics tools and use them in a way that optimizes the efficiency and quality of digital forensics investigations.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: access and critically evaluate relevant	PO1, PO2,

	technical and legal information and emerging industry trends	PO3,PO8,PO9,PSO2,
6.	CO6:Adapt effectively the results of a computer, network, and/or data forensic analysis verbally, in writing, and in presentations to both technical and lay audiences.	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Digital Forensics (Course Code CSC201)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Digital Forensics (CSC201)	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSC201	Digital Forensics	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to***Slight (Low=1)extent2.*** Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

Program: B.Tech

Branch: **Computer Science & Engineering with Specialization in Cyber Security and Forensics**

1	Course Code	CCP201
2	Course Title	Digital Forensics Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory/Elective
5	Course Objective	• Provide the students with practice on applying digital forensics techniques and enhance their skills regarding practical applications of digital forensics.
6	Course Outcomes	CO1:Demonstrate digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting; CO2:Compare and adhere to the highest professional and ethical standards of conduct, including impartiality and the protection of personal privacy CO3:List potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards CO4: Evaluate collaboratively with clients, management, and/or law enforcement to advance digital investigations or protect the security of digital resources; CO5:Access and critically evaluate relevant technical and legal information and emerging industry trends; and CO6:Illustrate effectively the results of a computer, network, and/or data forensic analysis verbally, in writing, and in presentations to both technical and lay audiences.
7	Course Description	This course introduces students to basics of Digital Forensics. Make them apply appropriate skills and knowledge in solving computer forensics problems.

8	Outline syllabus		CO Mapping
	Unit 1	Introduction to computer forensics	
	A	Learn to install wine / virtual box or any other equivalent software on the host os	CO1
	B	Perform an experiment to grab a banner with telnet and perform the task using netcat utility	CO1, CO2,CO4
	Unit 2	An overview of digital forensics investigation	
	A	Perform an experiment for port scanning with nmap, superscan or any other software.	CO1, CO2
	B	Using nmap1)find open ports on a system 2) find the machines which are active 3)find the version of remote os on other systems 4)find the version of s/w installed on other system	CO1, CO2,CO5,CO6
	Unit 3	Data forensics	
	A	Perform an experiment on active and passive finger printing using xprobe2 and nmap.	CO1,CO2,CO3
	B	Performa an experiment to demonstrate how to sniff for router traffic by using the tool wireshark	CO1,CO2,CO3

Unit 4	Router forensics and network forensics	
A	Perform an experiment how to use dumpsec.	CO2,CO3,CO4
B	Perform an wireless audit of an access point / router and decrypt wep and wpa.	CO3,CO4
C	Perform an experiment to sniff traffic using arp poisoning.	CO2, CO4,CO5
Unit 5	E-mail forensics and steganography	
A	Install ipcop on a linux system and learn all the function available on the software.	CO2,CO5,
B	Install jcrypt tool (or any other equivalent) and demonstrate asymmetric, symmetric crypto algorithm, hash and digital/pki signatures	CO3,CO5,CO6
Mode of examination	Jury/Practical/Viva	
Weightage Distribution	CA 60% MTE 0% ETE 40%	
Text book/s*	• Anthony Reyes, Jack Wiles, "Cybercrime and Digital Forenscis", Syngress Publishers, Elsevier 2007. • John Sammons, "The Basics of Digital Forensics", Elsevier 2012	
Other References	• Linda Volonins, Reynalds Anzaldua, "Computer Forensics for dummies", Wiley Publishing 2008.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Demonstrate digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting;	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Compare and adhere to the highest professional and ethical standards of conduct, including impartiality and the protection of personal privacy	PO1, PO2, PO3, PSO3
3.	CO3: List potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Evaluate collaboratively with clients, management, and/or law enforcement to advance digital investigations or protect the security of digital resources;	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Access and critically evaluate relevant technical and legal information and emerging industry trends; and	PO1, PO2, PO3, PO8, PO9, PSO2,

6.	CO6: Illustrate effectively the results of a computer, network, and/or data forensic analysis verbally, in writing, and in presentations to both technical and lay audiences.	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Digital Forensic Lab (Course Code CCP201)

Course Code – Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Digital Forensics (CCP 201)	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CCP 201	Digital Forensics Lab	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**	
1	Course Code	CSC202	
2	Course Title	**Security Architecture**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	UG	
5	Course Objective	Students will learn security architecture technologies via lectures and assignments.	
6	Course Outcomes	Students will be able to: CO1: Explain Security Architecture and assessments CO2: Analyze Security Architecture Basics CO3: Define and analyze Low-Level Architecture CO4: Illustrate Mid-Level Architecture CO5: Define and analyze High-Level Architecture CO6: Summarize Security design architecture, Security Architecture Basics, low, middle and high Level Architecture	
7	Course Description	This course aims to introduce students to the fundamental concepts and techniques in security architecture, and giving students an overview of information security in architecture perspective.	
8	Outline syllabus		CO Mapping
	Unit 1	**Security architectures and Security Assessments**	
	A	Security architectures, key attributes of security architecture, key phases in the security architecture process, Computer System architecture- CPU, Storage, Operating System, Firmware, Virtual machine. Systems Security Architecture- Security Design Principles (secure design, software security, Design Principles for Protection Mechanisms), Trusted Computing Base (TCB), Security Modes of Operation.	CO1
	B	What Is a Security Assessment?; The Organizational Viewpoint; The Five-Level Compliance Model; The System Viewpoint; Pre-Assessment Preparation- The Security Assessment Meeting, Security Assessment Balance Sheet Model, Describe the Application Security Process, Identify Assets, Identify Vulnerabilities and Threats, Identify Potential Risks, Examples of Threats and Countermeasures.	CO1, CO2
	C	Post-Assessment Activities; Why Are Assessments So Hard?- Matching Cost Against Value, Why Assessments Are Like the Knapsack Problem, Why Assessments Are Not Like the Knapsack Problem, Enterprise Security and Low Amortized Cost Security Controls.	CO1, CO2,CO4
	Unit 2	**Security Architecture Basics**	

A	Security As an Architectural Goal - Corporate Security Policy and Architecture, Vendor Bashing for Fun and Profit; Security and Software Architecture - System Security Architecture Definitions, Security and Software Process, Security Design Forces against Other Goals; Security Principles; Additional Security-Related Properties	CO1, CO2
B	Other Abstract or Hard-to-Provide Properties – Inference, Aggregation, Least Privilege, Self-Promotion, Graceful Failure, Safety; Authentication - User IDs and Passwords, Tokens, Biometric Schemes, Authentication Infrastructures; Authorization.	CO1, CO2
C	Models for Access Control - Mandatory Access Control, Discretionary Access Control, Role-Based Access Control, Access Control Rules, Understanding the Application's Access Needs; Other Core Security Properties; Analyzing a Generic System.	CO1, CO2,CO5,CO6
Unit 3	**Low-Level Architecture**	
A	Code Review: Why Code Review Is Important; Buffer Overflow Exploits- Switching Execution Contexts in UNIX, Building a Buffer Overflow Exploit, Components of a Stack Frame, Why Buffer Overflow Exploits Enjoy Most-Favored Status.	CO1,CO2,CO3
B	Countermeasures Against Buffer Overflow Attacks - Avoidance, Prevention by Using Validators, Sentinel, Layer, Sandbox, Wrapper, Interceptors; Why Are So Many Patterns Applicable? - Stack Growth Redirection, Hardware Support; Security and Perl - Syntax Validation, Sentinel, Sandbox.	CO1,CO2,CO3
C	Bytecode Verification in Java; Good Coding Practices Lead to Secure Code; Trusted Code: Adding Trust Infrastructures to Systems; The Java Sandbox - Running Applets in a Browser, Local Infrastructure, Local Security Policy Definition, Local and Global Infrastructure, Security Extensions in Java, Systems Architecture.	CO1,CO2,CO3
Unit 4	**Mid-Level Architecture**	
A	Middleware Security: Middleware and Security- Service Access, Service Configuration, Event Management, Distributed Data Management, Concurrency and Synchronization, Reusable Services; The Assumption of Infallibility; The Common Object Request Broker Architecture; The OMG CORBA Security Standard; The CORBA Security Service Specification - Packages and Modules in the Specification.	CO2,CO3,CO4
B	Vendor Implementations of CORBA Security; CORBA Security Levels; Secure Interoperability - The Secure Inter-ORB Protocol, Secure Communications through SSL, Why Is SSL Popular?; Application-Unaware Security; Application-Aware Security; Application Implications.	CO3,CO4
C	Application and OS Security : Structure of an Operating System; Structure of an Application - Application Delivery;	CO2, CO4,CO5

	Application and Operating System Security - Hardware Security Issues, Process Security Issues, Software Bus Security Issues, Data Security Issues, Network Security Issues, Configuration Security Issues, Operations, Administration, and Maintenance Security Issues.	
Unit 5	**High-Level Architecture**	
A	Security Components: Secure Single Sign-On - Scripting Solutions, Strong, Shared Authentication, Network Authentication, Secure SSO Issues; Public-Key Infrastructures - Certificate Authority, Registration Authority, Repository, Certificate Holders, Certificate Verifiers, PKI Usage and Administration, PKI Operational Issues.	CO2,CO5,
B	Firewalls - Firewall Configurations, Firewall Limitations; Intrusion Detection Systems; LDAP and X.500 Directories - Lightweight Directory Access Protocol, Architectural Issues.	CO3,CO5,CO6
C	Kerberos - Kerberos Components in Windows 2000, Distributed Computing Environment, The Secure Shell, or SSH 318, The Distributed Sandbox.	CO4,CO5,CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	"Security Architecture: Design, Deployment, and Operations" Curtis E. Dalton, Osborne/McGraw-Hill, 2001	
Other References	ISO/IEC 27001:2013	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Explain Security system Architecture	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: Analyze Survivability analysis of architecture	PO1, PO2, PO3, PSO3
3.	CO3: Define types of firewall and IDS	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Illustrate system security architecture	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Find out how to Reduce the attack surface, defense in depth, test security, weaknesses and vulnerabilities, secure coding, learn from mistakes	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: Summarize Security design architecture, enterprise design frameworks	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Security Architecture CSC202

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

Security Architecture CSC202	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSC202	Securi Architecture	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to***Slight (Low=1)extent2.*** Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

2.1 Template A1: Syllabus for Theory Courses (SAMPLE)

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**	
1	Course Code	CSC301	
2	Course Title	Ethical Hacking	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	core	
5	Course Objective	To provide students about the Ethical hacking Concepts, importance of ethical hacking in IT and Working structure of hacking	
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Define the description of ethical Hacking CO2: Illustrate Types of Ethical Hacking. CO3: Explain about web and network hacking CO4: Demonstrate report writing and Mitigation CO5: Formulate the use of safe techniques on the World Wide Web CO6: Analyze various digital forensic problems	
7	Course Description	This course introduces ethical hacking concept and application of ethical hacking in network security.	
8	Outline syllabus		Outline syllabus
	Unit 1	Introduction to Ethical Hacking	
	A	Security Fundamental, Security testing, Hacker and Cracker, Descriptions	CO1
	B	Test Plans-keeping It legal, Ethical and Legality	CO1, CO2
	C	The Attacker's Process, The Ethical Hacker's Process, Security and the Stack	CO1, CO2,CO4
	Unit 2	Footprinting and Scanning	
	A	Information Gathering, Determining the Network Range, Identifying Active Machines	CO1, CO2
	B	Finding Open Ports and Access Points, OS Fingerprinting Services, Mapping the Network Attack Surface	CO1, CO2

C	Enumeration, System Hacking	CO1, CO2,CO5,CO6
Unit 3	Malware Threats	
A	Viruses and Worms, Trojans, Covert Communication	CO1,CO2,CO3
B	Keystroke Logging and Spyware, Malware Counter measures	CO1,CO2,CO3
C	Sniffers, Session Hijacking, Denial of Service and Distributed, Denial of Service	CO1,CO2,CO3
Unit 4	Web Server Hacking	
A	Web Server Hacking, Web Application Hacking	CO2,CO3,CO4
B	Database Hacking	CO3,CO4
C	Wireless Technologies, Mobile Device Operation and Security, Wireless LANs	CO2, CO4,CO5
Unit 5	IDS, Firewalls and Honeypots	
A	Intrusion Detection Systems, Firewalls, Honeypots	CO2,CO5,
B	Physical Security, Social Engineering	CO3,CO5,CO6
C	Case Studies	CO4,CO5,CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1.Ec-Council, "Ethical Hacking and Countermeasures: Attack Phases", Delmar Cengage Learning, 2009. 2. Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning, 2012	
Other References	3. Patrick Engebretson, "The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy", Syngress Media, Second Revised Edition, 2013. 4. Jon Erickson, "Hacking: The Art of Exploitation", No Starch Press, Second Edition, 2008.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the description of ethical Hacking	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: Illustrate Types of Ethical Hacking.	PO1, PO2, PO3, PSO3

3.	CO3: Explain about web and network hacking	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Demonstrate report writing and Mitigation	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Formulate the use of safe techniques on the World Wide Web	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: Analyze various digital forensic problems	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Ethical Hacking (Course Code CSC301)

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Ethical Hacking (Course Code CSC 301)	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSC301	Ethical Hacking	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to***Slight (Low=1)extent2.*** Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B.Tech**	
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**	
1	Course Code	CCP301	
2	Course Title	Ethical Hacking Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	core	
5	Course Objective	To provide students about the Ethical hacking Concepts, importance of ethical hacking in IT and Working structure of hacking	
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Define the description of ethical Hacking CO2: Illustrate Types of Ethical Hacking. CO3: Explain about web and network hacking CO4: Demonstrate report writing and Mitigation CO5: Formulate the use of safe techniques on the World Wide Web CO6: Analyze various digital forensic problems	
7	Course Description	This course introduces ethical hacking concept and application of ethical hacking in network security.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Ethical Hacking	
		To learn about hacking tools and skills.	CO1, CO2
	Unit 2	Footprinting and Scanning	
		To study about Footprinting and Reconnaissance	CO1, CO2
		To study about Fingerprinting.	CO1, CO2,CO3
	Unit 3	Malware Threats	
		To study about system Hacking.	CO1,CO2,CO3, CO5
	Unit 4	Web Server Hacking	
		To study about Wireless Hacking	CO2,CO3,CO4
	Unit 5	IDS, Firewalls and Honeypots	
		To learn & study about Sniffing & their tools.	CO2,CO5,CO6
	Mode of examination	Jury/Practical/Viva	
	Weightage	CA MTE ETE	

Distribution	60%	0%	40%

Text book/s* 1.Ec-Council, "Ethical Hacking and Countermeasures: Attack Phases", Delmar Cengage Learning, 2009.
2. Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning, 2012

Other References 3. Patrick Engebretson, "The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy", Syngress Media, Second Revised Edition, 2013.
4. Jon Erickson, "Hacking: The Art of Exploitation", No Starch Press, Second Edition, 2008.

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Define the description of ethical Hacking	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: Illustrate Types of Ethical Hacking.	PO1, PO2, PO3, PSO3
3.	CO3: Explain about web and network hacking	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Demonstrate report writing and Mitigation	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Formulate the use of safe techniques on the World Wide Web	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: Analyze various digital forensic problems	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Ethical Hacking Lab-CCP301

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CCP301_ Ethical Hacking Lab	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CCP301	Ethical Hacking Lab	3	2.7	1.1	1	1. 5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to***Slight (Low=1)extent2.*** Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

School:		**School of Engineering and technology**	
Department		**Department of Computer Science and Engineering**	
Program:		**B. Tech**	
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**	
1	Course Code	CSC302	
2	Course Title	Cryptography and Network Security	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Core	
5	Course Objective	To provide students with an overview cryptography and related algorithm which is required during data communication in computer networks which are the basic building blocks of different organizations throughout world with respect to security.	
6	Course Outcomes	After the successful completion of this course, students will be able to : CO1: Analyze the conventional Network security technique which are basically designed to maintain confidentiality. CO2: Compare the techniques of algorithms developed in modern cryptographic era. CO3: Explain the tools and methodologies used to perform Security analysis. CO4: Summarize the working knowledge of the Crytography application during Network Security to maintain security. CO5. Examine security at application layer, transport layer and network layer. CO6:Interpret use of cryptographic data integrity algorithms and user authentication protocols	
7	Course Description	This course introduces concepts of Crytography & all the techniques related to it. It also imparts the knowledge of digital signature & message authentication for effective Network Security.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Network Security & Ethics**	
	A	Computer Security Concepts- OSI security Architecture, Security attacks, Services, mechanism, model of network security	CO1, CO2, CO3
	B	Classical encryption techniques- Substitution Cipher (Mono-alphabetic, Poly-alphabetic), Transposition cipher, Steganography	CO1, CO2, CO3
	C	Block Cipher- Encryption Principles, DES & strength of DES	CO1, CO2, CO3

Unit 2	**Mathematics of Cryptography**	
A	Euclidean, Extended Euclidean Algorithm, Euler's Totient Function, Ferment little Theorem, Euler's Theorem	CO3
B	Primality Testing-Miller Rabin test, Chinese Remainder Theorem	CO3, CO4
C	Exponential- square and multiply method, Discrete Logarithm	CO3, CO4
Unit 3	**Asymmetric Cryptography & Key Exchange**	
A	Public Key cryptography-RSA, Cryptanalysis of RSA	CO2, CO3
B	Key management & distribution: KDC	CO2, CO3
C	Diffie Hellman key exchange	CO3, CO4
Unit 4	**Digital Signatures**	
A	User Authentication protocol- Kerberos, Digital Signature –RSA, Elgamal	CO2, CO3
B	DSS, Data integrity algorithms-Hash Functions	CO2, CO4
C	MD5, SHA-512	CO2, CO4
Unit 5	**Message Authentication & hash function**	
A	Authentication requirement & functions, Message Authentication Code	CO1, CO2
B	Security of Hash function & MAC	CO2, CO4
C	Secure HASH & MAC algorithm.	CO2
Mode of examination	Theory/Jury/Practical/Viva	

Weightage	CA	MTE	ETE
Distribution	30%	20%	50%

Text book/s*

10. Atul Kahate , "Network Security ", Wiley India Pvt Ltd, 2010.
11. Michael T. Simpson, "Hands-on Cryptography & Network Security & Network Defense", Course Technology, 2010.
12. Rajat Khare, "Network Seuciryt and Cryptography & Network Security ", Luniver Press, 2006.

Other References

2. Bruce Schneier, “Applied Cryptography”, John Wiley & Sons Inc, 2001.
3. Behrouz A. Forouzan, “Cryptography And Network Security”- McGraw Hill
4. Internet as a resource for reference.

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Analyze the conventional Network security technique which are basically designed to maintain confidentiality.	PO1, PO2, PSO1
2.	CO2: Compare the techniques of algorithms developed in modern cryptographic era.	PO1,PO2,PO3,PSO1,PSO2
3.	CO3: Explain the tools and methodologies used to perform Security analysis.	PO1, PO3, PO5, PSO1, PSO2
4.	CO4: Summarize the working knowledge of the Crytography application during Network Security to maintain security	PO1, PO4, PO6, PO7, PSO1,PSO2

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5.	CO5. Examine security at application layer, transport layer and network layer.	PO5,PO7, PO8, PO9, PSO1,PSO2
6.	CO6:Interpret use of cryptographic data integrity algorithms and user authentication protocols	PO10,PO11,PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Cryptography and Network Security(Course Code CSC302)

Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC302_ Cryptography &Network Security	CO1	2	2		-	-	-	-	-	-	-	-	-	2	2	-
	CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	2	-
	CO3	2	-	2	-	2	-	-	-	-	-	-	-	2	2	-
	CO4	2	-	-	2	-	2	2	-	-	-	-	-	2	2	
	CO5	-	-	-	-	2	-	2	2	2		-	-	2	-	-
	CO6	-	-	-	-	-	-	-	-	-	2	2	2	2	-	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSE302	Cryptography and Network Security	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**
Department		**Department of Computer Science and Engineering**
Program:		**B. Tech**
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**
1	Course Code	CCP302
2	Course Title	**Cryptography and Network Security Lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Core
5	Course Objective	To provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures. To explain various approaches to Encryption techniques. To familiarize symmetric and asymmetric cryptography, Digital Signing, Message Authentication Codes (MAC), Hashing functions.
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Illustrate basic security attacks and services CO2: Demonstrate the skill on symmetric and asymmetric key algorithms for cryptography CO3:Perform basic cryptanalysis on encryption algorithms CO4: Analyze Digitally Sign documents or data CO5: Apply various Authentication functions CO6: Perform Hashing functions on data
7	Course Description	This course gives practical exposure on basic security attacks, encryption algorithms, authentication techniques. Apart from security algorithms, firewall configuration is also introduced.

8	Outline syllabus		CO Mapping
	Unit 1	**Symmetric Encryption – Substitution (Stream Ciphers)**	
	A	Perform the following implementation	CO1
	B	1. Encryption and Decryption with Ceaser cipher	CO1
	C	2. Encryption and Decryption with Playfair cipher	CO1
		3. Encryption and Decryption with Hill cipher	
		4. Encryption and Decryption with Vigenere cipher	
	Unit 2	**Symmetric Encryption – Transposition Technique**	
		Perform the following implementation	CO2,
		1. Transposition using Rail Fence Cipher	CO6
		2. Transposition using Columnar Transposition	
		3. Transposition using Route Cipher	
		4. Transposition using Scytale Cipher	
	Unit 3	**Symmetric Encryption – Substitution (Block Ciphers)**	

	Perform the following implementation 1. Encryption and Decryption with DES 2. Encryption and Decryption with 3-DES 3. Encryption and Decryption with AES 4. Encryption and Decryption with IDEA	CO3
Unit 4	**Asymmetric Encryption** Perform the following implementation 1. Encryption and Decryption with RSA 2. Encryption and Decryption with Diffie-Hellman 3. Encryption and Decryption with DSA	CO4, CO6
Unit 5	**Digital Signature & Hashing & Authentication** Perform the following implementation 1. Digital signature of data using RSA 2. Digital signature of data using Diffie-Hellman 3. Hashing function – SHA-1 4. Message Authentication Code (MAC)	CO5, CO6
Mode of examination	Jury/Practical/Viva	
Weightage Distribution	CA 60% · MTE 0% · ETE 40%	
Text book/s*	1.Cryptography and Network Security, 4th Edition, William Stallings, Prentice Hall, 2005	
Other References	1. Cryptography & Network Security by Atul Kahate, Tata McGraw-Hill, 2008. 2. Internet as a Resource for Reference.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Identify basic security attacks and services for cryptography	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PSO
2.	CO2: Use symmetric and asymmetric key algorithms	PO1, PO2, PO3, PO5, PSO
3.	CO3:Perform basic cryptanalysis on encryption algorithms	PO1, PO2,,PO3 PO5, PSO1
4	CO4: Digitally Sign documents or data	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PSO1,PSO2
5	CO5: Make use of Authentication functions	PO1, PO2, PO3,PO4, PO5, PSO1
6	CO6: Perform Hashing functions on data	PO1, PO2, PO4, PO5, PO6, PO7, PO8, PO9,PSO

PO and PSO mapping with level of strength for Course Name Cryptography and Network Security Lab (CCP302)

Course Code – Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CCP 302_ Cryptography and Network Security Lab	CO1	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
	CO3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
	CO6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CCP 302	Cryptography and Network Security Lab	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to***Slight (Low=1) extent*** ***2.*** Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

Department		**Department of Computer Science and Engineering**
Program:		**B. Tech**
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**
1	Course Code	CSC303
2	Course Title	**Intrusion Detection and Prevention System**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Core
5	Course Objective	The objective of this course is to provide an in depth introduction to intrusion detection and prevention. The course covers methodologies, techniques, and tools for monitoring events in computer system or network, with the objective of preventing and detecting unwanted process activity and recovering from malicious behavior.
6	Course Outcomes	On successful completion of this module students will be able to: CO1: illustrate in-depth introduction to the Science and Art of Intrusion Detection and Prevention CO2: demonstrate the skill to learn Unauthorized Activity CO3: demonstrate the skill to capture and analyze network packets and detection methods CO4: analyze and apply various architecture CO5: analyze apply IDS, IPS Internals & Snort rules, outputs, and plug-ins to detect unauthorized activity CO6: apply and analyze different tools related to traffic monitoring and analysis, snort, architecture, IDS, IPS Internals
7	Course Description	This course introduces intrusion detection and prevention, which is one of the most essential concepts in looking at how threats and attacks are detected and mitigated.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Intrusion Detection, basics of Intrusion Detection and Intrusion Prevention, Intrusion Detection system (IDS) and its types, Intrusion Prevention System (IPS), History, Importance	CO1
	B	IDS and IPS Analysis Schemes: The Anatomy of Intrusion Analysis, Misuse detection, anomaly detection, specification-based detection, hybrid detection; Example IDS Rules; IDS/IPS Pros and Cons; Myths	CO1
	C	Attacks: DDos attacks, TCP reset attack, malformed DNS attack	CO1
	Unit 2	**Unauthorized Activity**	
	A	Limitations of IDS, Network Protocol Abuses: ARP Abuses, IP Abuses, UDP Abuses, TCP Abuses, ICMP Abuses	CO2, CO6
	B	Pros and Cons of Open Source, Types of Exploits	CO2, CO6
	C	Commonly Exploited Programs and Protocols, Viruses and Worms	CO2, CO6

Unit 3	**Traffic monitoring & analysis**	
A	Tcpdump Command Line, Tcpdump Output Format, Tcpdump Expressions, Bulk Capture, Bytes Transferred in Connection	CO3, CO6
B	Tcpdump as Intrusion Detection, Tcpslice, Tcpflow, and Tcpjoin, formats of tcpdump filters, bit masking	CO3, CO6
C	Packet capturing using wireshark, wireshark display filters, Live network packet capturing, protocol analysis	CO3, CO6
Unit 4	**Architecture**	
A	Tiered Architecture of IDS and IPS: Single-Tiered Architecture, Multi-Tiered Architecture, Peer-to-Peer Architecture	CO4, CO6
B	Sensors: Sensor Functions, Network-Based Sensors, Host-Based Sensors, Sensor Deployment Considerations, Sensor Security Considerations,	CO4, CO6
C	Agents: Agent Functions, Agent Deployment Considerations, Agent Security Considerations; Manager Component: Manager Functions, Manager Deployment Considerations, Manager Security Considerations	CO4, CO6
Unit 5	**IDS, IPS Internals & Snort**	
A	Information Flow in IDS and IPS, Detection of Exploits	CO5, CO6
B	Malicious Code Detection, Output Routines, Defending IDS/IPS	CO5, CO6
C	Snort: configuration of snort, flow process of snort, Model of operation sniffer, logger, NIDS, Writing snort rules, writing a rule for vulnerability	CO5, CO6
Mode of examination	Theory/Jury/Practical/Viva	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	2. Intrusion Detection & Prevention , Carl F. Endorf, Eugene Schultz and Jim Mellander, McGraw Hill Professional, 2004	
Other References	3. Metasploit: The Penetration Tester's Guide by David Kennedy, Jim O'Gorman, Devon Kearns, Mati Aharoni 4. Internet as a Resource for Reference.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: illustrate in-depth introduction to the Science and Art of Intrusion Detection and Prevention	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: demonstrate the skill to learn Unauthorized Activity	PO1, PO2, PO3, PSO3
3.	CO3: demonstrate the skill to capture and analyze	PO1, PO2, PO3, PO5, PO9,

	network packets and detection methods	PO12, PSO1
4.	CO4: analyze and apply various architecture	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: analyze apply IDS, IPS Internals **&** Snort rules, outputs, and plug-ins to detect unauthorized activity	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: apply and analyze different tools related to traffic monitoring and analysis, snort, architecture, IDS, IPS Internals	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Intrusion detection and prevention system (CSC303)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC303_Intrusion detection and prevention system	**CO1**	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
	CO3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
	CO6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC303	Intrusion detection and prevention system	**3**	**2.7**	**1.1**	**1**	**1.5**	**1**	**.5**	**1.3**	**.8**	**.5**	**.5**	**.8**	**1**	**1**	**1**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**
Department		**Department of Computer Science and Engineering**
Program:		**B. Tech**
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**
1	Course Code	CCP303
2	Course Title	**Intrusion Detection and Prevention System Lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Core
5	Course Objective	The objective of this course is to provide an in depth introduction to intrusion detection and prevention. The course covers methodologies, techniques, and tools for monitoring events in computer system or network, with the objective of preventing and detecting unwanted process activity and recovering from malicious behavior.
6	Course Outcomes	On successful completion of this module students will be able to: CO1: illustrate and able to perform scanning using nmap. CO2: demonstrate the skill to capture and analyze network packets CO3: analyze packet and detection methods CO4: analyze and apply Snort rules, outputs, and plug-ins to detect unauthorized activity CO5: apply different protocol analyzers tools CO6: apply different tools related to traffic monitoring, snort, toolkits
7	Course Description	This course introduces intrusion detection and prevention, which is one of the most essential concepts in looking at how threats and attacks are detected and mitigated.

8	Outline syllabus		CO Mapping
	Unit 1	**nmap**	
	A	Performa an experiment to demonstrate	CO1
	B	1. Download and install nmap.	CO1
	C	2. Use nmap with different options to scan open ports.	CO1
		3. Perform OS fingerprinting, ping scan, tcp port scan, udp port scan, etc. using nmap	
	Unit 2	**Traffic monitoring**	

	1. Performa an experiment to demonstrate how to perform binary packet capture, formats of tcpdump filters, bit masking using tcpdump 2. Performa an experiment to demonstrate how to sniff for router traffic by using the tool wireshark - Download and install wireshark network analyzer. - Capturing live network data - Open, save and merge Capture Files - Working with captured packets	CO2, CO6
Unit 3	**Packets Analysis**	
	Performa an experiment to demonstrate 1. Examination of fields in TCPchecksums, normal and abnormal tcp stimulus and response 2. Detection methods for application protocols, pattern matching, protocol decode and anomaly detection 3. Sample attacks http, malformed dns , DDos, tcp reset attacks	CO3
Unit 4	**Open source IDS: Snort**	
	Performa an experiment to demonstrate 1. Installing Snort into the Operating System. 2. Configuring and Starting the Snort IDS. 3. Defines Snort rules to detect the intrusions. 4. Write and Add Snort Rule 5. Triggering an Alert for the New Rule	CO4, CO6
Unit 5	**Analyst toolkit**	
	Performa an experiment to demonstrate 1. TCP/ UDP connectivity using ngrep, tcpflow, netcat. 2. Create , read/write, alter and send packets using jpcap 3. launch arp poisining, dns poisioning attacks using jpcap	CO5, CO6
Mode of examination	Jury/Practical/Viva	
Weightage Distribution	CA 60% MTE 0% ETE 40%	
Text book/s*	3.Intrusion Detection & Prevention , Carl F. Endorf, Eugene Schultz and Jim Mellander, McGraw Hill Professional, 2004	
Other References	5. Metasploit: The Penetration Tester's Guide by David Kennedy, Jim O'Gorman, Devon Kearns, Mati Aharoni 6. Internet as a Resource for Reference.	

<u>CO and PO Mapping</u>

S.	Course Outcome	Program Outcomes (PO)

No.		& Program Specific Outcomes (PSO)
1.	CO1: illustrate and able to perform scanning using nmap.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PSO
2.	CO2: demonstrate the skill to capture and analyze network packets	PO1, PO2, PO4, PO5, PSO
3.	CO3: analyze packet and detection methods	PO1, PO2, PO4, PO5, PSO
4.	CO4: analyze and apply Snort rules, outputs, and plug-ins to detect unauthorized activity	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PSO
5.	CO5: apply different protocol analyzers tools	PO1, PO2, PO4, PO5, PSO
6.	CO6: apply different tools related to traffic monitoring, snort, toolkits	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PSO

PO and PSO mapping with level of strength for Course Name Intrusion detection and prevention System Lab (CCP303)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CCP303_Intrusion detection and prevention Lab	**CO1**	3	3	-	-	2	-	-	3	-	-	3	-	-	3	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
	CO3	3	3	2	-	2	-	-	-	2	-	2	3	-	-	3
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	3	-	3
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	3	-	3
	CO6	3	3	-	3	3	3	3	-	-	3	-	3	-	-	3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CCP303	Intrusion detection and prevention System Lab	**3**	**2.7**	**1.1**	**1**	**1.5**	**1**	**.5**	**1.3**	**.8**	**.5**	**.5**	**.8**	**1**	**1**	**1**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		School of Engineering and technology
Department		Department of Computer Science and Engineering
Program:		B.Tech
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**
1	Course Code	CSC401
2	Course Title	Introduction to IoT and Its Security
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	CORE
5	Course Objective	Provide the students with practice on applying digital forensics techniques and enhance their skills regarding practical applications of digital forensics.
6	Course Outcomes	On successful completion of this module students will be able to:- CO1: Apply the concepts of IOT CO2: Identify the different technology. CO3: Apply IOT to different applications. CO4: Examine and evaluate hardware aspect of security in IOT. CO5: Examine and evaluate software aspect of security in IOT CO6: Analysis and evaluate the data received through sensors in IOT
7	Course Description	This course introduces students to basics of Digital Forensics. Make them apply appropriate skills and knowledge in solving computer forensics problems.

8	Outline syllabus		CO Mapping
	Unit 1	OVERVIEW	
	A	IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	CO1
	B	M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management,	CO1, CO2
	C	Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management	CO1, CO2,CO4
	Unit 2	REFERENCE ARCHITECTURE	
	A	IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model	CO1, CO2
	B	IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.	CO1, CO2
	C	Real-World Design Constraints- Introduction,	CO1,

	Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.	CO2,CO5,CO6
Unit 3	Conceptualizing the Secure Internet of Things	
A	The BadUSB Thumb Drive, Air-Gap Security, Stuxnet,	CO1,CO2,CO3
B	Designing Safe and Secure Cyber-Physical Systems	CO1,CO2,CO3
C	Constrained Computing and Moore's Law, Trusted IoT Networks and the Network Edge	CO1,CO2,CO3
Unit 4	Base Platform Security Hardware Building Blocks	
A	Background and Terminology	CO2,CO3,CO4
B	Identity Crisis, Device Boot Integrity, Data Protection,	CO3,CO4
C	RunTime Protection, Threat Mitigated	CO2, CO4,CO5
Unit 5	IOT Software Security Building Blocks	
A	Operating System, Hypervisors and Virtualization	CO2,CO5,
B	Software separation and containment, Network stack and security management, Device Management	CO3,CO5,CO6
C	System Firmware and Root of Trust Update Services, Application level language Framework, Message Orchestration	CO4,CO5,CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	Sunil Cheruvu, Anil Kumar, Ned Smith, David M. Wheeler "Demystifying Internet of Things Security"	
Other References	1. Maciej Kranz, Building the Internet of Things - Comprehensive, Business Focused, Well-articulated coverage of IoT, WILEY 2. Brian Russell and Drew Van Duren, Practical Internet of Things Security, PACKT	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Apply the concepts of IOT	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Identify the different technology.	PO1, PO2, PO3, PSO3
3.	CO3: Apply IOT to different applications.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Examine and evaluate hardware aspect of	PO1, PO2, PO4, PO5, PO6, PO8,

	security in IOT.	PSO2
5.	CO5: Examine and evaluate software aspect of security in IOT	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6: Analysis and evaluate the data received through sensors in IOT	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Introduction to IoT and Its Security (CSC401)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Introduction to IoT and its security (CSC401)	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC401	Introduction to IoT and its security	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed to*Slight (Low=1) extent* 2. Addressed to*Moderate (Medium=2) extent*
3. Addressed to*Substantial (High=3) extent*

School:		**School of Engineering and Technology**			
Department		**Department of Computer Science and Engineering**			
Program:		**B. Tech**			
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**			
1	Course Code	CSC011 Machine Learning			
2	Course Title	Machine Learning			
3	Credits				
4	Contact Hours (L-T-P)	3	0	0	
	Course Status	Elective			
5	Course Objective	Students are Expected to learn and develop Comprehensive Understanding of the of the following Concepts and Techniques: 6. To introduce the ideas of learning rule and implement them based on human experience. 7. To conceptualize the working of human brain using SVM, RF and ANN. 8. To become familiar with decision boundaries that can learn from available examples and generalize to form appropriate learning rules for inference systems. 9. To provide the mathematical background for SVM, RF and Neural Network based classification techniques. 10. To understand and demonstrate how to solve patterns learning from a large series of data using computer based learning algorithms			
6	Course Outcomes	On successful completion of this module students will be able to: CO1: iIdentify Machine Learning and stochastic concept. CO2: Interpretation of existing models to understand the solution environment. CO3: Application of existing mathematical solutions to test problems. CO4: Analyse the logical ability to apply feature engineering to extract hierarchical patterns existing in real life problems. CO5: Build the understanding of learning theory to glance the upcoming world through it. CO6: Appraise recent trends in machine learning and applications.			
7	Course Description	This course introduces computational learning paradigm for critical & implementable understanding for supervised and unsupervised learning based problem areas.			
8					CO Mapping
	Unit 1	**Introduction**			
	A	What is Machine Learning? What kind of problems can be tackled using machine learning? The ML Mindset, Introduction to Machine Learning Problem Framing(Common ML Problems, ML Use Cases, Identifying Good Problems for ML, Hard ML Problems), Machine Learning Applications(Image Recognition, Speech Recognition, Medical Diagnosis, Statistical Arbitrage, Learning Associations), Standard learning tasks(Machine Learning Pipeline, Classification, Regression, Ranking, Clustering, Dimensionality reduction or Manifold learning)			CO1
	B	Learning Stages(Features, Labels, Hyperparameters, Validation Samples, Test Samples, Loss Function, Hypothesis Tests), Learning Scenarios(Supervised learning, Unsupervised learning, Semi-Supervised learning, Transductive inference, On-line learning, Reinforcement learning, Active learning), Generalization			CO1, CO2

C	Supervised Learning, Unsupervised Learning, Reinforcement learning) Data Preparation and Feature Engineering in ML(Data and Features, Information, Knowledge, Data Types, Big Data), Data Preprocessing: An Overview(Data Quality: Why Preprocess the Data?, Major Tasks in Data Preprocessing), Data Cleaning(Missing Values, Noisy Data, Data Cleaning as a Process), Data Integration(The Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Detection and Resolution of Data Value Conflicts), Data Reduction(Overview of Data Reduction Strategies, Attribute Subset Selection, Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation), Data Transformation and Data Discretization(Overview of Data Transformation Strategies, Data Transformation by Normalization, Discretization by Binning, Discretization by Histogram Analysis, Discretization by Cluster, Decision Tree, and Correlation Analyses, Concept Hierarchy Generation for Nominal Data)	CO1, CO2
Unit 2	**Supervised Learning Algorithms - Part One**	
A	How Supervised Learning Algorithms Work ? Steps (Bias-variance trade off, Function complexity and amount of training data, Dimensionality of the input space, Noise in the output values, Algorithms, Other factors to consider (Heterogeneity of the data, Redundancy in the data, Presence of interactions and non-linearities	CO1, CO2
B	Linear Regression Model Representation, Linear Regression Learning the Model (Simple Linear Regression, Ordinary Least Squares, Gradient Descent), Regularization / Shrinkage Methods (Bias-variance trade off, Overfitting Issues, Lasso Regression, Ridge Regression), Making Predictions with Linear Regression(Cost Function, Feature Scaling, Normalization, Mean Normalization, Learning Rate, Automatic Convergence Test)	CO1, CO2
C	Logistic Regression, The Logistic Model (Latent variable interpretation, Logistic function, odds, odds ratio, and logit, Definition of the logistic function, Definition of the inverse of the logistic function, Interpretation of these terms, Definition of the odds, The odds ratio, Multiple explanatory variables), Model fitting ("Rule of ten", Iteratively reweighted least squares (IRLS), Evaluating goodness of fit, Limitations of Logistic Regression), Linear discriminant analysis (LDA for two classes, Assumptions, Discriminant functions, Discrimination rules, Eigenvalues, Effect size), Practical use and Applications (Bankruptcy prediction, Face recognition, Marketing, Biomedical, studies), Comparison to Logistic Regression	CO1, CO2
Unit 3	**Supervised Learning Algorithms - Part Two**	
A	Support Vector Machines, Linear SVM (Hard-margin, Soft-margin), Nonlinear Classification, Computing the SVM classifier(Primal, Dual, Kernel trick), Modern methods(Sub-gradient descent, Coordinate descent), Empirical risk minimization(Risk minimization, Regularization and stability, SVM and the hinge loss, Target functions), Properties(Parameter selection, Issues)	CO1,CO2, CO3
B	Introduction to Artificial Neural Networks (Feed-forward Network Functions, Weight-space symmetries), Network Training (Parameter optimization, Local quadratic approximation, Use of gradient information, Gradient descent optimization), Error Backpropagation(Evaluation of error-function derivatives, Simple examples, Efficiency of backpropagation)	CO1,CO2, CO3
C	Decision Tree Learning (Decision tree representation, ID3 learningalgorithm, Entropy, Information gain, Overfitting and Evaluation, Overfitting, Validation Methods, Avoiding Overfitting in Decision Trees, Minimum-Description Length Methods, Noise in Data), Random ForestsAlgorithm (Preliminaries: decision tree learning, Bagging, From bagging to random forests, Extra Trees, Properties, Variable importance)	CO1,CO2, CO3

Unit 4	**Unsupervised Learning**	
A	Unsupervised Learning (What is Unsupervised Learning?), Clustering Methods (Method Based on Euclidean Distance, Method Based on Probabilities, Hierarchical Clustering Methods, Method Based on Euclidean Distance)	CO2,CO3, CO4
B	k-means ClusteringAlgorithm (Standard algorithm (naive k-means), Initialization methods), Applications (Vector quantization, Cluster analysis, Feature learning)	CO2,CO3, CO4
C	Principal Component Analysis for making predictive models (First component, Further components, Covariances, Dimensionality reduction, Singular value decomposition), Properties and limitations of PCA (Properties, Limitations), Computing PCA using the covariance method, Typical Applications	CO2,CO3, CO4
Unit 5	**Hypothesis Testing, Parameter Estimation, Model Evaluation and Ensemble Methods**	
A	Hypothesis Testing (Motivation, Structure of Statistical Test, Null and Alternative Hypotheses, Evidence - Test Statistics, P-value, Verdict), Common Test Statistics Terms (Decision Errors, Significance Level, Robustness, One-Sided vs , Two-Sided One-Sided), Advice for Hypothesis Testing (p-values, Data Collection, Two-Sided Tests, Practical Significance, Data Snooping),Relationship with Confidence Intervals	CO2,CO5, CO6
B	Parameter Estimation (Point Estimation, Maximum Likelihood Estimation, Unbiased Estimation,Confidence Intervals for One Mean, Two Mean, Variances) Model Evaluation (ML Model Validation by Humans, Holdout Set Validation Method, Cross-Validation Method for Models, Leave-One-Out Cross-Validation, Random Subsampling Validation, Teach and Test Method, Bootstrapping ML Validation Method, Running AI Model Simulations, Overriding Mechanism Method), The ROC Curve	CO3,CO5, CO6
C	**Ensemble Methods (Ensemble Theory, Ensemble Size, Voting and Averaging Based Ensemble Methods Boosting, Weightage Average, Stacking, Bagging, Boosting and Bootstrap Aggregating)**	CO4,CO5, CO6
Mode of examination	Theory and Practical	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	4. Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag. 5. Foundations of Machine Learning, Second Edition By MehryarMohri, Afshin Rostamizadeh and Ameet Talwalkar, MIT Press, Second Edition, 2018. 6. Introduction to Machine Learning, Third Edition, By Ethem Alpaydin, The MIT Pressmitpress.mit.edu › books › introduction-machine-learni...	
Other References	10) Baldi, P. and Brunak, S. (2002). Bioinformatics: A Machine Learning Approach. Cambridge, MA: MIT Press. 11) Russel, S. and Norvig, P. (2003). Artifiical Intelligence: A Modern Approach. 2ndEdition. New York: Prentice-Hall. 12) Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press. 13) https://www.toptal.com/machine-learning/ensemble-methods-machine-learning.	

SHARDA UNIVERSITY
Beyond Boundaries

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**Identify** Machine Learning and stochastic concept.	PO2, PO5, PO12
2.	**Interpretation** of existing models to understand the solution environment.	PO2, PO5, PO6, PO12
3.	**Application** of existing mathematical solutions to test problems.	PO2, PO3, PO4, PO5, PO12
4.	**Analyse** the logical ability to apply feature engineering to extract hierarchical patterns existing in real life problems.	PO2, PO3, PO10, PO12
5.	**Build** the understanding of learning theory to glance the upcoming world through it.	PO2, PO3, PO5, PO9, PO10
6.	**Appraise** recent trend in machine learning and applications.	PO5, PO9, PO10, PO12

PO and PSO mapping with level of strength for Course Name Machine Learning **(CSC011)**

Course Code_ Course Name	**PO's / PSO's**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
Machine Learning **(CSC011)**	CO1	3	3	1	-	1	-	-	1	-	-	-	-	2	3	-
	CO2	3	3	2	1	2	1	-	1	2	2	-	-	2	3	-
	CO3	3	3	2	1	2	1	-	1	2	2	-	2	3	3	-
	CO4	3	3	2	2	2	1	-	1	2	2	-	2	3	3	-
	CO5	3	3	2	3	2	1	-	1	2	2	-	2	3	3	-
	CO6	3	3	2	3	2	1	-	1	2	2	-	2	3	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CSC011	Machine Learning	3	3	1.8	2	1.8	1	-	1	2	2	-	2	2.6	3	-

Strength of Correlation

1. Addressed to**Slight (Low=1)extent** **2.** Addressed to**Moderate (Medium=2) extent**
3. Addressed to**Substantial (High=3) extent**

School: **School of Engineering and Technology**
Department **Department of Computer Science and Engineering**
Program: **B. Tech**
Branch: **Computer Science & Engineering with Specialization in Cyber Security and Forensics**

1	Course Code	CSC012
2	Course Title	**Business Communication and Ethics**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	To provide students with an overview of business ethics and related techniques which is required during business communication in which are the basic building blocks of different organizations throughout world with respect to security.
6	Course Outcomes	After the successful completion of this course, students will be able to : CO1: Analyze the conventional business ethics technique which are basically designed to maintain confidentiality. CO2: Compare the techniques of Busines Ethics in modern infrastructural Security. CO3: Establish the management background of the business ethics CO4: Comprehend the working knowledge of the business ethics application during business communication to maintain security. CO5: Explain and analyze Cyber Ethics at application layer, transport layer and network layer. CO6: Compare various Ethical issues & key management distribution
7	Course Description	This course introduces concepts of business ethics & all the techniques related to it. It also imparts the knowledge of digital signature & message authentication for effective business communication.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Business Communication & Ethics**	
	A	Concept of Communication – Characteristics of Communication – Importance of Communication – Means and Modes of Communication – Verbal Communication.	CO1, CO2, CO3
	B	Application of business communication principles through creation of effective security in business documents , application of team communication and use of technology to facilitate the communication process.	CO1, CO2, CO3
	C	Inter-department Communication security, Preparation of Press Releases, Business	CO1, CO2, CO3

	Communication Reporting	
Unit 2	Business Ethics Management	
A	Features of Business Ethics – What is the Business Ethics – Importance of Business Ethics – Characteristics of Business Ethics	CO3
B	Formal code of conduct ,Ethics committee , Ethical communication ,,An Ethic office with Ethical officers	CO3, CO4
C	A disciplinary system , Establishing an	CO3, CO4
Unit 3 A	Ethics Monitoring System – Principles of Business Ethics – Elements of Business Ethics Management – Chalanged in Business Ethics	CO2, CO3
B	Key management & distribution:	CO2, CO3
C	Authority and Responsibility in Business Ethics – Authority – Responsibility – Accountability	CO3, CO4
Unit 4	**Digital Signatures**	
A	User Authentication protocol- Kerberos, Digital Signature –RSA, Elgamal	CO2, CO3
B	DSS, Data integrity algorithms-Hash Functions	CO2, CO4
C	MD5, SHA-512	CO2, CO4,CO5,CO6
Unit 5	**Applications and Research in Global Business Ethics**	
A	Ethical Hacking, Secure HASH & MAC algorithm.	CO1, CO2
B	Process and Research Methods, Key global issues , Application in Business Ethicss	CO2, CO4,CO5,CO6
C	Environmental Ethics, IT Marketing Ethics, Software Development Ethics	CO2,CO5
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	13. Stallings, W., “business ethics and Network Security – Principles and Practices”, Prentice Hall of India, Fourth Edition. 14. Bruce Schneier, “Applied business ethics ”, John Wiley & Sons Inc, 2001.	
Other References	5. Behrouz A. Forouzan, “business ethics And Network Security”- McGraw Hill 6. Internet as a resource for reference	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Analyze the conventional business ethics technique which are basically designed to maintain confidentiality.	PO1, PO2, PO3, PO5,PO10, PO12, PSO1, PSO2
2.	CO2: Compare the techniques of Busines Ethics in modern infrastructural Security.	PO1,PO2, PO4, PSO2
3.	CO3: Establish the management background of the business ethics	PO1, PO2, PO3, PO6,PO5,PO10, PO12, PSO1, PSO2
4.	CO4: Comprehend the working knowledge of the business ethics application during business communication to maintain security.	PO1,PO2, PO3, PO5, PO10, PO12, PSO1, PSO2
5.	CO5: Explain and analyze Cyber Ethics at application layer, transport layer and network layer.	PO1, PO2, PO3, PO4, PO10, PO12, PO12, PSO1
6.	CO6: Compare various Ethical issues & key management distribution	PO1,PO2, PO10

PO and PSO mapping with level of strength for Course Business Communication and Ethics (CSC012)

Course Code_ Course Name	CO's	PO1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSC012_Business Communication & Ethics	CO1	1	1	2	-	2	-	-	-	-	2	-	3	1	1	-
	CO2	3	2	-	1	-	2	-	-	-	-	-	-	-	-	-
	CO3	1	1	2	-	2	-	-	-	-	2	-	3	1	1	-
	CO4	1	1	2	-	2	-	-	-	-	2	-	2	1	1	-
	CO5	3	2	3	2	-	-	-	-	-	2	-	1	1	1	-
	CO6	2	2	-	-	-	-	-	-	-	1	-	-	-	-	

Average of non-zeros entry in following table (should be auto calculated).

Strength of Correlation

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	Pso2	Pso3
CSC012	Business Communication and Ethics	1.83	1.5	2.25	1.5	2	2	0	0	0	1.8	0	1.25	1	1	0

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School: | School of Engineering and technology
Department | Department of Computer Science and Engineering
Program: | B.Tech
Branch: | **Computer Science & Engineering with Specialization in Cyber Security and Forensics**

1	Course Code	CSC021
2	Course Title	Mobile and Wireless Security
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	To learn about Systems, protocols and cryptographic functions for realizing security properties, such as authentication, key distribution, integrity, confidentiality, in wireless access networks.
6	Course Outcomes	On successful completion of this module students will be able to: CO1: acquire knowledge of information security technology and methods for communication systems that provide services for mobile users by wireless access networks. CO2: about some of the models, design principles, mechanisms and solutions used in wireless network security to obtain authentication and key transport protocols. CO3: acquire practice and analytical skills in information security assessment of technology CO4: apply security mechanisms and protocols in wireless communication networks. CO5: illustrate network security to obtain authentication and key transport protocols CO6: demonstrate security measures in wireless communication for WPAN, WLAN, mobile networks, and new emerging technology.
7	Course Description	The course presents a selection of security functionalities employed in existing wireless communication for WPAN, WLAN, mobile networks, and new emerging technology.

8	Outline syllabus		CO Mapping
	Unit 1	Wireless Network Basics	
	A	Distinction between wired and wireless networks from information theory;	CO1
	B	Effect of mobility on networks & systems - Mobile Ad Hoc Networks - Wireless Sensor Networks - Location Discovery	CO1, CO2
	C	In-Network Processing - Routing - Energy Efficiency - Clustering	CO1, CO2,CO4
	Unit 2	Security in Wireless Networks	
	A	Issues of security in wireless; IP broadcast, Satellite broadcast; issues of information capacity; issues of 802.11 protocols;	CO1, CO2
	B	design of secure protocols; Secure routing - Secure localization - Secure and resilient data aggregation - Key pre-distribution and management	CO1, CO2
	C	Encryption and authentication - Security in group communication - Impact on IP stack from MAC layer and up	CO1, CO2,CO5,CO6

Unit 3	Source authentication	
A	Source authentication of transmissions, and non-repudiation;	CO1,CO2,CO3
B	Power management and selfishness issues, attacks in wireless networks;	CO1,CO2,CO3
C	DOS and DDOS attacks, reaction to attacks, information processing for sensor networks.	CO1,CO2,CO3
Unit 4	Socket Programming	
A	Introduction to socket programming- Concurrent Processing in Client-Server Software-Byte ordering and address conversion functions	CO2,CO3,CO4
B	Socket Interface - System calls used with sockets - Iterative server and concurrent server- Multi protocol and Multi service server- TCP/UDP Client server programs	CO3,CO4
C	Thread Creation and Termination – TCP Echo Server using threads- Remote Procedure Call.	CO2, CO4,CO5
Unit 5	Next Generation Internet Protocol	
A	Introduction to IPv6 – IPv6 Advanced Features –V4 and V6 header comparison	CO2,CO5,
B	V6 Address types –Stateless auto configuration	CO3,CO5,CO6
C	IPv6 routing protocols – IPV4- V6 Tunneling and Translation Techniques.	CO4,CO5,CO6
Mode of examination	Theory	
Weightage Distribution	CA 30%, MTE 20%, ETE 50%	

Text book/s*

1. Douglas E. Comer ,"Internetworking with TCP/IP, Principles, Protocols, and Architecture", Addison-Wesley, 5th edition, Vol 1. 2005.
2. Douglas E. Comer, David L. Stevens ,"Internetworking with TCP/IP Vol. III, Client-Server Programming and Applications", Addison-Wesley, 2 nd edition, 2000.
3. Wendell Odom, "CCNP Route 642-902, CCIE", Official Certification Guide, Pearson education, 2010.

Other References

1. Behrouz A. Forouzan, "Data Communications and Networking", McGraw-Hill, 5th edition, 2012.

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: acquire knowledge of information security technology and methods for communication systems that provide services for mobile users	PO1, PO2, PO5, PO8, PO12, PSO3

	by wireless access networks.	
2.	CO2: about some of the models, design principles, mechanisms and solutions used in wireless network security to obtain authentication and key transport protocols.	PO1, PO2, PO3, PSO3
3.	CO3: Acquire practice and analytical skills in information security assessment of technology	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Apply security mechanisms and protocols in wireless communication networks.	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: illustrate network security to obtain authentication and key transport protocols	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6: demonstrate security measures in wireless communication for WPAN, WLAN, mobile networks, and new emerging technology.	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course NameMobile and Wireless Security (CSC021)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC021_ Mobile and Wireless Security	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC 021	Mobile and Wireless Security	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed toSlight (Low=1) extent 2. Addressed toModerate (Medium=2) extent
3. Addressed toSubstantial (High=3) extent

Department		Department of Computer Science and Engineering	
Program:		B.Tech	
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**	
1	Course Code	CSC022	
2	Course Title	Disaster Recovery Management	
3	Credits	3	
4	Contact Hours (L-T-P)	3 0 0	
	Course Status	Elective	
5	Course Objective	Students will learn fundamentals of Disaster Recovery via lectures and assignments and, investigate various problem and regulation of BCM through projects and assignments.	
6	Course Outcomes	Students will be able to: CO1: Explain Disaster and risk reduction CO2: Illustrate Disaster management cycle CO3: Adapt to the knowledge of Business continuity Management CO4: summarize the application of BCM development process CO5: Analyse and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used. CO6: Demonstrate Capacity to manage the Public Health aspects of the disasters.	
7	Course Description	This course aims to introduce students to the fundamental concepts and techniques in disaster recovery and business continuity management.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Disaster	
	A	Concepts of Hazard, Vulnerability, Risks, Natural Disasters (earthquake, Cyclone, Floods, Volcanoes), and Man-Made Disaster (Armed conflicts and civil strip, Technological disasters, Human Settlement, Slow Disasters (famine, draught, epidemics) and Rapid Onset Disasters (Air Crash, tidal waves, Tsunami) Risks	CO1
	B	Difference between Accidents and Disasters, Simple and Complex Disasters, Refugee problems, Political, Social, Economic impacts of Disasters, Gender and Social issues during disasters, principles of psychosocial issues and recovery during emergency situations, Equity issues in disasters	CO1, CO2
	C	Relationship between Disasters and Development and vulnerabilities, different stake holders in Disaster Relief. Refugee operations during disasters, Human Resettlement and Rehabilitation issues during and after disasters, Inter-sectoral coordination during disasters, Models in Disasters	CO1, CO2,CO4
	Unit 2	Approaches to Disaster Risk Reduction	
	A	Disaster Risk Reduction Strategies, Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and	CO1, CO2

	Procedures, Early warning Systems Models in disaster preparedness, Components of Disaster Relief-(Water, food, sanitation, shelter, Health and Waste Management), Community based DRR, Structural non-structural measures in DRR	
B	Factors affecting Vulnerabilities, Main streaming disaster risk reduction in development, Undertaking risk and vulnerability assessments, Policies for Disaster Preparedness Programs, Preparedness Planning, Roles and Responsibilities, Public Awareness and Warnings, Conducting a participatory capacity and vulnerability analysis	CO1, CO2
C	Sustainable Management, Survey of Activities Before Disasters Strike, Survey of Activities During Disasters, DRR Master Planning for the Future, Capacity Building, Sphere Standards. Rehabilitation measures and long-term reconstruction. Psychosocial care provision during the different phases of disaster	CO1, CO2,CO5,CO6
Unit 3	Disaster Management Cycle and Framework	
A	Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development	CO1,CO2,CO3
B	Awareness During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment	CO1,CO2,CO3
C	Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action	CO1,CO2,CO3
Unit 4	Business Continuity Management	
A	Introduction, Definition and Scope of Business	CO2,CO3,CO4
B	Business Continuity Management (BCM), Drivers of Business continuity management	CO3,CO4
C	Roles and Responsibility of BCM	CO2, CO4,CO5
Unit 5	Development of BCM	
A	Developing effective BCM Capabilities	CO2,CO5,
B	Software application that support BCM	CO3,CO5,CO6
C	BCM in Action: Example of "Good" Practices	CO4,CO5,CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Dr. Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd. 2. Tushar Bhattacharya Disaster Science and	

Management McGraw Hill Education (India) Pvt. Ltd.

3. Jagbir Singh Disaster Management : Future Challenges and Opportunities K W Publishers Pvt. Ltd.

Other References

1. J. P. Singhal Disaster Management Laxmi Publications.
2. Shailesh Shukla, Shamna Hussain Biodiversity, Environment and Disaster Management Unique Publications
3. C. K. Rajan, Navale Pandharinath Earth and Atmospheric Disaster Management : Nature and Manmade B S Publication

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Explain Disaster and risk reduction	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: Illustrate Disaster management cycle	PO1, PO2, PO3, PSO3
3.	CO3: Adapt to the knowledge of Business continuity Management	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: summarize the application of BCM development process	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Analyse and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: Demonstrate Capacity to manage the Public Health aspects of the disasters.	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course **Disaster Recovery Management CSC022**

Course Code_ Course Name	CO's	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSC022_Disaster Recovery Management	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CSC-022	**Disaster Recovery Management**	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* *2.* Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School:	School of Engineering and technology	
Department	Department of Computer Science and Engineering	
Program:	B.Tech	
Branch:	**Computer Science & Engineering with Specialization in Cyber Security and Forensics**	

1	Course Code	CSC031	
2	Course Title	Exploit Writing	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	to explore the needs and effects of leveraging modern exploit mitigation controls.	
6	Course Outcomes	CO1: Analyze fuzz testing to enhance your company's SDL process. CO2: Explain network devices and assess network application protocols. CO3: Illustrate restricted environments on Linux and Windows. CO4: Test cryptographic implementations. CO5: Model the techniques used by attackers to perform 0-day vulnerability discovery and exploit development. CO6: Develop more accurate quantitative and qualitative risk assessments through validation.	
7	Course Description	The course will describe how to use essential skills for advanced penetration testers and software security professionals.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Exploit Development Life Cycle	CO1
	B	System Architecture	CO1, CO2
	C	Memory Organisation	CO1, CO2,CO4
	Unit 2	Programming languages	
	A	Powershell Programming	CO1, CO2
	B	Python Scripts to perform exploits	CO1, CO2
	C	Assembly Language	CO1, CO2,CO5,CO6
	Unit 3	Protection	
	A	GDB usage -operating debugger, decompilers	CO1,CO2,CO3
	B	Prevention and Bypassing Address Space Layout	CO1,CO2,CO3
	C	Randomization & DEP protection mechanisms	CO1,CO2,CO3
	Unit 4	Techniques	
	A	Shell Code- Shell-Spawning, Port Binding, Connect-Back, Fuzzing with SPIKE	CO2,CO3,CO4
	B	Challenges: KSTET and GMON, Bypassing Antivirus Software	CO3,CO4
	C	Safe SEH Based Overflow, Egg Hunting, Exploiting Character Set Restrictions	CO2, CO4,CO5
	Unit 5	Applications	
	A	Windows Buffer Overflow Exploitation, Linux Buffer Overflow Exploitation, Windows Kernel Driver Exploitation	CO2,CO5,
	B	Kernel Pool Exploitation	CO3,CO5,CO6
	C	RCE on Windows and Linux	CO4,CO5,CO6
	Mode of examination	Theory	

Weightage Distribution	CA 30%	MTE 20%	ETE 50%
Text book/s*	Enrico Perla and Massimiliano Oldani, A Guide to Kernel Exploitation: Attacking the Core		
Other References	Gray Hat Hacking The Ethical Hacker's Handbook, Fourth Edition		

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Analyze fuzz testing to enhance your company's SDL process.	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Explain network devices and assess network application protocols.	PO1, PO2, PO3, PSO3
3.	CO3: Illustrate restricted environments on Linux and Windows.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Test cryptographic implementations.	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Model the techniques used by attackers to perform 0-day vulnerability discovery and exploit development.	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6: Develop more accurate quantitative and qualitative risk assessments through validation.	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Exploit Writing (CSC-031)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Exploit Writing CSC031	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC 031	Exploit Writing	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* *2.* Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

<table>
<tr><td colspan="2">School:</td><td colspan="4">School of Engineering and technology</td></tr>
<tr><td colspan="2">Department</td><td colspan="4">Department of Computer Science and Engineering</td></tr>
<tr><td colspan="2">Program:</td><td colspan="4">B. Tech</td></tr>
<tr><td colspan="2">Branch:</td><td colspan="4">Computer Science & Engineering with Specialization in Cyber Security and Forensics</td></tr>
<tr><td>1</td><td>Course Code</td><td>CSC032</td><td colspan="3"></td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="4">Malware Analysis</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="4">3</td></tr>
<tr><td>4</td><td>Contact Hours (L-T-P)</td><td>3-0-0</td><td></td><td colspan="2"></td></tr>
<tr><td></td><td>Course Status</td><td colspan="4">Elective</td></tr>
<tr><td>5</td><td>Course Objective</td><td colspan="4">The objective of this course is to provide an insight to fundamentals of malware analysis, detection and prevention such as different types of malware, static and dynamic analysis, functionality and detection technique of malware.</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td colspan="4">On successful completion of this module students will be able to:
CO1: illustrate the nature of malware, its capabilities, types and its analysis
CO2: apply the tools and methodologies used to perform static analysis.
CO3: apply the tools and methodologies used to perform dynamic analysis.
CO4: explain executable formats, Windows internals and API, and analysis techniques.
CO5: utilize the techniques of signature-based and non-signature based of malware detection.
CO6: identify and apply the techniques for real world problems in the domain</td></tr>
<tr><td>7</td><td>Course Description</td><td colspan="4">This course is to provide students with an overview of the concepts and fundamentals of malware, static analysis, dynamic analysis, malware functionality, Covert malware launching, malware detection techniques and Case Studies.</td></tr>
<tr><td>8</td><td colspan="4">Outline syllabus</td><td>CO Mapping</td></tr>
<tr><td></td><td>Unit 1</td><td colspan="3">Introduction</td><td></td></tr>
<tr><td></td><td>A</td><td colspan="3">The Goals of Malware Analysis, Introduction to malware, OS security concepts, malware threats, evolution of malware, General Rules for Malware Analysis.</td><td>CO1</td></tr>
<tr><td></td><td>B</td><td colspan="3">Malware types, viruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs,</td><td>CO1</td></tr>
<tr><td></td><td>C</td><td colspan="3">Malware analysis, Malware Analysis Techniques: Basic Static Analysis, Basic Dynamic Analysis, Advanced Static</td><td>CO1</td></tr>
</table>

		Analysis, Advanced Dynamic Analysis	
	Unit 2	**Static Analysis**	
	A	Antivirus Scanning: A Useful First Step, Hashing: A Fingerprint for Malware, Finding Strings, Packed and Obfuscated Malware, Portable Executable File Format, Linked Libraries and Functions	CO2
	B	Static Analysis in Practice, PotentialKeylogger.exe: An Unpacked Executable, PackedProgram.exe: A Dead End, The PE File Headers and Sections	CO2, CO6
	C	Malware analysis in virtual machines : The Structure of a Virtual Machine, Creating Your Malware Analysis Machine, Configuring VMware, Using Your Malware Analysis Machine	CO2, CO6
	Unit 3	**Dynamic Analysis**	
	A	Sandboxes: The Quick-and-Dirty Approach, Using a Malware Sandbox, Sandbox Drawbacks, Running Malware, Monitoring with Process Monitor, The Procmon Display, Filtering in Procmon	CO3
	B	Viewing Processes with Process Explorer: The Process Explorer Display, Using the Verify Option, Comparing Strings, Using Dependency Walker, Analyzing Malicious Documents. Comparing Registry Snapshots with Regshot, Faking a Network : Using ApateDNS, Monitoring with Netcat	CO3, CO6
	C	Packet Sniffing with Wireshark, Using INetSim, Basic Dynamic Tools in Practice	CO3, CO6
	Unit 4	**Malware Functionality**	
	A	Downloaders and Launchers, Backdoors, Credential Stealers	CO4
	B	Persistence Mechanisms, Privilege Escalation, Covering Its Tracks—User-Mode Rootkits	CO4
	C	Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection	CO4
	Unit 5	**Malware Detection Techniques**	
	A	Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature	CO5
	B	Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences	CO5
	C	Case Studies – Plankton, DroidKungFu, AnserverBot, Smartphone (Apps) Security	CO6
	Mode of	Theory	

	examination				
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Michael Sikorski and Andrew Honig, “Practical Malware Analysis : The Hands-On Guide to Dissecting Malicious Software”, No Starch Press,2012.			
	Other References	1. Jamie Butler and Greg Hoglund, “Rootkits: Subverting the Windows Kernel”, Addison-Wesley, 2005. 2. Dang, Gazet, Bachaalany, “Practical Reverse Engineering”, Wiley, 2014. 3. Reverend Bill Blunden, “The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System” Second Edition, Jones & Bartlett, 2012. 4. Monnappa K A, “Learning Malware Analysis: Explore the concepts, tools, and techniques to analyze and investigate Windows malware”			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: illustrate the nature of malware, its capabilities, types and its analysis	PO1,PO2, PO5, PO8,PO12,PSO3
2.	CO2: apply the tools and methodologies used to perform static analysis.	PO1, PO2, PO3, PSO3
3.	CO3: apply the tools and methodologies used to perform dynamic analysis.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: explain executable formats, Windows internals and API, and detection and prevention techniques	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: utilize the techniques of signature-based and non-signature based of malware detection.	PO1, PO2, PO3,PO8,PO9,PSO2,
6.	CO6: identify and apply the techniques for real world problems in the domain	PO1, PO2, PO4, PO5, PO6,PO7,PO10,PO11,PSO1

PO and PSO mapping with level of strength for Course Name Malware Analysis **(CSC032)**

Course Code_ Course Name	CO’s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC032_Malware Analysis	**CO1**	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-

	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC032	Malware Analysis	**3**	**2.7**	**2.3**	**3**	**2.2**	**3**	**3**	**2.6**	**2.5**	**3**	**3**	**2.5**	**2**	**2**	**2**

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:	**School of Engineering and technology**
Department	**Department of Computer Science and Engineering**
Program:	**B. Tech**
Branch:	**Computer Science & Engineering with Specialization in Cyber Security and Forensics**

1	Course Code	CSC041
2	Course Title	**Cloud Security**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	1. Provide students with an overview of the fundamental concepts of Cloud Computing. 2. Gain insight into the challenges and limitations Models of cloud computing. 3. To learn the various technologies of the cloud computing paradigm and learn about recent advances in Cloud Computing and enabling technologies. 4. Prepare students for research in the area of cloud Computing risks and cloud security challenges. 5. Enhance students' communication and problem solving skills
6	Course Outcomes	Students will be able to: **CO1:** To identify the cloud computing Concepts. **CO2:** Explain how and why this paradigm came about and the influence of several enabling technologies physical and logical infrastructure **CO3: Examine** cloud access control methods **CO4: Analyze** of Cloud monitoring, auditing and management CO5:Compare types and objectives of virus **CO6:** Evaluate the different type of intrusion detection and firewall design principles.
7	Course Description	This course introduces advanced aspects of Cloud Computing, encompassing the principles, to analyze the cloud, identify the problems, and choose the relevant models and algorithms to apply.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction Cloud Computing**	
	A	Introduction to distributed systems, Defining Cloud Computing	CO1, CO2
	B	Understanding of Cloud Architecture: Composability, Infrastructure, Platform	CO1, CO2
	C	Virtual Appliances, Communication Protocols, Applications, Understanding Services: SaaS, PaaS, IaaS	CO1, CO2
	Unit 2	**Secure Isolation of Physical & Logical Infrastructure**	
	A	Isolation: Compute, Network and Storage	CO1, CO2, CO4

B	Common attack vectors and threats, Secure Isolation Strategies, Multitenancy, Virtualization strategies	CO1, CO2, CO4
C	Inter-tenant network segmentation strategies, Storage isolation strategies	CO1, CO2, CO4
Unit 3	**Data Protection for Cloud Infrastructure and Services**	
A	Understand the Cloud based Information Life Cycle, Data protection for Confidentiality and Integrity	CO1, CO2, CO3
B	Common attack vectors and threats, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key Management, Assuring data deletion	CO1, CO2, CO3
C	Data retention, deletion and archiving procedures for tenant data, Data Protection Strategies	CO1, CO2, CO3
Unit 4	**Enforcing Access Control for Cloud Infrastructure based Services**	
A	Understand the access control requirements for Cloud infrastructure,	CO1, CO2, CO3
B	Authentication and Authorization, Roles-based Access Control, Multi-factor authentication	CO1, CO2, CO3
C	Securing remote access, Verified and measured boot, Firewalls, IDS, IPS and honeypots	CO1, CO2, CO3
Unit 5	**Monitoring, Auditing and Management**	
A	Proactive activity monitoring, Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges, intrusion detection, events and alerts	CO1, CO2, CO3
B	Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs	CO1, CO2, CO3
C	Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management	CO1, CO2, CO3
Mode of examination	Theory	
Weightage Distribution	CA 30% — MTE 20% — ETE 50%	
Text book/s* Other References	8. Barrie Sosinsky "*Cloud Computing (Bible)"*,Wiley 9. Anthony T.Velte, Toby J. Velte, Robert Elsenpeter"Cloud Computing: A Practical Approach" TATA McGRAW-HILL Edition. 10. Ronald L. Krutz and Russell Dean Vines, "Cloud Security: A comprehensive Guide to Secure Cloud Computing", WILEY.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: To understand the cloud computing Concepts.	PO1, PO2, PO3, PO4, PSO1
2.	CO2: Explain how and why this paradigm came about and the influence of several enabling	PO1, PO3, PO4, PSO2

	technologies physical and logical infrastructure	
3.	CO3: cloud access control methods	PO1, PO2, PO3, PO4,PO6
4.	CO4: Understanding of Cloud monitoring, auditing and management	PO9, PO10, PO11, PSO5,PO7
5.	CO5. Examine security at application layer, transport layer and network layer.	PO5,PO7, PO8, PO9, PSO1,PSO2
6.	CO6:Interpret use of cryptographic data integrity algorithms and user authentication protocols	PO10,PO11,PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Cloud Security (CSC041)

Course Code, Course Name	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Cloud Security (CSC041)	CO1	3	3	2	2	--	--	--	2	2	1	2	1	3	2
	CO2	2	2	3	3	--	--	--	2	2	2	1	1	2	3
	CO3	3	3	3	3	--	2	--	1	1	1	3	2	3	2
	CO4	2	2	2	2	2	--	-2	2	3	3	3	1	2	2
	CO5	-	-	-	-	2	-	2	2	2		-	-	2	-
	CO6	-	-	-	-	-	-	-	-	-	2	2	2	2	-

verage of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CSC041	Cloud Security	2.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2	2	2

Strength of Correlation

1. Addressed to***Slight (Low=1) extent*** ***2.*** Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

School:		School of Engineering and technology
Department		Department of Computer Science and Engineering
Program:		B.Tech
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**
1	Course Code	CSC042
2	Course Title	**Penetration Testing**
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	6. Students will learn fundamentals of penetration testing via lectures and assignments. 7. Students will investigate various problem and regulation of penetration testing through projects and assignments.
6	Course Outcomes	Students will be able to: **CO1:** acquire knowledge on Penetration Testing **CO2:**acquire the ability to identify Legal and ethical consideration **CO3:** explain Social Engineering Attacks **CO4:** explain and analyze Performing Host Reconnaissance **CO5:** explain and analyze attacking the network **CO6:** acquire the knowledge to prevent threats in targeted attacks and real time systems.
7	Course Description	This course aims to introduce students to the fundamental concepts and techniques in penetration testing, and giving students an overview of attack and securing methods

8	Outline syllabus		CO Mapping
	Unit 1	**Understanding Penetration Testing**	
	A	Defining penetration testing, proliferation of Viruses and worm, Wireless LANs.	CO1, CO2, CO3
	B	Complexity of networks today, frequency of software updates, availability of hacking tools, the nature of open source	CO1, CO2, CO3
	C	Unmonitored mobile users and telecommuters, marketing demands, industry regulation, administrator trust, Hacktivism, Attack Stages	CO1, CO3
	Unit 2	**Legal and ethical consideration**	
	A	Ethics of penetration testing, Laws: US Law, Computer Fraud and abuse act (CFAA), State Laws	CO1, CO4, CO3
	B	Regulatory Laws: Health Insurance Portability and Accountability Act (HIPAA), Graham-Leach-Bliley (GLB)	CO1, CO2, CO3
	C	Federal Information Security Management Act (FISMA), Sarbanes-Oxley Act (SOX)	CO1, CO2, CO3
	Unit 3	**Performing Social Engineering**	
	A	Human Psychology: conformity persuasion, logic persuasion, need-based persuasion, authority based	CO2, CO3

	persuasion, reciprocation based social engineering, similarity based social engineering, information based social engineering	
B	First Impressions and the social engineer, tech support impersonation, third-party impersonation	CO2, CO3
C	E-Mail impersonation, end user impersonation, customer impersonation, Reverse Social engineering	CO2, CO3
Unit 4	**Performing Host Reconnaissance**	
A	Passive host reconnaissance, active host reconnaissance	CO1, CO2
B	Port Scanning: TCP scan, SYN scan, NULL scan, FIN scan, ACK scan, Xmas-tree scan, Dump scan	CO4
C	NMap, Detecting a Scan: intrusion detection, Anomaly Detection system, misuse detection system,	CO1, CO2,CO4
Unit 5	**Attacking the Network**	
A	Bypassing Firewall, Evading Intruder Detection Systems, Testing Routers for Vulnerabilities: CDP, HTTP service, Password Cracking, Modifying Routing Tables	CO2,CO5, CO6
B	Testing Switches for Vulnerability: VLAN Hopping, Spanning Tree Attacks, MAC Table Flooding, ARP Attacks, VTP Attacks	CO3,CO5, CO6
C	Securing the Network; Securing Firewalls, Securing Routers, Securing Switches. Case Study	CO3,CO5, CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% / MTE 20% / ETE 50%	
Text book/s*	1. Penetration Testing and Network Defence, Andrew Whitaker, Daniel P. Newman 2. David Kennedy, Jim O'Gorman, Devon Kearns, and Mati Aharoni, METASPLOIT The Penetration Tester's Guide, No Starch Press,2011. 8. Wil Allsopp, Advanced Penetration Testing: Hacking theworlds most Secure Networks, 1st Edition, John Wiley & Sons,2017	
Other References	1. Sean-Philip Oriyano, Penetration Testing Essentials, John Wiley & Sons, 2017. 2. Leebrotherston, Amanda Berlin, Defensive Security handbook, O'reilly, 2017	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** acquire knowledge on Penetration Testing	PO1, PO2, PO5, PO8, PO12, PSO3
2.	**CO2:** acquire the ability to identify Legal and ethical consideration	PO1, PO2, PO3, PSO3
3.	**CO3:** explain Social Engineering Attacks	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	**CO4:** explain and analyze Performing Host Reconnaissance	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	**CO5:** explain and analyze attacking the network	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	**CO6:** acquire the knowledge to prevent threats in targeted attacks and real time systems.	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Penetration Testing (Course Code CSC042**)**

	Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CSC042_**Penetration Testing**	CO 1		3	3	-	-	2	-	-	3	-	-	-	3	-	-
	CO 2		3	3	2	-	-	-	-	-	-	-	-	-	-	-
	CO 3		3	3	2	-	2	-	-	-	2	-	-	2	3	-
	CO 4		3	3	-	3	2	3	-	2	-	-	-	-	-	3
	CO 5		3	2	3	-	-	-	-	3	3	-	-	-	-	3
	CO 6		3	3	-	3	3	3	3	-	-	3	3	-	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC 042	**Penetration Testing**	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School:		School of Engineering and technology
Department		Department of Computer Science and Engineering
Program:		B.Tech
Branch:		**Computer Science & Engineering with Specialization in Cyber Security and Forensics**
1	Course Code	CSC051
2	Course Title	Digital Water Marking and Steganography
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	The primary objective of this syllabus is to build blind, secured, robust and perceptual transparent digital image watermarking system in transform domain by embedding high capacity payload in an image.
6	Course Outcomes	CO1: To learn about the watermarking models and message coding CO2: To learn about watermark security and authentication. CO3: To learn about steganography. Perceptual models CO4:Applications of different watermarking techniques used with different media objects (Stegeo-objects), such as video, audio and Circuitry CO5: Different commercial and e-commerce protocols of Digital watermarking CO6: Different attacks on digital watermarking and benchmarks used
7	Course Description	The subject deals with application of steganography on different objects and Classification of watermarking algorithms: Transform-based, spatial domain, statistical, and others

8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Information Hiding, Steganography and Watermarking – History of watermarking – Importance of digital watermarking – Applications – Properties – Evaluating watermarking systems	CO1
	B	Watermarking Models & Message Coding: Notation – Communications – Communication based models	CO1, CO2
	C	Mapping messages into message vectors – Error correction coding – Detecting multi-symbol watermarks.	CO1, CO2,CO4
	Unit 2	Watermarking	
	A	Watermarking With Side Information & Analyzing Errors: Informed Embedding	CO1, CO2
	B	Informed Coding – Structured dirty-paper codes	CO1, CO2
	C	Message errors – False positive errors – False negative errors – ROC curves – Effect of whitening on error rates.	CO1, CO2,CO5,CO6
	Unit 3	Model	
	A	Perceptual Models: Evaluating perceptual impact – General form of a perceptual model	CO1,CO2,CO3
	B	Examples of perceptual models – Robust watermarking approaches - Redundant Embedding,	CO1,CO2,CO3
	C	Spread Spectrum Coding, Embedding in Perceptually significant coefficients	CO1,CO2,CO3
	Unit 4	Security	
	A	Watermark Security & Authentication: Security requirements	CO2,CO3,CO4
	B	Watermark security and cryptography – Attacks – Exact authentication	CO3,CO4
	C	Selective authentication – Localization – Restoration	CO2, CO4,CO5
	Unit 5	Steganography	
	A	Steganography communication – Notation and	CO2,CO5,

	terminology	
B	Information-theoretic foundations of steganography – Practical steganographic methods	CO3,CO5,CO6
C	Minimizing the embedding impact – Steganalysis	CO4,CO5,CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, “Digital Watermarking and Steganography”, Margan Kaufmann Publishers, New York, 2008. 2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, “Digital Watermarking”, Margan Kaufmann Publishers, New York, 2003. 3. Michael Arnold, Martin Schmucker, Stephen D. Wolthusen, “Techniques and Applications of Digital Watermarking and Contest Protection”, Artech House, London, 2003.	
Other References	4.Juergen Seits, “Digital Watermarking for Digital Media”, IDEA Group Publisher, New York, 2005. 5. Peter Wayner, “Disappearing Cryptography – Information Hiding: Steganography & Watermarking”, Morgan Kaufmann Publishers, New York, 2002. 2ndEdition, O’ Reilly Media, 2006.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: To learn about the watermarking models and message coding	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: To learn about watermark security and authentication.	PO1, PO2, PO3, PSO3
3.	CO3: To learn about steganography. Perceptual models	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4:Applications of different watermarking techniques used with different media objects (Stegeo-objects), such as video, audio and Circuitry	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Different commercial and e-commerce protocols of Digital watermarking	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6: Different attacks on digital watermarking and benchmarks used	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Digital Water Marking and Steganography (CSC051)

Course Code_ Course Name	CO’s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC051_Digital Water Marking and Steganography	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-

	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC051	Digital Water Marking and Steganography	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* *2.* Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School: **School of Engineering and technology**
Department **Department of Computer Science and Engineering**

Program: **B. Tech**

Branch: **Computer Science & Engineering with Specialization in Cyber Security and Forensics**

1	Course Code	CSC052
2	Course Title	Information Security and Audit Monitoring
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	Students will learn various information security & auditing concepts, and technologies via lectures and assignments. Students will investigate various information security and auditing related topics
6	Course Outcomes	After the successful completion of this course, students will be able to : Students will be able to: **CO1:** Identify security weaknesses in information systems, and rectify them with appropriate security mechanisms **CO2:** Analyze the latest trend of computer security threats and defense **CO3:** Explain the security controls in the aspects of physical, logical and operational security control **CO4: Examine** the security of information systems CO5:Compare types and objectives of virus **CO6:** Evaluate the different type of intrusion detection and firewall design principles.
7	Course Description	This course aims to introduce students to the fundamental concepts and techniques in computer and network security, and giving students an overview of information security and auditing, and to expose students to the latest trend of computer attack and defense. Other advanced topics on information security such as mobile computing security, security and privacy of cloud computing, as well as secure information system development will also be discussed.

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Information Security and IS Auditing**	
	A	Objectives of IS audit and control,	CO1, CO3
	B	The structure of an IS audit and audit reports,	CO1, CO3
	C	IS auditing standards, Computer assisted audit tools	CO1, CO3
	Unit 2	**Organization Security and Controls**	
	A	Physical security controls: contingency plan, disaster recovery and reconstruction	CO1, CO2, CO3

B	Logical security controls: operating system security and access control, Operating controls: segregation of duties, monitoring and logging controls	CO1, CO2, CO3
C	Personnel security and management practices: user training and incident reporting, third-party access and outsourcing, Application software control: software development control, input, processing and output control	CO1, CO2, CO3
Unit 3	**Basics of Cryptographic Technologies**	
A	Symmetric encryption, Asymmetric encryption	CO2, CO3
B	Basics of message authentication and cryptographic hash functions	CO2, CO3
C	Digital signatures and digital certificates, Public-key Infrastructure & Web of Trust	CO2, CO3
Unit 4	**Network Security & Network Defense**	
A	**Network Security:** User Authentication, Access Control and Identity Management	CO1, CO4
B	Network Security – Attack & Defense, Network Attacks: Host based attacks, Network attacks, Web based attacks	CO4,CO5
C	**Network Defense:** Intrusion detection systems & firewall, IPSec and DNSSec, IPv6, Cloud Computing	CO2, CO5
Unit 5	**Information System Security Auditing, Computer Forensic and Other Security Technologies**	
A	Security auditing and security standards	CO2,CO6
B	Incident handling and computer forensic	CO3,CO6
C	Other security technologies including blockchain	CO4,CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. William Stallings and Lawrie Brown, Computer Security Principles and Practice, (3rd Edition), Pearson, 2014 2. Bruce Schneier, Applied Cryptography: Protocols, Algorithms and Source Code in C, Wiley, 2015 3. Niels Ferguson, Bruce Schneier, and Tadayoshi Kohno, Cryptography Engineering: Design Principles and Practical Applications, John Wiley & Sons, 2010. 4. Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, Software Security Engineering: A Guide for Project Managers, Addison-Wesley, 2008.	
Other References	1. Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, Software Security Engineering: A Guide for Project Managers, Addison-Wesley, 2008. 2. ISO/IEC 27001:2013	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1:** Identify security weaknesses in information	PO1, PO2, PSO1,PSO2

systems, and rectify them with appropriate security mechanisms

2. **CO2:** Analyze the latest trend of computer security threats and defense — PO1,PO2,PO3,PSO1,PSO2

3. **CO3:** Explain the security controls in the aspects of physical, logical and operational security control — PO1, PO3, PO5, PSO1, PSO2

4. **CO4: Examine** the security of information systems — PO1, PO4, PO6, PO7, PSO1,PSO2

5. CO5:Compare types and objectives of virus — PO5,PO7, PO8, PO9, PSO1,PSO2

6. **CO6:** Evaluate the different type of intrusion detection and firewall design principles. — PO10,PO11,PO12,PSO1,PSO3

PO and PSO mapping with level of strength for Course Name Information Security and Audit Monitoring **(Course Code CSC052)**

Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC052_Information Security and Audit Monitoring	CO1	2	2		-	-	-	-	-	-	-	-	-	2	2	-
	CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	2	-
	CO3	2	-	2	-	2	-	-	-	-	-	-	-	2	2	-
	CO4	2	-	-	2	-	2	2	-	-	-	-	-	2	2	
	CO5	-	-	-	-	2	-	2	2	2		-	-	2	-	-
	CO6	-	-	-	-	-	-	-	-	-	2	2	2	2	-	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE052	**Cryptography & Network Sec.**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

Strength of Correlation

1. Addressed to***Slight (Low=1) extent*** ***2.*** Addressed to***Moderate (Medium=2) extent***
3. Addressed to***Substantial (High=3) extent***

School: School of Engineering and technology
Department: Department of Computer Science and Engineering
Program: B.Tech
Branch: **Computer Science & Engineering with Specialization in Cyber**

Security and Forensics

1	Course Code	CSC061	
2	Course Title	**Security Threats Intelligence and Risk Management**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The subject provides a foundational platform for Cyber Security Aspirants by providing Cyber Security Awareness and Training that heighten the chances of catching a scam or attack before it is fully enacted, minimizing damage to the resources and ensuring the protection of information technology assets.	
6	Course Outcomes	CO1: Analyze and evaluate the cyber security needs of an organization. CO2: Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation. CO3: Measure the performance and troubleshoot cyber security systems. CO4: Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools. CO5: Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators. CO6: Design and develop a security architecture for an organization.	
7	Course Description	Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Security threats - Sources of security threats- Motives	CO1
	B	Target Assets and vulnerabilities – Consequences of threats- E-mail threats	CO1, CO2
	C	Web-threats - Intruders and Hackers, Insider threats, Cyber crimes.	CO1, CO2,CO4
	Unit 2	Network Threats	
	A	Network Threats: Active/ Passive – Interference – Interception – Impersonation	CO1, CO2
	B	Worms – Virus – Spam's – Ad ware - Spy ware – Trojans and covert channels – Backdoors – Bots	CO1, CO2
	C	IP Spoofing - ARP spoofing - Session Hijacking - Sabotage-Internal treats- Environmental threats - Threats to Server security	CO1, CO2,CO5,CO6
	Unit 3	Security Threat	
	A	Security Threat Management: Risk Assessment - Forensic Analysis - Security threat correlation	CO1,CO2,CO3
	B	Threat awareness - Vulnerability sources and assessment- Vulnerability assessment tools -Threat identification - Threat Analysis - Threat Modeling - Model for Information Security Planning	CO1,CO2,CO3
	C	Concepts of risk-based planning and risk management of computer and information systems.	CO1,CO2,CO3
	Unit 4	Security Elements	
	A	Security Elements: Authorization and Authentication - types, policies and techniques	CO2,CO3,CO4
	B	Security certification - Security monitoring and Auditing - Security Requirements Specifications	CO3,CO4

C	Security Policies and Procedures, Firewalls, IDS, Log Files, Honey Pots	CO2, CO4,CO5
Unit 5	Access control & Human factors	
A	Access control, Trusted Computing and multilevel security - Security models	CO2,CO5,
B	Trusted Systems, Software security issues, Physical and infrastructure security	CO3,CO5,CO6
C	Human factors – Security awareness, training , Email and Internet use policies.	CO4,CO5,CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1.Joseph M Kizza, "Computer Network Security", Springer Verlag, 2005 2.Swiderski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004. 3.William Stallings and Lawrie Brown, "Computer Security: Principles and Practice",	
Other References	4.Brian Kahin and Charles Nesson, eds, "Borders in Cyberspace: Information Policy and the Global Information Infrastructure" Cambridge: MIT Press, 1997. 5.Philip Agree and Marc Rotenberg, "Technology and Privacy: The New Landscape" Cambridge: MIT Press, 1998.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Analyze and evaluate the cyber security needs of an organization.	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.	PO1, PO2, PO3, PSO3
3.	CO3: Measure the performance and troubleshoot cyber security systems.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators.	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6: Design and develop a security architecture for an organization.	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name**Security Threats Intelligence and Risk Management (CSC061)**

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CSC061_Security Threats Intelligence and Risk Management	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3
	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC061	**Security Threats Intelligence and Risk Management**	3	2.7	2.3	3	2.2	3	3	2.6	2.5	3	3	2.5	2	2	2

Strength of Correlation

1. Addressed to *Slight (Low=1) extent* 2. Addressed to *Moderate (Medium=2) extent*
3. Addressed to *Substantial (High=3) extent*

School: School of Engineering and technology
Department Department of Computer Science and Engineering
Program: B.Tech
Branch: **Computer Science & Engineering with Specialization in Cyber Security and Forensics**

1	Course Code	CSC062	
2	Course Title	Web Application Security	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	Provide the students with practice on applying digital forensics techniquesin Web Application and enhance their skills regarding practical applications of Web security.	
6	Course Outcomes	CO1: Enhance students communication and problem solving skills CO2: Identify, explain and demonstrate the problems in insecure coding practices and methods to rectify the same in Web Application. CO3: Provide students with an overview of the IT infrastructure on web application Security CO4: Gain insight into the challenges and limitations of application security techniques CO5: Design with practice on applying data mining solutions in Web Application Security. CO6:Examine security on Database and Web Specific Input issues	
7	Course Description	This course contains exploring of security problems that are being successfully tackled with web application , describe insecure coding practices and methods	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION**	
	A	Need for secure systems-	CO1, CO2, CO3
	B	Proactive security development process-	CO1, CO2, CO3
	C	Security principles to live by and threat modeling.	CO1, CO2, CO3
	Unit 2	**SECURE CODING IN C**	
	A	Character strings- String manipulation errors – String Vulnerabilities and exploits	CO1, CO2, CO3
	B	Mitigation strategies for strings- Pointers – Mitigation strategies in pointer-based vulnerabilities	CO1, CO2, CO3
	C	Buffer Overflow based vulnerabilities.	CO1, CO2, CO3
	Unit 3	**SECURE CODING IN C++ AND JAVA**	
	A	Dynamic memory management- Common errors in dynamic memory management-	CO1, CO2, CO3
	B	Memory managers- Double	CO1, CO6, CO3
	C	free vulnerabilities –Integer security Mitigation strategies.	CO1, CO2, CO3
	Unit 4	**DATABASE AND WEB SPECIFIC INPUT ISSUES**	
	A	Quoting the Input – Use of stored procedures-	CO1, CO3, CO4
	B	Building SQL statements securely	CO1, CO2, CO4
	C	XSS related attacks and remedies	CO1, CO2, CO5
	Unit 5	**SOFTWARE SECURITY ENGINEERING**	
	A	Requirements engineering for secure software	CO1, CO2, CO6
	B	Misuse and abuse cases QUARE process model- and	CO1, CO4, CO5

C	Software security practices - knowledge for architecture and design.	CO1, CO2, CO6
Mode of examination	Theory	

Weightage Distribution	CA 30%	MTE 20%	ETE 50%

Text book/s*

11. J.Han,J. Pei "Web Security *Concepts and Techniques"*,Edition:3 , Morgan Kaufmann

Other References

2. M.H. Dunham, *Data Mining Introductory and Advanced Topics*, Pearson Education.
3. Adriaans, *Data Mining*, Pearson Education
4. Vikram Pudi & P. Radhakrishnan, "Data Mining", Oxford University Press

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Enhance students communication and problem solving skills	PO1, PO2, PO5, PO8, PO12, PSO3
2.	CO2: Identify, explain and demonstrate the problems in insecure coding practices and methods to rectify the same in Web Application.	PO1, PO2, PO3, PSO3
3.	CO3: Provide students with an overview of the IT infrastructure on web application Security.	PO1, PO2, PO3, PO5, PO9, PO12, PSO1
4.	CO4: Gain insight into the challenges and limitations of application security techniques .	PO1, PO2, PO4, PO5, PO6, PO8, PSO2
5.	CO5: Design with practice on applying data mining solutions in Web Application Security.	PO1, PO2, PO3, PO8, PO9, PSO2,
6.	CO6:Examine security on Database and Web Specific Input issues	PO1, PO2, PO4, PO5, PO6, PO7, PO10, PO11, PSO1

PO and PSO mapping with level of strength for Course Name Web Application Security (CSC062)

Course Code_ Course Name	CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSC	CO1	3	3	-	-	2	-	-	3	-	-	-	3	-	-	3

062_ Web Application Security	CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3
	CO3	3	3	2	-	2	-	-	-	2	-	-	2	3	-	-
	CO4	3	3	-	3	2	3	-	2	-	-	-	-	-	3	-
	CO5	3	2	3	-	-	-	-	3	3	-	-	-	-	3	-
	CO6	3	3	-	3	3	3	3	-	-	3	3	-	3	-	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CSC 062	Web Application Security	3	2.7	1.1	1	1.5	1	.5	1.3	.8	.5	.5	.8	1	1	1

Strength of Correlation

1. Addressed to Slight (Low=1) extent 2. Addressed to Moderate (Medium=2) extent
3. Addressed to Substantial (High=3) extent

B.Tech-Computer Science & Engineering with specialization in Blockchain Technology

School: **School of Engineering and technology**
Department **Department of Computer Science and Engineering**
Program: **B.Tech - CSE**
Branch: **Blockchain**

1	Course Code	BCC102 Semester- 2			
2	Course Title	Introduction to Blockchain Technology			
3	Credits	2			
4	Contact Hours (L-T-P)		2	0	0
	Course Status	Core			

5 Course Objective

By the end of the course, students will be able to:
1. Understand how blockchain systems work,
2. To securely interact with them,
3. Design, build, and deploy smart contracts and distributed applications,
4. Integrate ideas from blockchain technology into their own projects

6 Course Outcomes
1. Explain Abstract model of blockchain and consensus problem.
2. List and describe differences between proof-of-work and proof-of-stake consensus.
3. Summarizing the benefits of cryptographic basics for cryptocurrency in case of various attacks
4. Analyzing properties of Bitcoin and Ethereum
5. List Ethereum Virtual Machine (EVM) and its benefits
6. List topics like SNARK and zcash along with various applications of blockcahin technology

7 Course Description

Decentralized blockchain-based systems, such as Bitcoin and Ethereum, are successful beyond all expectations. Although still in their infancy, they promise to revolutionize how we think of financial, information, and other infrastructures. This course covers the technical aspects of public distributed ledgers, blockchain systems, cryptocurrencies, and smart contracts. Students will learn how these systems are built, how to interact with them, how to design and build secure distributed applications.

8 Outline syllabus

		CO Mapping
Unit 1	**Introduction**	
A	The consensus problem - Asynchronous Byzantine Agreement and its analysis	CO1 , CO2
B	Abstract Models for BLOCKCHAIN - GARAY Model - RLA Model	CO1 , CO2

C	Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS)	CO1 , CO2
Unit 2	**Cryptographic Basics For Cryptocurrency**	
A	A Short Overview of Hashing	CO1, CO3
B	Signature Schemes,	CO1, CO3
C	Encryption Schemes	CO1, CO3
Unit 3	**Bitcoin - Wallet**	
A	Merkley Tree - Hardness of Mining	CO3, CO4
B	Transaction Verifiability - Anonymity - Forks - Double Spending	CO3, CO4
C	Mathematical Analysis of Properties Of Bitcoin	CO3, CO4
Unit 4	**Ethereum**	
A	Ethereum Virtual Machine (EVM) - Wallets for Ethereum	CO4,CO5
B	Smart Contracts - some attacks on smart contracts	CO3,CO5
C	Vulnerability, Attacks, Sidechain	CO3,CO5
Unit 5	**Application and future of Blockchain**	
A	Zero Knowledge proofs and protocols in Blockchain	CO5, CO6
B	Succinct non interactive argument for Knowledge (SNARK)	CO5, CO6
C	Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain, Zcash	CO5, CO6
Mode of examination	Theory	
Weightage Distribution	CA MTE ETE 30% 20% 50%	
Text book/s*	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.	
Other References	1. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015 (article available for free download) { curtain raiser kind of generic article, written by seasoned experts and pioneers}. 2. J.A.Garay et al, The bitcoin backbone protocol - analysis and applications EUROCRYPT 2015 LNCS VOl 9057, (VOLII), pp 281-310. (Also available at eprint.iacr.org/2016/1048) . (serious beginning of discussions related to formal models for bitcoin protocols). 3. R.Pass et al, Analysis of Blockchain protocol in Asynchronous networks, EUROCRYPT 2017, (eprint.iacr.org/2016/454) . A significant progress and consolidation of several principles).	

4. R.Pass et al, Fruitchain, a fair blockchain, PODC 2017 (eprint.iacr.org/2016/916).

CO and PO Mapping

S. No	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Explain Abstract model of blockchain and consensus problem.	PO1, PO2,PO3,PO4,PO5, PO6,PO11,PSO1, PSO2,PSO3
2	List and describe differences between proof-of-work and proof-of-stake consensus.	PO1,PO2,PO3,PO4,PO5,PO7,PO10,PO12 PSO2,PSO3
3	Summarizing the benefits of cryptographic basics for cryptocurrency in case of various attacks	PO1,PO2,PO3,PO4,PO5,PO8, PO9, PSO1, PSO2,PSO3
4	Analyzing properties of Bitcoin and Ethereum	PO1, PO2,PO3,PO4,PO5, PO8,PO9,PO12,PSO1, PSO2
5	List Ethereum Virtual Machine (EVM) and its benefits	PO1, PO2,PO3,PO4,PO5, PO7,PO10,PSO1, PSO2,PSO3
6	List topics like SNARK and zcash along with various applications of blockcahin technology	PO1, PO2,PO3,PO4,PO5, PO6, PO11,PO12,PSO1, PSO2,PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
BCC102_ Introduction to Blockchain Technology	CO1	3	2	2	2	2	1	-	-	-	-	1	-	1	3	1
	CO2	3	3	2	2	2	-	1	-	-	1	-	1	-	3	2
	CO3	3	3	3	2	2	-	-	1	1	-	-	-	1	3	1
	CO4	2	3	2	2	2	-	-	1	1	-	-	1	1	3	-
	CO5	2	2	2	3	2	-	1	-	-	1	-	-	2	3	1
	CO6	2	3	2	2	3	1	-	-	-	-	1	1	1	3	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC102	Introduction to Blockchain Technology	2.5	2.7	2.2	2.2	2.2	0.3	0.3	0.3	0.3	0.3	0.3	0.5	1.0	3.0	1.0

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

BITCOIN AND CRYPTOCURRENCIES

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC201 Semester- 3		
2	Course Title	**BITCOIN AND CRYPTOCURRENCIES**		
3	Credits	4		
4	Contact Hours (L-T-P)	3	1	0
	Course Status	Core		

5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Bitcoins and Cryptocurrencies, with a practical approach in understanding them. To visualize the scope of bitcoin and cryptocurrencies, and its role in futuristic development.	
6	Course Outcomes	On successful completion of this module students will be able to CO-1: Explain the working of bitcoin and cryptocurrencies. CO-2: Discover bitcoin mechanism and network. CO-3: Interpret different bitcoin blocks. CO-4: Compare online wallets and exchanges. CO-5: Design bitcoin and cryptocurrency based application. CO-6: Discuss distributed systems and future of blockchain.	
7	Course Description	The fundamental concepts in Bitcoins and Cryptocurrencies, with a practical approach in understanding them will be discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO CRYPTO AND CRYPTOCURRENCIES**	
	A	Introduction, Cryptographic Hash Functions, Hash Pointers and Data Structures	CO1, CO2
	B	Digital Signatures, Public Keys as Identities	CO1, CO2
	C	A Simple Cryptocurrency	CO1, CO2,CO3
	Unit 2	**BITCOIN BASICS**	
	A	Bitcoin Protocol and Consensus: A High Level Overview,	CO1, CO2,CO3
	B	Bitcoin and Blockchain History,	CO2, CO3
	C	Bitcoin Mechanics and Optimizations: A Technical Overview, Bitcoin IRL: Wallets, Mining, and More	CO1, CO2,CO3
	Unit 3	**MECHANICS OF BITCOIN**	
	A	Bitcoin Transactions, Bitcoin Scripts	CO2,CO3,CO4
	B	Applications of Bitcoin Scripts, Bitcoin Blocks	CO2,CO3,CO4
	C	The Bitcoin Network, Limitations & Improvements	CO2,CO3,CO4
	Unit 4	**STORE AND USE BITCOINS**	
	A	How to Store and Use Bitcoins, Hot and Cold Storage	CO4,CO5
	B	Online Wallets and Exchanges, Payment Services	CO4,CO5
	C	Transaction Fees, Currency Exchange Markets	CO3,CO4,CO5
	Unit 5	**APPLICATIONS AND SCALING**	

	A	Enabling a Decentralized Future, Distributed Systems and Alternative Consensus,			CO2,CO5,CO6
	B	How to Destroy Bitcoin, Crypto economics and Proof-of- State,			CO2,CO5,CO6
	C	Scaling Blockchain: Cryptocurrencies for the Masses, Enterprise Blockchain: Real-World Applications, Anonymity: Mixing and Altcoins, Conclusion: Future of Blockchains			CO3,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	• Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies • Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System			
	Other References	• Wattenhofer, The Science of the Blockchain • Dr. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1: Explain the working of bitcoin and cryptocurrencies.	PO1, PO2, PO3, PO4, PO5, PO7, PO11, PO12, PSO1, PSO2,PSO3
2.	CO-2: Discover bitcoin mechanism and network.	PO1, PO2, PO3, PO4, PO11, PO12, PSO1, PSO2, PSO3
3.	CO-3: Interpret different bitcoin blocks.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO11, PO12, PSO1, PSO2, PSO3
4.	CO-4: Compare online wallets and exchanges.	PO1, PO2, PO3, PO4, PO5, PO8, PO11, PO12, PSO1, PSO2, PSO3
5	CO-5: Design bitcoin and cryptocurrency based application.	PO1, PO2, PO3, PO5, PO6, PO11, PO12, PSO1, PSO2, PSO3
6	CO-6: Discuss distributed systems and future of blockchain.	PO1, PO2, PO3, PO4, PO5,PO6, PO7, PO8, PO9, PO10, PO12, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	3	1	2	-	1	-	-	-	1	2	1	2	1
CO2	1	3	3	2	-	-	-	-	-	-	2	3	1	2	2
CO3	3	1	2	1	1	1	1	-	-	-	2	1	2	2	1
CO4	2	2	1	3	1	-	-	2	-	-	1	1	2	3	1
CO5	2	2	1	-	2	2	-	-	-	-	2	1	1	2	2
CO6	1	3	2	2	3	2	2	2	2	2	-	2	1	3	1
	1.8	2.0	2.0	1.5	1.5	0.8	0.7	0.7	0.3	0.3	1.3	1.7	1.3	2.3	1.3

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC201	BITCOIN AND CRYPTOCURRENCIES	1.8	2	2	1.5	1.5	0.8	0.7	0.7	0.3	0.3	1.3	1.7	1.3	2.3	1.3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC202 Semester: 4		
2	Course Title	Blockchain using Multichain		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		
5	Course Objective	By the end of the course, students will be able to 1. Understand how multi chain systems Platform work 2. How securely interact with multichain 3. How to Create streams		
6	Course Outcomes	On completion of this course the student should be able to: 1. Synthesize the basic concepts and principles of block chain AND multichain 2. Setup a Private blockchain Using Multichain 3. To learn the approaches followed in smart contracts 4. Understand the functioning of streams 5. To learn concept of Decentralized and Distributed Ledger. 6. To maintain security, privacy, and efficiency of a given system.		
7	Course Description	**Blockchain using Multichain**		
8	Outline syllabus			CO Mapping
	Unit 1	**Introduction**		
	A	What is Block chain? Basic ideas behind blockchain, how it is changing the landscape of digitalization, Uses of Blockchain. Abstract Models for BLOCKCHAIN - GARAY model - RLA Model		CO1
	B	What is Multichain? Objective of Multichain, Features of Multichain, Uses of Multichain, Process of mining in Multichain technology		CO1
	C	Analyse Multichain platform, why it is better than other open platforms		CO1
	Unit 2	**Privacy and Permissions in Multichain,**		
	A	Privacy and Permissions in Multichain, compare Multichain Core, and Bitcoin Core, Hand-Shaking Process, Private blockchains Multichain		CO1, CO6
	B	Multiple configurable Blockchains using Multichain, Decentralized exchange		CO1, CO6

C	Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts	CO1, CO3, CO6
Unit 3	**DECENTRALIZED APPLICATIONS (DAPPS)**	
A	Characteristics of Decentralized application, Setting up a Private Blockchain, Multiple configurable Blockchains using Multichain	CO2, CO5, CO6
B	Deployment scenarios of Multichain, Centralized currency settlement, Bond issuance and peer-to-peer trading	CO2, CO5, CO6
C	Consumer-facing rewards scheme in Decentralized Applications	CO2, CO5, CO6
Unit 4	**Introducing Multichain Feeds**	
A	Multichain feed Adapters, MultiChain Feeds for Database Integration, feed file adaptors, MultiChain streams	CO4
B	Purpose of Multichain streams, off chain data vs on chain data, JSON and Unicode text, Streams required to implement database, Streams and the MultiChain roadmap,	CO4
C	Three areas of high-level functionality, create the streams, publish the data into streams, retrieve the data from the streams using the key, and give permission to others to publish the data into the same streams.	CO4
Unit 5	**Smart contract approaches**	
A	Hyperledger Fabric, smart filters, R3 Corda, Transaction rules in Hyperledger Fabric, smart filters, R3 Corda, Multichain , Etherium, Conflict transaction	CO4, CO5
B	Hyperledger Fabric vs MultiChain vs Ethereum vs Corda, Multichain Tools: MultiChain Explore, Multichain web demo	CO4, CO5
C	Applications of Multi chain: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain	CO1
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	1. Blockchain From Concept to Execution: BitCoin, Ethereum, Quorum, Ripple, R3 Corda, Hyperledger Fabric/SawTooth/Indy, MultiChain, IOTA, CoCo Kindle Edition by Debajani Mohanty (Author) 2. Beginner's Guide to Ontology: The Public Multi-Chain & Distributed Trust Collaboration Platform: (crypto, cryptocurrency, forex, trading, bitcoin, invest, earn money, invest, ethereum, blockchain) Kindle Edition by Juan Jimenez (Author) 3. Mastering Blockchain, Second Edition Paperback – 1	

January 2018 by Imran Bashir (Author)

Other References	1. https://www.multichain.com/ 2. https://www.multichain.com/download/MultiChain-White-Paper.pdf

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Synthesize the basic concepts and principles of block chain AND multichain	PO1, PO2,PO3,PO4,PO5, PO6, PO8, PSO2
2	Setup a Private blockchain Using Multichain	PO1, PO2,PO3,PO4,PO5, PO6, PSO2
3	To learn the approaches followed in smart contracts	PO1, PO2,PO3,PO4,PO5, PO6, PSO2
4	Understand the functioning of streams	PO1, PO2,PO3,PO4,PO5, PO6, PO8, PSO2
5	To learn concept of Decentralized and Distributed Ledger.	PO1, PO2,PO3,PO4,PO5, PO6, PO8, PO10,PSO1,PSO2,PSO3
6	To maintain security, privacy, and efficiency of a given system.	PO1, PO2,PO3,PO4,PO5, PO6, PO8, PSO2,PSO3

PO and PSO mapping with level of strength

Course Code_ Course Name	CO's	PO 1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
BCC202_ Blockchain using Multichain	**CO1**	2	3	1	1	2	2	-	2	-	-	-	-	-	2	-
	CO2	2	2	3	2	3	2	-	-	-	-	-	-	-	2	-
	CO3	2	2	3	2	3	2	-	-	-	-	-	-	-	2	-
	CO4	2	3	1	1	2	2	-	1	-	-	-	-	-	2	-
	CO5	3	3	3	1	1	1	--	1	-	1	-	-	1	2	2
	CO6	3	3	3	1	2	1	-	1	-	-	-	-	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC202	Blockchain using Multichain	2.3	2.7	2.3	1.3	2.2	1.7	0.0	0.8	0.0	0.2	0.0	0.0	0.2	2.2	0.7

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Programming with GO

School: SET		**Batch : 2020 onwards**	
Program: B.TECH-CSE		**Current Academic Year: 2020-21**	
Branch: BLOCKCHAIN		**Semester: 5**	
1	Course Code	BCC301	
2	Course Title	Programming in GO	
3	Credits	3	
4	Contact Hours (L-T-P)	2-0-2	
	Course Status	CORE	
5	Course Objective	The objective of the course is a short, concise introduction to computer programming using the language Go	
6	Course Outcomes	Students will be able to: CO1. Implement GO fundamentals in programming concepts by identifying classes, objects, members of a class and relationships among them needed for a specific problem. CO2. Write GO programs to solve problems of applications in the real world scenarios. CO3.The ability to handle Concurrency primitives via go routines and channels makes concurrent programming easy. CO4. Create their own Stand-alone command-line apps or scripts Network and Web server's software. CO5. Analyse and evaluate the code coverage by your tests, benchmarking tests and writing example code that is used in generating your code documentation. CO6: design and develop GO program.	
7	Course Description	The course is about short, concise introduction to computer programming using the language Go	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to GO programming, Advantages of GO, Concurrency	CO1, CO2
	B	Installing Go, Workspaces & Packages, Go Tool	CO1, CO2
	C	Variables, Variable Initialization	CO1, CO2
	Unit 2	**Data Types**	
	A	Overview, Pointers, Variable Scope, Deallocating Memory, Garbage Collection	CO1
	B	Comments, Printing, Integers, Ints, Floats, Strings, String Packages	CO1

C	Constants, Control Flow, Control Flow, Scan	CO1, CO2
Unit 3	**Functions in GO**	
A	Function Declaration, Function types, variadic Parameters, result parameters	CO1, CO2
B	Passing parameter value, Higher order functions, Error signalling and handling	CO1,CO2
C	Deferring function call, Function panic and recovery	CO1,CO2
Unit 4	**Go Packages and Programs**	
A	Understanding the GO package, the workspace, creating a workspace, The import path	CO1, CO2
B	Declaring the package, Multi File Package, Naming Package, Installing a Package, Package visibility	CO1,CO2,CO4, CO5
C	Importing a package, Package initialization, creating programs, remote packages.	CO1,CO2,CO4, CO5,CO6
Unit 5	**Concurrency**	
A	Go routines, GO routines scheduling, Channels and channel type, channel length and capacity, closing a channel	CO1,CO2,CO4
B	Writing concurrent program , synchronization, streaming data, Generator function, Selecting from multiple channels, channel time out	CO2,CO3,CO4
C	The sync package, synchronizing with mutex locks, synchronizing with composite values, concurrency barrier with sync.Waitgroup, Detecting race condition, parallelism in GO	CO2,CO3,CO4
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	Learning Go Programming By Vladimir Vivien	
Other References	1. The Go Programming Language, Alan A. A. Donovan, Brian W. Kernighan 2. Programming in Go: Creating Applications for the 21st Century, Mark Summerfield	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. Implement GO fundamentals in programming concepts by identifying classes, objects, members of a class and relationships among them needed for a specific problem.	PO1, PO2, PO3,PO6, PO7, PO8, PO11, PO12,PSO1, PSO2, PSO3
2.	CO2. Write GO programs to solve problems of applications in the real world scenarios.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1, PSO2, PSO3
3.	CO3.The ability to handle Concurrency	PO1, PO2, PO3, PO4, PO5, PO10,

	primitives via go routines and channels makes concurrent programming easy.	PO12, PSO1, PSO2, PSO3
4.	CO4. Create their own Stand-alone command-line apps or scripts Network and Web server's software.	PO1, PO2, PO3, PO4, PO7, PO8, PO9,PO10,PSO1, PSO2, PSO3
5.	CO5. Analyse and evaluate the code coverage by your tests, benchmarking tests and writing example code that is used in generating your code documentation.	PO1, PO2, PO3, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO6: design and develop GO program.	PO1, PO2,PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO11,PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	2	1	2	-	-	3	3	2	-	-	3	1	1	2	1
CO 2	2	3	1	2	2	-	-	-	-	2	-	2	1	3	-
CO 3	1	2	3	3	2	-	1	2	-	2	-	2	1	2	1
CO 4	2	1	2	2	-	-	2	2	1	1	-	-	1	3	2
CO 5	3	2	2	-	-	-	-	-	2	2	1	2	1	3	1
CO 6	2	3	2	1	2	2	1	1	2	-	2	-	1	2	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC301	Programming in GO	2.0	2.0	2.0	2.0	2.0	2.5	1.8	1.8	1.7	1.8	2.0	1.8	1.0	2.5	1.2

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

SMART CONTRACTS USING ETHEREUM

School:	**School of Engineering and technology**
Department	**Department of Computer Science and Engineering**
Program:	**B.Tech - CSE**
Branch:	**Blockchain**

1	Course Code	BCC302 Semester- 6		
2	Course Title	**SMART CONTRACTS USING ETHEREUM**		
3	Credits	4		
4	Contact Hours (L-T-P)	3	1	0
	Course Status	Core		

5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Smart Contracts using Ethereum with a practical approach in understanding them. To visualize the scope of smart contracts and Ethereum its role in futuristic development.	
6	Course Outcomes	On successful completion of this module students will be able to CO-1: Develop smart contract, solidarity, ethereum based application. CO-2: Compare bitcoin, ethereum, hyperledger and various crpyocurrencies concept. CO-3: Discuss decentralization and crowfunding systems. CO-4: Explain smart contracts, their technical capabilities, practical applications, limitations and security constraints. CO-5: Discuss the most prominent smart contract platform and Ethereum. CO-6: Improve other smart contract problems.	
7	Course Description	The fundamental concepts in Smart Contracts using Ethereum with a practical approach in understanding them have been discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	**INTRODUCTION TO SMART CONTRACTS**	
	A	Smart Contract Basics: Why Smart Contracts? Contract lifecycle,	CO1, CO2
	B	Solidity: Structure, Basic Data Types & Statements,	CO1, CO2
	C	Contract lifecycle, distinction between a payment system and a decentralized applications platform	CO1, CO2
	Unit 2	**ETHEREUM**	
	A	Ethereum – Introduction, Multitude of clients in Ethereum,	CO1, CO2, CO3
	B	Production and test networks in Ethereum , Public, private and development deployments	CO1, CO2, CO3
	C	Comparing Bitcoin and Ethereum, Ethereum sub-protocols	CO1, CO2, CO3
	Unit 3	**SOLIDITY**	
	A	Demonstration of smart contract , Introduction to Solidity, Solidity in depth, Building blocks , Contract lifecycle,	CO1, CO2, CO3, CO4
	B	Solidity for Contract Writing, Developing, Compiling and Deploying MyContract	CO1, CO2, CO3, CO4
	C	Interacting with the Contract, Limitations of Remix	CO1, CO2, CO3, CO4

Unit 4	**DECENTRALIZATION**	
A	Decentralized Autonomous Organization (DAO), Decentralized Applications	CO3, CO4, CO5
B	A Central Bank or Your Own Coin, A Crowdfunding System	CO3, CO4, CO5
C	State, Merkle Patricia Tree, Client Applications , Objects of smart contracts	CO3, CO4, CO5
Unit 5	**USE AND APPLICATION OF SMART CONTRACTS**	
A	Examples of using smart contracts, Time Elements in developing smart contracts	CO4,CO5, CO6
B	Features of smart contracts: Autonomy, Trust, Savings, Safety, Efficiency	CO4,CO5, CO6
C	Other smart contract platforms, Quality of decentralized applications, Code patterns , Discussion of future prospects	CO4,CO5, CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	• Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder Princeton University Press 2016 • Mastering Bitcoin by Andreas Antonopoulos, O'Reilly Publishing 2014 978-0691171692	
Other References	• Ethereum White Paper Vitalik Buterin Online 2017 • Ethereum documentation (http://www.ethdocs.org/en/latest) • Solidity documentation ((https://solidity.readthedocs.io/en/develop))	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1: Develop smart contract, solidarity, ethereum based application.	PO1, PO2, PO3,PO6, PO7, PO8, PO11, PO12,PSO1, PSO2, PSO3
2.	CO-2: Compare bitcoin, ethereum, hyperledger and various crpyocurrencies concept.	PO1, PO2, PO3,PO4,PO5,PO10, PO12, PSO1, PSO2, PSO3
3.	CO-3: Discuss decentralization and crowfunding systems.	PO1, PO2, PO3,PO4, PO5, PO7, PO8, PO10,PO12,PSO1, PSO2, PSO3
4.	CO-4: Explain smart contracts, their technical capabilities, practical applications, limitations and security constraints.	PO1, PO2, PO3,PO4, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
5.	CO-5: Discuss the most prominent smart contract platform and Ethereum.	PO1, PO2, PO3,PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	CO-6: Improve other smart contract problems.	PO1, PO2, PO3,PO4, PO5, PO6, PO7, PO8,PO9,PO11,PSO1,PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

CO1	2	1	2	-	-	3	1	1	-	-	1	1	1	2	1
CO2	2	3	1	2	2	-	-	-	-	1	-	2	1	2	2
CO3	1	2	3	3	2	-	1	1	-	1	-	2	1	2	1
CO4	2	1	2	2	-	-	1	1	1	1	-	-	1	3	2
CO5	3	2	3	-	-	-	-	-	2	1	1	2	1	2	1
CO6	2	3	2	1	2	2	1	1	1	-	1	-	1	2	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
BCC302	**SMART CONTRACTS USING ETHEREUM**	2	2	2.2	1.3	1	0.8	0.7	0.7	0.7	0.7	0.5	1.2	1	2.2	1.3

Strength of Correlation

1. Addressed to ***Slight (Low=1)*** ***extent*** ***2.*** Addressed to ***Moderate (Medium=2)*** ***extent***

3. Addressed to ***Substantial (High=3)*** ***extent***

Smart Contracts using Hyperledger Fabric

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B.Tech -CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC303	SEMESTER: 6	
2	Course Title	**Smart Contracts using Hyperledger Fabric**		
3	Credits	4		
4	Contact Hours (L-T-P)	3	1	0
	Course Status	CORE		
5	Course Objective	This course is designed for Developers and system programmers who are interested in blockchain technology but have little to no experience with blockchain and chaincode.		
6	Course Outcomes	CO1. Understand the concept of smart contracts and chaincode in blockchain		
		CO2. Understanding the key concepts of Hyperledger fabric		
		CO3. Explore Block chain application using Hyperledger Fabric		
		CO4. Understand the architecture and framework of hyperledger and smart contracts		
		CO5. Understand Hyperledger Explorer fabric & Hyperledger Composer environment		
		CO6. Develop Solutions to business modules.		
7	Course Description	Blockchain is an emerging technology pattern that can radically improve banking, supply-chain, and other transaction networks, creating new opportunities for innovation.Blockchain technology offers exciting possibilities to radically improve transactions networks, enabling innovations for asset transfer while reducing the cost and risk. Blockchain technology provides the basis for a dynamic shared ledger that can be applied to save time when recording transactions between parties, remove costs associated with intermediaries, and reduce risks of fraud and tampering. All industries can benefit from this technology, from manufacturing to finance and intellectual property.		
8	Outline syllabus		CO Mapping	
	Unit 1	**Blockchain and smart contracts**		
	A	Smart contracts: Introduction, Legal design of small contracts, Developing a smart contract,Communicating between smart codes	CO1, CO2	

	B	System chaincode, chain code API,valid transactions, channels and chaincode definitions	CO1, CO2
	C	Blockchain network, MSP, Identity	CO1, CO2
	Unit 2	**Exploring Hyperledger Fabric**	
	A	Hyperledger Fabric Model terminology, tools	CO2
	B	Frameworks of hyperledger fabric, component design	CO2
	C	Use cases for design philosophy	CO2, CO3
	Unit 3	**ARCHITECTURE OF HYPERLEDGER FABRIC V1.1**	
	A	Architecture of hyperledger Fabric : Reference and run time architecture, Transaction, Ledger	CO3,CO4
	B	Nodes, peer, Endorser, Ordering nodes	CO3,CO4
	C	Channels, certification authority, Transaction flow.	CO3
	Unit 4	**Hyperledger Explorer**	
	A	Hyperledger explorer, Definition , Structure, Components	CO5,CO6
	B	Block code peer list, Chaincode list, Transaction details	CO5,CO6
	C	Technical requirements: Installation and setting up environment, Configuring with fabric	CO5,CO6
	Unit 5	**Hyperledger Composer**	
	A	Hyperledger Composer, Definition and structure	CO5,CO6
	B	Benefits, Components of Hyperledger composer	CO5,CO6
	C	Hyperledger composer solution, Installation and configuration	CO5,CO6
	Mode of examination	Theory/Jury/Practical/Viva	

	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	

	Text book/s*	"1. Mastering Hyperledger Fabric: Master The Art of Hyperledger Fabric on Kubernetes	
		By Narendranath Reddy Thota"	
		"2. Developing a Blockchain Business Network with	

		Hyperledger Composer using the ...	
		By Vance Morris, Rohit Adivi, Ratnakar Asara, Matthew Cousens, Nick Gupta, Nicholas Lincoln, Barry Mosakowski, Hong Wei Sun, IBM Redbooks"	
	Other Reference s	https://www.hyperledger.org/wp-content/uploads/2018/08/HL_Whitepaper_IntroductiontoHyperledger.pdf	
		https://www.hyperledger.org/projects/explorer	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	Understand the concept of smart contracts and chaincode in blockchain	PO1,PO2,PO3,PO5, PO7,PO8,PO12,PSO1,PSO2
2	Understanding the key concepts of Hyperledger fabric	PO1,PO3,PO5,PSO1,PSO2
3	Explore Block chain application using Hyperledger Fabric	PO1,PO2,PO3,PO5, PO8,PSO2,PSO3
4	Understand the architecture and framework of hyperledger and smart contracts	PO1,PO2,PO4,PO6, PSO1
5	Understand Hyperledger Explorer fabric and Hyperledger Composer environment	PO5,PO10,PSO2
6	Develop Solutions to business modules.	PO1,PO2,PO3,PO5, PO6,PO8,PO11,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Smartcontracts using hyperledger fabric

Course Code_ Course Name	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BCC303_Smartcontracts_for hyperledger fabric	**CO1**	2	2	3	-	2	-	1	3	-	-	-	1	1	3	-
	CO	2	-	1	-	1	-	-	-	-	-	-	-	1	1	-

	2															
	CO3	3	3	2	-	2	-	-	3	-	-	-	-	-	2	1
	CO4	2	2	-	1	-	1	-	-	-	-	-	-	2	-	-
	CO5	-	-	-	-	2	-	-	-	-	1	-	-	-	1	-
	CO6	2	2	3	-	3	2	-	3	-	-	1	-	2	3	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
BCC 303	**Smart Contracts using Hyperledger Fabric**	1.8	1.5	1.5	0.1	1.6	0.5	0.15	0.15	1.5	0	0.15	0.15	1	1.6	0.15

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

School:		**School of Engineering and technology**		
Department		**Department of Computer Science and Engineering**		
Program:		**B.Tech - CSE**		
Branch:		**Blockchain**		
1	Course Code	BCC401 Semester- 7		
2	Course Title	Cyber Security in Blockchain Technology		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Core		

5	Course Objective	By the end of the course, students will be able to: 1. define cyber security challenges in blockchain technology 2. analyze public key cryptography in blockchain technology 3. understand role of time stamping in blockchain technology	
6	Course Outcomes	1. Classifying Attacks On Blockchain Technology 2. Explain Consensus Algorithms To Prevent Attacks 3. Demonstrate Public Key Cryptography 4. Construct Digital Signature From Blockchain Context 5. Demonstrate Time Stamping Algorithms 6. Explain Use Cases Of Blockchain In Cyber Security	
7	Course Description	This course provides insight to Cyber Security in Blockchain Technology	
8	Outline syllabus		CO Mapping
	Unit 1	**Privacy, Security issues in Blockchain**	
	A	Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation	CO1 , CO2
	B	attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand	CO1 , CO2
	C	Sharding based consensus algorithms to prevent these attacks	CO1 , CO2
	Unit 2	**Cryptography**	
	A	Public Key Infrastructure (PKI) and Cryptography	CO1, CO3
	B	Conventional PKI , Blockchain as a Form of Distributed PKI , Blockchain vs PKI	CO1, CO3
	C	Blockchain - Public Key Cryptography, Decentralized Public Key Infrastructure (DPKI)	CO1, CO3
	Unit 3	**Digital Signature**	
	A	Digital Signature from Blockchain context	CO3, CO4
	B	Undeniable signature	CO3, CO4
	C	Diffie–Hellman, Digital signature scheme for	CO3, CO4

	information non-repudiation in blockchain	
Unit 4	**Blockchain-based time stamping**	
A	Time stamping Metadata Using Blockchain	CO4,CO5
B	Decentralized Trusted Time stamping Based on Blockchains	CO3,CO5
C	Content Time stamping	CO3,CO5
Unit 5	**Use Cases of Blockchain In Cyber security**	
A	Decentralized Storage Solutions, How Guardtime uses blockchain technology to safeguard data	CO5, CO6
B	IoT Security, Safer DNS, Using blockchains to prevent DDoS attacks	CO5, CO6
C	Implementing Security in Private Messaging	CO5, CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	Blockchain Technology Basics: Blockchain cryptography and cybersecurity Kindle Edition by Raghava Shankar (Author), Srikanth RC Cherukupalli M.Tech (Author)	
Other References	Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks Kindle Edition by Imran Bashir (Author) Format: Kindle Edition	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	classifying attacks on blockchain technology	PO1, PO2,PO3,PO4,PO5, PSO1, PSO2,PSO3
2	explain consensus algorithms to prevent attacks	PO1, PO2,PO3,PO4,PO5, PO6,PO7,PO8,PO9, PSO1, PSO2,PSO3
3	demonstrate public key cryptography	PO1, PO2,PO3,PO4,PO5, PO6,PO7,PO8,PO9, PSO1, PSO2,PSO3
4	construct digital signature from blockchain context	PO1, PO2,PO3,PO4,PO5, PO10,PO11,PO12,PSO1, PSO2,PSO3
5	demonstrate time stamping algorithms	PO1, PO2,PO3,PO4,PO5, PO10,PO11,PO12,PSO1, PSO2,PSO3
6	explain Use Cases of Blockchain In Cyber security	PO1, PO2,PO3,PO4,PO5, PO10,PO11,PO12,PSO1, PSO2,PSO3

PO and PSO mapping with level of strength

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	2	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO	3	2	3	2	2	1	1	1	1	-	-	-	2	1	2

2															
CO 3	2	2	3	2	2	1	1	1	1	-	-	-	1	2	2
CO 4	2	1	3	1	2	-	-	-	-	2	2	2	2	2	1
CO 5	2	2	2	2	2	-	-	-	-	2	1	2	1	1	1
CO 6	2	1	1	1	1	-	-	-	-	1	1	1	1	1	1

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC401	Cyber Security in Blockchain Technology	2.1	1.6	2.3	1.6	1.8	0.3	0.3	0.3	0.3	0.8	0.6	0.8	1.5	1.5	1.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Blockchain for Business

School:	**School of Engineering and technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech-CSE**	
Branch:	**Blockchain**	

1	Course Code	BCC011 Semester : 4			
2	Course Title	**Blockchain for Business**			
3	Credits	3			
4	Contact Hours (L-T-P)	3	0	0	
	Course Status	Program Elective			
5	Course Objective	It aims at eliminating the middleman, or data gatekeeper, blockchain allows companies to quickly and easily trace products and transactions all the way back to their roots. Because data is shared on multiple systems in multiple countries — and validated before it's recorded — it's more secure.			
6	Course Outcomes	CO1. Define how the concept of money and relate in the concept of DLT CO2. Interpret various blockchain functionalities to extend existing business models and make correct & fully informed decisions. CO 3. Apply Blockchain technology in various business domains of financial and commodities CO 4. Discover Blockchain from Big data perspective CO 5. Recommend new Business application for the Blockchain CO 6. Imagine CO current issues of blockchain and propose potential solutions.			
7	Course Description	Blockchain will bring about profound changes to business, and even to the nature of business itself. This technology will disrupt how enterprises are funded and managed, how they create value, and even how they perform basic functions like marketing and accounting. In this course you will learn how blockchain technology will penetrate into the structures of organizations. You will explore how blockchain will transform the roles of the C-Suite, and how a blockchain can be used to manage and protect intellectual property. You will be able to identify the different layers of the blockchain technology stack, and explain how these affect the governance of blockchain systems. As well, you will be able to identify seven qualities that a region in the world needs in order to attract technology startups and to build a vibrant blockchain ecosystem.			

8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Blockchain and business applications**	
	A	Evolution of blockchain, creation, Growth, Rise of crypto currencies	CO2
	B	Blockchain Principles, Qualities , Popular blockchain platforms	CO2
	C	Brief history of money, Impact of blockchain: Financial sector, internet	CO1,CO2

Unit 2	**Financial Services& Government Public Sectors**	
A	Blockchain and Smart Contracts, Transparency in government services, Land Right Management, real world use cases	CO2,CO3
B	Manufacturing & Industrial: Blockchain for Supply chain, Logistics, IOT	CO3
C	Health Care and Life Sciences: Recordkeeping, Pharmaceuticals, Public health	C03,CO2,CO5
Unit 3	**Data Management and cyber security**	
A	Data management: Blockchain for big data,CCT,Cloud based blockchain	CO3,CO4
B	Monetizing Big data, Blockchain and Big Data Analytics, Challenges	CO3,CO4
C	Blockchain for Gaming, Blockchain and cyber security	CO3
Unit 4	**Implementing blockchain in Enterprises**	
A	Identifying opportunities and threats, People and partners	CO5,CO6
B	Determining use cases and impact on processes, Conceptual model of implementation	CO5,CO6
C	New Business applications of blockchain :Smart Cities, Digital Medicine, M2M Transactions	CO5,CO6
Unit 5	**Current Issues and Potential solutions to blockchain to the next level**	
A	Issues faced, Solutions for scalability issues	CO5,CO6
B	On-chain solutions: Proof of stake,sharding Off-chain solutions: Payment or state channels, Plasma Truebit	CO5,CO6
C	Next generation blockchain projects, A case study: The exciting world of blockchain	CO5,CO6
Mode of examination	Theory/Jury/Practical/Viva	

Weightage Distribution	CA	MTE	ETE
	30%	20%	50%

Text book/s* " "1. Applications of Blockchain Technology in Business: Challenges and Opportunities
By Mohsen Attaran, Angappa Gunasekaran"
"2. Blockchain for Business 2019: A user-friendly introduction to blockchain ...
By Peter Lipovyanov"

Other References	1. Blockchain and Business: Applications and Implications https://www.coursera.org/learn/blockchain-business/home/welcome 2. Blockchain for Business Professional https://www.edx.org/professional-certificate/linuxfoundationx-blockchain-for-business

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
CO1	Define how the concept of money and relate in the concept of DLT	PO1,PO2,PO3,PO8,PO11, PSO1,PSO3
CO2	Interpret various blockchain functionalities to extend existing business models and make correct & fully informed decisions.	PO1,PO3,PO5,PO8,PO11, PSO1,PSO2
CO3	Apply Blockchain technology in various business domains of financial and commodities	PO1,PO2,PO8,PSO2,PSO3
CO4	Discover Blockchain from Big data perspective	PO1,PO2,PO3,O4,PO7,PO8, PSO2
CO5	Recommend new Business application for the Blockchain	PO3,PO4,PO5,PO8,PSO2, PSO1
CO6	Imagine current issues of block chain and propose potential solutions.	PO1,PO2,,PO5,PO6,PO8,PO11,PSO1,PSO2

PO and PSO mapping with level of strength for Course Name Blockchain for business

Course Code_ Course Name	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BCC011_Blockchain for	**CO1**	2	2	1	-	-	-	-	3	-	-	1	-	1	-	1

Business	**CO2**	2	-	1	-	1	-	-	2	-	-	2	-	1	1	-
	CO3	1	2	-	-	-	-	-	3	-	-	-	-	-	1	1
	CO4	2	2	2	3	-	-	2	2	-	-	-	-	-	3	-
	CO5	-	-	1	1	2	-	-	1	-	-	-	-	2	1	-
	CO6	1	1	1	-	2	2	-	1	-	-	1	-	1	1	-

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BCC 011	Blockchain for Business	1.3	1.1	1	0.6	0.8	0.3	0.3	2	0	0	0.6	0	0.8	1.1	0.3

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

IMPLEMENTING BLOCK CHAIN ON CLOUD

School:	**School of Engineering and Technology**	
Department	**Department of Computer Science and Engineering**	
Program:	**B.Tech - CSE**	
Branch:	**Blockchain**	
1 Course Code	BCC021 Semester- 5	
2 Course Title	**IMPLEMENTING BLOCK CHAIN ON CLOUD**	
3 Credits	3	
4 Contact Hours (L-T-P)	3	0	0
Course Status	Elective	

5 Course Objective	The objective of the course is a short, concise introduction and implementation of block chain techniques over cloud system.	
6 Course Outcomes	On successful completion of this module students will be able to 1. synthesize the basic concepts and principles of blockchain 2. analyze the concept of secure service container and IBM cloud private cluster. 3. synthesize the planning and installation of the secure service container 4. develop and install the secure service container architecture 5. identify the application client, Smart contract programming language, Endorsement policy, Orderer block configuration 6. design and develop GO language program	
7 Course Description	The fundamental concepts in Smart Contracts using Eherium with a practical approach in understanding them have been discussed.	
8 Outline syllabus		CO Mapping
Unit 1	**INTRODUCTION**	
A	Why Blockchain?, IBM blockchain platform introduction, benefits and differentiators of deploying and using a blockchain environment of LinuxONE	CO1, CO2
B	LinuxONE, Kubernetes(K8s), IBM cloud private, Gluster FS, IBM secure service container, IBM blockchain platform,	CO1, CO2
C	Secure service container partition, IBM cloud private cluster.	CO1, CO2
Unit 2	**PLANNING FOR INSTALLATION**	
A	Why secure service container? Persistant storage provider, setting up file storage system	CO1, CO2, CO3
B	IBM blockchain platform console, Minimum	CO1, CO2,

	network , Pilot network, Production network, Component containers, Resource reallocation	CO3
C	Consideration for specific use cases	CO1, CO2, CO3
Unit 3	**SECURE SERVICE CONTAINER INSTALLATION AND CONFIGURATION**	
A	Secure service container architecture, SSC bootleader overview, download the image	CO1, CO2, CO3, CO4
B	Hardware requirement for SSC partition, Networking, Supported operating system and platform, software requirement, supported docker version, Supported IBM Cloud Private Versions, required ports,	CO1, CO2, CO3, CO4
C	Creating SSC partitions, Installing IBM cloud private cluster, Deploying IBM cloud private, Uninstalling ICP and SSC, Updating cluster resource dynamically	CO1, CO2, CO3, CO4
Unit 4	**IBM BLOCKCHAIN PLATFORM INSTALLATIONS AND CONFIGURATIONS**	
A	Loading Helm chart, setting up role based access control (RBAC) rules, scripted console installation, manual console installation	CO3, CO4, CO5
B	Creating peer organization, creating a peer, creating the ordering service, Open shift support	CO3, CO4, CO5
C	Troubleshooting the installation	CO3, CO4, CO5
Unit 5	**PERFORMANCE AND CONSIDERATIONS**	
A	Application client, Smart contract programming language, Endorsement policy, Orderer block configuration, Peer container resource allocation	CO4,CO5, CO6
B	Hiper sockets, Hiper socket benefits	CO4,CO5, CO6
C	Cryptography importance in block chain, CPACF's role in acceleration and protection	CO4,CO5, CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	• 1. Serious Cryptography: A Practical Introduction to Modern Encryption By Jean-Philippe Aumasson • 2. Handbook of Research on Blockchain Technology by Saravanan Krishnan, Valentina Emilia Balas, Julie Golden, Y. Harold Robinson, S. Balaji, Raghvendra Kumar	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	synthesize the basic concepts and principles of blockchain	PO1, PO2, PO3,PO6, PO7, PO8, PO11, PO12,PSO1, PSO2, PSO3

2.	analyze the concept of secure service container and IBM cloud private cluster.	PO1, PO2, PO3, PO4, PO5, PO10, PO12, PSO1, PSO2, PSO3
3.	synthesize the planning and installation of the secure service container	PO1, PO2, PO3, PO4, PO5, PO7,PO8, PO10,PO12, PSO1, PSO2, PSO3
4.	develop and install the secure service container architecture	PO1, PO2, PO3, PO4, PO7, PO8, PO9, PO10, PSO1, PSO2, PSO3
5.	identify the application client, Smart contract programming language, Endorsement policy, Orderer block configuration	PO1, PO2, PO3, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3
6.	design and develop GO language program	PO1, PO2,PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO11,PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	-	-	3	3	2	-	-	3	1	2	2	3
CO2	2	2	1	2	2	-	-	-	-	2	-	2	1	2	2
CO3	3	2	2	2	2	-	1	2	-	2	-	2	1	2	1
CO4	2	1	2	2	-	-	2	2	1	1	-	-	1	3	2
CO5	3	2	3	-	-	-	-	-	2	2	1	2	1	1	1
CO6	2	3	2	1	2	2	1	1	2	-	2	-	2	1	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
BCC021	IMPLEMENTING BLOCK CHAIN ON CLOUD	2.3	1.8	2.0	1.2	1.0	0.8	1.2	1.2	0.8	1.2	1.0	1.2	1.3	1.8	1.8

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

Cryptocurrency with Ethereum

School:	**School of Engineering and technology**			
Department	**Department of Computer Science and Engineering**			
Program:	**B.Tech - CSE**			
Branch:	**Blockchain**			
1	Course Code	BCC031 Semester- 6		
2	Course Title	**Cryptocurrency with Ethereum**		
3	Credits	3		
4	Contact Hours (L-T-P)	3	0	0
	Course Status	Program Elective		

5 Course Objective

By the end of the course, students will be able to

1. Understand how blockchain systems (Ethereum) work,
2. To securely interact with them,
3. Design, build, and deploy smart contracts and distributed applications,
4. Integrate ideas from blockchain technology into their own projects.

6 Course Outcomes

On completion of this course the student should be able to:

7. understanding of the realities of Cryptocurrency
8. Explain design principles of Ethereum
9. Design, build, and deploy smart contracts
10. The student will be able to use cryptocurrency exchanges and wallets safely
11. To learn concept of Decentralized and Distributed Ledger.
12. Evaluate security, privacy, and efficiency of a given blockchain system.

7 Course Description **Cryptocurrency with Ethereum**

8 Outline syllabus

		CO Mapping
Unit 1	**Introduction to cryptocurrency**	
A	What is Cryptocurrency? History of Cryptocurrency Cryptocurrency vs. Traditional Currency, Understanding Blockchain Technology	CO1
B	Major global market cryptocurrencies; Compares the potential benefits and problems of cryptocurrency to other currencies. Virtual currency, Centralize and decentralize currency	CO1
C	Where to store your cryptocurrency - Wallets & Cold Storage Paper Wallets: Hardware Wallets, How to Buy Cryptocurrency, Things to Consider Before Investing in Cryptocurrency	CO1, CO4
Unit 2	**Introduction to Ethereum**	
A	What is Ethereum? Ethereum Virtual Machine (	CO2

	EVM) , Mining in Ethereum, private and public Blockchain, Platform Functions used in Ethereum, Technologies that support Ethereum	
B	Introducing Smart Contracts Cryptocurrency in Ethereum, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts	CO2, CO3
C	Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts	CO2, CO3
Unit 3	**DECENTRALIZED APPLICATIONS (DAPPS)**	
A	Decentralized Application Types, Components for development of Ethereum DApps, Ethereum Platform – Transactions in Ethereum – Ether wallet, Ether Accounts, Ether Gas, Gas Price, Gas Limit,	CO2, CO4, CO5
B	Ether Tokens – ERC20 ethereum stands for Tokens,	CO2, CO4, CO5
C	Hyperledger Platform – Hyperledger Fabric Architecture, Hyperledger Fabric and Smart Contract – Chain Code and Go Language. Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain	CO2, CO4, CO5
Unit 4	**Cryptocurrency Investing Mindset**	
A	**Security:** Privacy, Security issues in Blockchain,Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation,	CO6
B	Hash Codes, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.	CO6
C	**Planning:** Short term gain vs. Long term investment, Paper proft vs. Actual Profit	CO6
Unit 5	**Cryptocurrency Regulation**	
A	Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.	CO4, CO6
B	Identify major research challenges and technical gaps existing between theory and practice in cryptocurrency domain	CO4, CO6
C	Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain	CO1
Mode of	Theory	

examination				
Weightage	CA	MTE	ETE	
Distribution	30%	20%	50%	
Text book/s*	1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).			
Other References	3. Stephen Satoshi - Cryptocurrency_ Ultimate Beginners Guide to Making Money with Cryptocurrency like Bitcoin, Ethereum and altcoins-CreateSpace Independent Publishing Platform (2017) 4. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1	understanding of the realities of Cryptocurrency	PO1,PO2,PO3,PO4,PO5,PO6,PO8, PSO1, PSO2
2	Explain design principles of Ethereum	PO1,PO2,PO3,PO4,PO5, PO6,PO8,PO12,, PSO1, PSO2,PSO3
3	Design, build, and deploy smart contracts	PO1, PO2,PO3,PO4,PO5, PO6,PO9,PO11,PO12, PSO2
4	The student will be able to use cryptocurrency exchanges and wallets safely	PO1, PO2,PO4,PO5,PO6,PO8, PO10,PO11, PSO2,PSO3
5	To learn concept of Decentralized and Distributed Ledger.	PO1, PO2,PO3,PO6,PO8,PO10,PSO1, PSO2,PSO3
6	Evaluate security, privacy, and efficiency of a given blockchain system.	PO1, PO2,PO3,PO5, PO6,PO8, PSO2,PSO3

PO and PSO mapping with level of strength for Course Name Cryptocurrency and Ethereum

S.No	Cos	PO1	PO 2	PO3	PO 4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO 11	PO1 2	PS O1	PSO2	PSO3
1	CO1	1	3	1	1	2	2	-	2	-	-	-	-	-	2	-
2	CO2	1	3	1	1	2	2	-	2	-	-	-	1	1	2	1
3	CO3	2	2	3	2	3	2	-	-	1	-	1	1	-	2	-
4	CO4	1	1	-	3	3	3	--	2	-	1	1	-	-	3	1
5	CO5	3	3	3	-	-	3	--	2	-	2	-	-	3	2	2
6	CO6	3	3	3	-	2	3	-	3	-	-	-	-	-	3	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC031	Cryptocurrency with Ethereum	1.8	2.5	1.8	1.2	2.0	2.5	0.0	1.8	0.2	0.5	0.3	0.3	0.7	2.3	1.0

OPEN SOURCE FOR BLOCKCHAIN USING HYPERLEDGER

School:	**School of Engineering and technology**			
Department	**Department of Computer Science and Engineering**			
Program:	**B.Tech - CSE**			
Branch:	**Blockchain**			
1 Course Code	BCC041 Semester- 6			
2 Course Title	OPEN SOURCE FOR BLOCKCHAIN USING HYPERLEDGER			
3 Credits	3			
4 Contact Hours (L-T-P)		3	0	0
Course Status	Program Elective			

5	Course Objective	The objective of the course is to introduce basic fundamental concepts in Open source for blockchain using hyperledger, with a practical approach in understanding them. To visualize the scope of blockchain and hyperledger, and its role in futuristic development.	
6	Course Outcomes	On successful completion of this module students will be able to CO1: Explain Hyperledger and blockchain technologies. CO2: Discover bitcoin mechanism and network. CO3: Interpret hyperledger ecosystem and blockchain for business. CO4: Compare different hyperledger frameworks and networks. CO5: Design applications using hyperledger tools such as sawtooth, Iroha etc. CO6: Discuss Hyperledger leverages open standards and open governance to support business solutions.	
7	Course Description	The fundamental concepts in Open source for blockchain using hyperledger, with a practical approach in understanding them have been discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	**Blockchain Technologies**	
	A	Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism,	CO1,CO2
	B	Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy	CO1, CO2
	C	Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain	CO1, CO2
	Unit 2	**Introduction to Hyperledger**	
	A	What is Hyperledger? Why we need Hyperledger? How Hyperledger Works? The Birth of Hyperledger	CO1, CO2
	B	Different types of Hyperledger frameworks. Comparing Hyperledger with Bitcoin and Ethereum	CO1, CO2, CO3
	C	Hyperledger Goals	CO2, CO3, CO4
	Unit 3	**Hyperledger Frameworks**	
	A	blockchain networks: public blockchains, consortiums, and private, Components of Hyperledger Frameworks	CO1, CO2, CO4
	B	key elements of a typical Hyperledger network,	CO1,CO2, CO4
	C	Hyperledger fabric transaction flow, Hyperledger Composer	CO1, CO2

Unit 4	**Hyperledger Tools**	
A	Open Standards, The Importance of Open Source, Open Source and Open Governance	CO1, CO2, CO5
B	Software Governance of the Hyperledger Projects, Unique Characteristics of Hyperledger Sawtooth	CO1, CO4, CO5
C	Hyperledger Sawtooth v1.0, Hyperledger Iroha v0.95,	CO1, CO4, CO5
Unit 5	**Hyperledger Ecosystem**	
A	Interest of developers in Open Source Software? Hyperledger vs. Apache	CO2, CO3, CO6
B	Blockchain for Business, Why Businesses Choose to Use Hyperledger?	CO2, CO3, CO6
C	Hyperledger Modules, Hyperledger Cello, Interoperability between Hyperledger Frameworks	CO2, CO3, CO6
Mode of examination	Theory	
Weightage Distribution	CA 30% MTE 20% ETE 50%	
Text book/s*	• Gaur Nitin et. al. (2018), Hands-On Blockchain with Hyperledger: Building decentralized applications with Hyperledger Fabric and Composer, Packt Publishing • Anotnopoulous AM. and Wood M.,(2018) Mastering Ethereum: Building Smart Contracts and DApps. O'Reilly Media	
Other References	• Wattenhofer, The Science of the Blockchain • Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Explain Hyperledger and blockchain technologies.	PO1, PO2, PO4, PO6, PO10, PO11, PO12, PSO1, PSO2, PSO3
2.	CO2: Discover bitcoin mechanism and network.	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO11, PO12, PSO1, PSO2, PSO3
3.	CO3: Interpret hyperledger ecosystem and blockchain for business.	PO1, PO2, PO3, PO4, PO5, PO6, PO8, PO11, PO12, PSO1, PSO2, PSO3
4.	CO4: Compare different hyperledger frameworks and networks.	PO1, PO2, PO4, PO8, PO9, PO12, PSO1, PSO2
5	CO5: Design applications using hyperledger tools such as sawtooth, Iroha etc.	PO1, PO2, PO3, PO5, PO9, PO11, PSO1, PSO2, PSO3
6	CO6: Discuss Hyperledger leverages open standards and open governance to support business solutions.	PO1, PO2, PO3, PO4, PO5,PO6, PO7, PO8, PO10, PSO1, PSO2, PSO3

PO and PSO mapping with level of strength

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO 1	PSO 2	PSO3
CO1	2	2	-	1	-	2	-	-		2	2	2	3	2	2
CO2	1	3	3	2	2	-	1	2	-	-	2	3	2	1	1
CO3	2	1	2	1	1	3	-	1	-	-	1	1	2	1	2
CO4	1	2	-	3	-	-	-	2	2	-	-	2	2	3	-

CO5	2	2	2	-	1	-	-	-	1	-	2	-	1	2	2
CO6	2	3	2	3	2	2	2	2	-	2	-	-	1	1	2

Average of non-zeros entry in following table (should be auto calculated).

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BCC041	OPEN SOURCE FOR BLOCKCHAIN USING HYPERLEDGER	1.7	2.2	1.5	1.7	1.0	1.2	0.5	1.2	0.6	0.7	1.2	1.3	1.8	1.7	1.5

Strength of Correlation

1. Addressed to ***Slight (Low=1) extent*** ***2.*** Addressed to ***Moderate (Medium=2) extent***
3. Addressed to ***Substantial (High=3) extent***

SHARDA UNIVERSITY
Beyond Boundaries

B.Tech-Computer Science & Engineering with specialization in Business Analytics & Optimization and Cloud Computing & Virtualization (IBM)

	Course Code	**CSE 222**
2	Course Title	Applied Statistical Analysis
3	Credits	**(3-1-0) 4**
4	Contact Hours	
5	Course Objective	The course enables students to 1. Learn how to analyze statistical data properly. 2. Understand the role of formal statistical theory and informal data analytic methods.
6	Course Outcomes	1.The students will be able to 2.Gain an understanding of statistical methods relevant to upper division interdisciplinary courses. 3.Sharpen students' statistical intuition and abstract reasoning as well as their reasoning from numerical data through community-based and other research.
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	Introduction to Statistical Analysis
8.02	Unit A Topic 1	Introduction, Meaning of Statistics, The Scietific Method, Basic Steps of the Research Process, Experimental Data and Survey Data,
8.03	Unit A Topic 2	Populations and Samples, Census and Samling Method, Parameter and Statistic, Independent and Dependent Variables
8.04	Unit A Topic 3	Examining Relationships, Introduction to SPSS Statistics.
8.05	Unit B	Describing Data
8.06	Unit B Topic 1	Introduction, Types of Data, Data Transformation, Summarizing Data: Graphical Methods, Summarizing Data:
8.07	Unit B Topic 2	Measures of Central Tendency, Summarizing Data: Measures of Dispersion, Levels of Measurement, Randon Variables and Probability Distributions, Discrete and Continuous Random Variable,
8.08	Unit B Topic 3	Making Inferences about Populations from samples, Estimator and Estimate, Confidence Interval for Population Mean (Large Sample).
8.09	Unit C	Testing Hypothesis
8.10	Unit C Topic 1	Introduction, Null and Alternative Hypothesis, Type I and Type II Error, The Procedure of Hepothesis Testing, Hypothesis Testing of a Population Mean: Large Sample, Hypothesis Testing of a Population Mean: Small Sample,
8.11	Unit C Topic 2	Hypothesis Test of a Proportion (One Sample), Hypothesis Test of Population Variance, Hypothesis Test of Population Mean: Two Independent Samples(), Hypothesis Test of Population Mean:
8.12	Unit C Topic 3	Dependent Samples (Paired Samples), Hypothesis Test about Two Population Proportion, Hypothesis Teest about Two Population Variances, Analysis of Variance (ANOVA), Nonparametric Test, Sign Test for Paired Data, Wilcoxon Matched Pairs Signed Ranks Test (for n>10 pairs), Mann-Whitney U Test, Kruskal-wallis Tests (H Test).
8.13	Unit D	Examining Relationships
8.14	Unit D Topic 1	Introduction, Types of Correlation, Karl Pearson Coefficient Correlation, Spearman's Rank Order Correlation, Partial Correlation,
8.15	Unit D Topic 2	Residuals and Plots, Simple Linear Regression, Multiple Regression Model, Repeated Measures, Non-linear Regression
8.16	Unit D	, Polynomial Regression Models, Weighted Least Squares, Two Stage Least

	Topic 3	Squares 1, Structural Equation Modeling.
8.17	Unit E	Advanced Techniques
8.18	Unit E Topic 1	Identifying Groups: Classification, Probit Analysis, Discriminant Function Analysis,
8.18	Unit E Topic 2	Proportional Odds Models, Decision Trees, Neural Networks, Cluster Analysis
8.20	Unit E Topic 3	, Factor Analysis, Multidimensional Scaling.
9	**Reading Content**	
9.1	Text book*	15. Advanced Statistical Analysis (IBM ICE Publication)
9.2	other references	8. Statistical Data Analysis (Oxford Science Publications) by Glen Cowen 9. Statistical Analysis : an Introduction using R.Wikibooks 10. Multivariate Statistical Analysis A Conceptual Introduction, 2nd edition by Sam Kash Kachigan 11. Handbook of Statistical Analysis and Data Mining Application by Robert Nisbet, John, IV Elder, Gary Miner

	Course Code	
2	Course Title	**Big Data Analytics**
3	Credits	**(2-0-2) 3**
4	Contact Hours	
5	Course Objective	**To work with unconventional & unstructured data sources like Web server logs, Internet click stream data, social media activity reports, mobile-phone call detail records and information captured by sensors to produce analytics.** **2. To understand and use the technologies associated with big data analytics including NoSQL databases, Hadoop and MapReduce.** **3. To practice big data operations on IBM Big Insight platform.**
6	Course Outcomes	**1. Understand and appreciate the use-cases & architectural considerations for big data analytics implementation.** **2. Learn best practices to extend data warehousing with Hadoop and other big data technologies across business operations and industries to enable big data analytics.**
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Big Data Concepts**
8.02	Unit A Topic 1	What Is Big Data, Volume, Velocity, and Variety; Why Its Important
8.03	Unit A Topic 2	, Risks Of Big Data, Need Of Big Data, Structure Of Big Data; Exploring Big Data
8.04	Unit A Topic 3	, Filtering Big Data, The Need For Standards; Big Data and Analytics, Adoption Architecture, Benefits & Barriers, Trends for Big Data Analytics
8.05	Unit B	**Hadoop Fundamentals**
8.06	Unit B Topic 1	Hadoop Architecture, Hadoop File System (HDFS); HDFS Administration;
8.07	Unit B Topic 2	Map / Reduce concepts; Setup of an Hadoop Cluster ; Managing Job Execution ;
8.08	Unit B Topic 3	move data into Hadoop using Flume, Data Loading ; Overview of workflow engine
8.09	Unit C	**Query languages for Hadoop**
8.10	Unit C Topic 1	Jaql basics, Jaql data types, Input/output with Jaql,
8.11	Unit C Topic 2	working with operators and expressions,
8.12	Unit C Topic 3	Use of Pig & Hive
8.13	Unit D	**Hadoop Reporting and Analysis**
8.14	Unit D Topic 1	Approaches to Big Data reporting and analysis
8.15	Unit D Topic 2	, Big Data Access Technologies for Reporting and Analysis.
8.16	Unit D Topic 3	, Business Intelligence and Hadoop Architecture, Direct Batch Reporting on Hadoop, Live Exploration of Big Data, Indirect Batch Analysis on Hadoop
8.17	Unit E	**Analytics for Big Data at Rest & in Motion**
8.18	Unit E Topic 1	Data Stream overview; Streams Processing Language Basics; Streams Processing Language Development ;
8.18	Unit E Topic 2	SPL Programming Introduction ; Adapter Operators ; Relational and Utility Operators - The Journey Begins ; Relational and Utility Operators (continued) ; Windowing and Joins ; Punctuation, aggregation and Sorting

8.20	Unit E Topic 3	; Timing and Coordination ; Lists, Sets, and Maps ; Nodes and Partitions ; Debugging; Adapters and Toolkits

10	**Reading Content**	
9.1	Text book*	**Big Data Analytics (IBM ICE Publications)**
9.2	other references	

	Course Code	
2	Course Title	**Business Intelligence**
3	Credits	**(3-0-2) 4**
4	Contact Hours	
5	Course Objective	**Learn the basics of Business Intelligence.** **• Learn dashboards design by utilizing key performance indicators that managers can use to improve day-to-day business operations.** **• To learn how to plan and implement BI development projects.** **• To know the administrative and deployment scenarios & issues in BI space.**
6	Course Outcomes	**Understand & appreciate the use of analytical skills and business principles in operational and strategic decision-making by means of BI.** **• Design and develop dashboards.** **• Learn the best practices to work on BI projects.** **• Use IBM Cognos BI tool to develop, implement and administrate wide range of BI artifacts.**
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Introduction to Business Intelligence**
8.02	Unit A Topic 1	Business Intelligence (BI), Scope of BI solutions and their fitting into existing infrastructure, BI Components and architecture, BI Components, Future of Business Intelligence, SaaS and Cloud computing techniques, Functional areas of BI tools, End user assumptions
8.03	Unit A Topic 2	, Setting up data for BI, Data warehouse, OLAP and advanced analytics, Supporting the requirements of senior executives including performance management,
8.04	Unit A Topic 3	Glossary of terms and their definitions specific to the field of BI and BI systems.
8.05	Unit B	**Elements of Business Intelligence Solutions**
8.06	Unit B Topic 1	Business Query and Reporting, Reporting,).
8.07	Unit B Topic 2	Dashboards and Scorecards Development, Development, Scorecards,
8.08	Unit B Topic 3	Metadata models, Automated Tasks and Events, Mobile Business Intelligence, Software development kit (SDK)
8.09	Unit C	**Building BI Project**
8.10	Unit C Topic 1	Stages of Business Intelligence Projects, Project Tasks
8.11	Unit C Topic 2	, Risk Management and Mitigation, Cost justifying BI solutions and measuring success.
8.12	Unit C Topic 3	, BI Design and Development
8.13	Unit D	**Report Authoring**
8.14	Unit D Topic 1	Building Reports, Building a Report ,
8.15	Unit D Topic 2	Drill-up,

8.16	Unit D Topic 3	Drill-down Capabilities.
8.17	Unit E	**BI Deployment, Administration and Security**
8.18	Unit E Topic 1	Centralized versus Decentralized Architecture, Phased and Incremental BI road map, Setting early expectations and measuring the results, EPM (Enterprise performance Management.
8.18	Unit E Topic 2	), End-User Provisos, OLAP Implementation, Implementation, Data Warehouse Architecture, Predictive Analysis, Text Mining , Authentication, Authorization, Access Permissions,
8.20	Unit E Topic 3	Group and Roles, Single Sign-on (SSO), Data Backup and Restoring

10	**Reading Content**	
9.1	Text book*	
9.2	other references	

	Course Code	
2	Course Title	**Business Process Management**
3	Credits	**(3-0-2)4**
4	Contact Hours	
5	Course Objective	**To Understand concepts of Business Process Management (Process Modeling & Analysis using BPM tools)**
6	Course Outcomes	**Gain knowledge on concepts of Business Process Management**
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Introduction to BPM**
8.02	Unit A Topic 1	Motivation and Definitions, Business Process – Process Designer, Design and Analysis, Evaluation, Administration and Stakeholders, Classification of Business Processes, Organizational versus Operational, Intraorganizational Processes versus Process Choreographies
8.03	Unit A Topic 2	, Degree of Automation, Degree of Repetition, Degree of Structuring, Goals, Structure, and Organization, Business Process Modelling Foundation, Conceptual Model and Terminology, Abstraction Concepts, Horizontal Abstraction, Vertical Abstraction, From Business Functions to Business Processes
8.04	Unit A Topic 3	, Activity Models and Activity Instances, Process Models and Process Instances, Process Models.
8.05	Unit B	**BPM Life Cycle Methodology**
8.06	Unit B Topic 1	Business Process Management Activities, Vision, Design, Modelling, Execution, Monitoring, Optimization, BPM suites, Practice, BPM technology, Managing end-to-end, customer-facing processes, Establishing a common language for business-IT alignment, Cloud computing BPM
8.07	Unit B Topic 2	, Market, Benefits, Business Process Management Life Cycle, Model, Implement, Execute, Monitor, Business model, Business process, Artifact-centric Business process
8.08	Unit B Topic 3	, Business process modelling tools, Modelling and simulation, Business process integration, Business process reengineering, Business Process Reengineering Cycle, Business process management, Reference Model.
8.09	Unit C	**Business Process Management Overview**
8.10	Unit C Topic 1	Designer in IBM Process Designer, Process development with the Process Centre, Process applications: Overview, Process applications and business level applications . Running and debugging processes, Deploying and managing process applications, Release and installment strategies, Process Designer, Process Designer tips and shortcuts, Linking to external information
8.11	Unit C Topic 2	, Setting preferences, Process Designer and Process Center tasks, Modelling processes, Getting started, Building processes in IBM BPM, Using the Designer in IBM Process Designer, Understanding process components
8.12	Unit C Topic 3	, Creating a business process definition (BPD), Creating a business process definition (BPD), Implementing activities, Assigning activities, Modelling subprocess activities, Building services, Understanding service components, Business objects and variables, Modelling events, Modelling event gateways,

		Creating user interfaces, Designing process interactions for business users, Enabling processes for tracking and reporting, Running and debugging processes with the Inspector
8.13	Unit D	**Creating User Interfaces**
8.14	Unit D Topic 1	Creating user interfaces, Coaches - Difference between Coaches and Heritage Coaches. Developing reusable Coach Views - Coach Views, Templates, Stock controls - Button, Checkbox, Date Time Picker, Horizontal Section, Output Text, Select, Table Tabs, Text, Vertical Section. Stock content controls, Document List - Document Viewer. Advanced items for Coach Views - Content box, Custom HTML
8.15	Unit D Topic 2	, Boundary events. Binding views with data - Defining Coach View behavior. Calling Ajax services from Coach Views, Example, Accessing a child Coach view, Building Coaches - Coach View API Reference. Architecting complex process applications - Designing process interactions for business users, Configuring a role-based business user interface. Developing flexible and efficient process applications, Setting up collaboration features for business users, Enabling task management, Integrating with other systems, Creating outbound integrations, Integration Service implementations, IBM Case Manager Integration Service implementations - Using a Web Service Integration step in an integration service, Using IBM.
8.16	Unit D Topic 3	Business Process Manager SQL Integration services. Creating inbound integrations - Building a sample inbound integration. Posting a message to IBM Business Process Manager Event Manager, Understanding the message structure, Passing complex variable types to Undercover Agents, Passing IBM BPM Structured types, Passing Record type, Passing Date/Time types, Passing Boolean type, Passing Map type, Passing XMLDocument type, Passing XMLElement type, Passing XMLNodeList type, Passing ANY type, Publishing IBM Business Process Manager Web Services - Web services, compatibility, Configuring conditional activities, Globalization
8.17	Unit E	**Dashboards and Reports**
8.18	Unit E Topic 1	Business value, Solution overview - Solution architecture, IBM products used in the solution, Software development roles that are associated with the solution, Product-specific roles that are associated with the solution, Usage scenarios.
8.18	Unit E Topic 2	IBM Solution for Collaborative Lifecycle Management - InfoSphere Data Architect, WebSphere Operational Decision Management, Business Process Manager Advanced, Integration. Designing process interactions for business users, Factors affecting BPEL process interactions - Interaction style, BPEL process type, WSDL operation type, Service endpoint resolution
8.20	Unit E Topic 3	. Developing flexible and efficient process applications - Enabling processes for tracking and reporting, Racking IBM Business Process Manager performance data. Defining reports in Process Designer (deprecated), Defining a custom layout Process Designer for reports (deprecated), IBM Business Monitor dashboards - Overview, Get the spreadsheets, Define metrics, Define KPIs, Define reports, Generate a monitor model using the CSV tool, Deploy your monitor model, Send events to the monitor model, View the dashboards.

10	**Reading Content**	
9.1	Text book*	**Business Process Management** (IBM ICE Publication)

9.2	other references	

School: SET		**Batch : 2018-22**		
Program: B.Tech(Business Analytics)		**Current Academic Year: 2018-19**		
Branch:CSE		**Semester:II**		
1	Course Code	CBA102	Course Name	
2	Course Title	Introduction to Business Analytics		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	CORE(IBM)		
5	Course Objective	**The course enables students to** • **To introduce the Business Analytics**		
6	Course Outcomes	**The students will be able to** **CO1: Gains the introductory knowledge of Business Analytics.**		
7	Course Description	**To provide introductory knowledge on Business Analytics**		
8	Outline syllabus			CO Mapping
	Unit 1	**Business Analytics and Optimization**		
	A	Introduction to Business Analytics and Optimization, Challenges - Volume, Variety (Diversity), and speed of Data Creation (and needed decisions), Approaches to help maximize profitability and returns, Business Analytics Capabilities, Enterprise Analytics Capabilities, Business Analytics Technologies, Predictive Analytics, Prescriptive Analytics		CO1
	B	, A fact-based decision making culture, A strong data infrastructure, The Right Analytical Tools, Analytics Workforce, Knowledge Requirements, Business Analyst, Data Scientist, Where to put the analytics team, IBM Business Analytics Maturity Model, Optimization		CO1
	C	Key BAO Concepts, The need for BAO now, Essential Capabilities In BAO, BAO Capabilities: Business Performance Management, Predictive Analysis and Mining, Value of BAO to Business Organization, Impact of BAO on diverse industries, Advantages to implementing BAO solutions, BAO Capabilities: Real-time Analytics: Data In Motion, BAO support for decision-making, High level architecture of BAO, Importance of reference architecture, BAO reference architecture, BAO reference architecture to BAO architects, IBM Technology Portfolio		CO1

		for BAO.	
	Unit 2	**Data Warehouse**	
	A	Decision Support, Three-Tier Decision Support Systems, Exploring and Analyzing Data, What is a data warehouse? Data warehouse architecture choices, Enterprise data warehouse, Independent data mart architecture, Dependent data mart architecture	CO1
	B	Data Warehouse, Data warehouse usage, Multidimensional Data, Conceptual Modeling of Data Warehouses, The “Classic” Star Schema, The “Snowflake” Schema, The “Fact Constellation” Schema, Data Warehouse Design Process, Single-Layer Architecture, Two-Layer Architecture, Three-Tier Data Warehouse Architecture, Data Warehouse Development, Multi-Tiered Architecture, Information pyramid	CO1
	C	BI reporting tool architectures, Types of BI users, Multidimensional analysis techniques, Data Analysis and OLAP, OLAP Server Architectures, Data Cube, Discovery-Driven Data Cubes, OLTP vs. OLAP, Business Query, Dashboards and Scorecards Development, Metadata Model, Automated Tasks and Events, Mobile BI, Disconnected BI, Collaborative BI, Real-time Monitoring, Software Development Kit (SDK), Setting up data for BI, Making BI easy to consume.	CO1
	Unit 3	**Business Intelligence**	
	A	Definitions of Business Intelligence, Sample BI Architecture, Things are getting more complex, BI Components and Architecture, Scope and fit of BI solutions within existing infrastructure, High Level BI Process,	CO1
	B	Functional Areas of BI Tool, A single or a few applications, Benefits of BI, Maximize Value from BI Systems, Strategy and Business Intelligence, Business Transformation Projects, Business Role of BI (TWDI), ASUG Business Intelligence Maturity Model, Why Act? BI Effectiveness Scorecard, BI Value Scorecard, Five key areas of strategy, Planning a BI Project, Pre-Engagement Activities, Engagement Activities and process, BI Design and Development,	CO1
	C	Business Environment, Project Tasks: Task 1-	CO1

		Knowledge Capture Goals - Discuss Business Objectives & Prior Learning, Interview key stakeholders, Project Planning, Task 2 - Consolidate Findings - Create logical design, Task 3 – Map the Customer Situation - Current Environment, Business/Functional Requirements Sample Diagram, Logical BI Diagram, Task 4 - Methodology & Approach, Task 5 - Standards & Governance, Task 6 - Sections, Milestones and Tasks, Task 7 – Proof of Concept (POC), Task 8 – Table Creation, Task 9 – OLAP Creation, Task 10 – Final Deliverables, Risk management and mitigation, Cost justification and measuring success.	
	Unit 4	**Data Mining**	
	A	What is Data Mining, Evolution of Data Mining, Why Data Mining? Knowledge-Based System, Data Mining Process, Phases of Data Mining Process, KDD Process Model, CRISP - DM, CRISP-DM - Elaborate view,	CO1
	B	Data Mining – On what kinds of Data? DM Tasks and Components of DM methods, Data mining operations, Data mining techniques, Industry examples of application of DM, Challenges of Data Mining, Why Machine should "Learn"?	CO1
	C	What is Machine Learning? Growth of Machine Learning, Machine Learning types, Unsupervised learning, Reinforcement Learning.	CO1
	Unit 5	**Dashboard & Report Designing and Big Data Analytics**	
	A	Definition, Dashboard Types, Evolution of Dashboards, Layers of Information, Dashboard Design, Dashboard Design Principles, Other Dashboard Examples, Display Media for Dashboards, Chart Overview, Singular Components, Metrics, Metrics drive behavior in a number of ways, Kaplan-Norton Balanced Scorecard, The Rayport-Jaworski Performance Dashboard and Strategy Framework	CO1
	B	, Introducing the R-J Performance Dashboard, Blueprint to the R-J Performance Dashboard, Building Reports, List Report, Crosstab Report, Chart Report, Map Report, Data group, sort and Filters, add calculations to report, Conditions and Aggregations in Report, Drilling in report, Run report – on demand or schedule, Charts, Chart Type	CO1

		– Bar Chart, Line, Pie, Area, Scatter.			
	C	What is Big Data? Intrinsic Property of Data…it grows, A Growing Interconnected and Instrumental World, Need for Big Data, Characteristics of Big Data, Structure of Big Data and need for standards, Big Data Analytics Adoption, Benefits & Barrier of Big Data Analytics, Trends for Big Data Analytics, Commoditization of Hardware Enabling New Analytics, the 5 Key Big Data Use Cases, More Ways – Wide Ranging Analytics and Techniques, Big Data Platform and Application Frameworks, A Big Data Platform Manifesto, Use Cases for a Big Data Platform.			CO1
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	16. **Introduction to Business Analytics** (IBM ICE Publication)			
	Other References				

	Course Code	**CBA203**
2	Course Title	**Data Mining and Predictive Modeling**
3	Credits	
4	Contact Hours	
5	Course Objective	**To learn, how to develop models to predict categorical and continuous outcomes, using such techniques as neural networks, decision trees, logistic regression, support vector machines and Bayesian network models.** **• To know the use of the binary classifier and numeric predictor nodes to automate model selection.** **• To advice on when and how to use each model. Also learn how to combine two or more models to improve prediction**
6	Course Outcomes	**Understand the process of formulating business objectives, data selection/collection, preparation and process to successfully design, build, evaluate and implement predictive models for a various business applications.** **• Compare and contrast the underlying predictive modeling techniques.** **• Select appropriate predictive modeling approaches to identify particular cases to progress with.** **• Apply predictive modeling approaches using a suitable package such as SPSS Modeler**
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Introduction to Data Mining**
8.02	Unit A Topic 1	Introduction, What is Data Mining?,
8.03	Unit A Topic 2	Concepts of Data mining, Technologies Used, Data Mining Process,.
8.04	Unit A Topic 3	KDD Process Model, CRISP – DM, Mining on different kinds of data, Applications of Data Mining, Challenges of Data Mining
8.05	Unit B	**Data Understanding and Preparation**
8.06	Unit B Topic 1	Introduction, Reading data from various sources, Data visualization
8.07	Unit B Topic 2	, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation
8.08	Unit B Topic 3	, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values.
8.09	Unit C	**Model development & techniques**
8.10	Unit C Topic 1	Data Partitioning, Model selection, Model Development Techniques
8.11	Unit C Topic 2	, Neural networks, Decision trees, Logistic regression, Discriminant analysis
8.12	Unit C Topic 3	, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules.
8.13	Unit D	**Model Evaluation and Deployment**
8.14	Unit D Topic 1	Introduction, Model Validation, Rule Induction Using CHAID

8.15	Unit D Topic 2	, Automating Models for Categorical and Continuous targets,	
8.16	Unit D Topic 3	Comparing and Combining Models	
8.17	Unit E	**Evaluation**	
8.18	Unit E Topic 1	, Evaluation Charts for Model Comparison, Meta-Level Modeling	
8.18	Unit E Topic 2	, Deploying Model, Assessing Model Performance	
8.20	Unit E Topic 3	, Updating a Model.	
10	**Reading Content**		
9.1	Text book*	**Data Mining and Predictive Modeling** (IBM ICE Publication)	
9.2	other references	Bruce Ratner, Statistical and Machine-Learning Data Mining, CRC Press, 2011 • Eric Siegel & Thomas H. Davenport, Predictive Analytics, Wiley Publications, 2013 • James Wu and Stephen Coggeshall, Foundations of Predictive Analytics, CRC Press, 2012	

	Course Code	
2	Course Title	Data Warehouse & Multidimensional Modeling
3	Credits	
4	Contact Hours	
5	Course Objective	The course enables students to 1.Understand the fundamentals of Data Warehousing 2. Learn modelling of datawarehousing 3. Understand the concepts of Multi-Dimensional Modeling and learn the Methodology 4. Learn Non-Temporal Design of R-OLAP 5. Learn Non-Temporal Design of M-OLAP.
6	Course Outcomes	The students will be able to Have understood the fundamental conceppts of data warehousing • Develop a model for datawarehousing • Do multidimensional modelling of datawarehousing. • Design R-OLAP • Design M-OLAP
7	**Prerequisite**	
8		
8.01	Unit A	Introduction to Data Warehousing
8.02	Unit A Topic 1	Data Warehouse Architectures
8.03	Unit A Topic 2	, A perspective on decision support application
8.04	Unit A Topic 3	
8.05	Unit B	Data Warehousing and Modeling
8.06	Unit B Topic 1	An Introduction to Data Warehouse Modeling,
8.07	Unit B Topic 2	Differentiating the Warehousing model from the OLTP model,
8.08	Unit B Topic 3	Warehouse Modeling Approaches, OLAP – OnLine Analytical Processing, Basic OLAP Operations.
8.09	Unit C	Multi-Dimensional Modeling – Methodology
8.10	Unit C Topic 1	Requirement Analysis, Requirements modeling,
8.11	Unit C Topic 2	Terminologies in a Multi-dimension Model
8.12	Unit C Topic 3	, Multi-Dimensional Model Structures, Solution Validation Techniques, Detailed Dimension Modeling.
8.13	Unit D	Non-Temporal Design - R-OLAP
8.14	Unit D Topic 1	R-OLAP and its design techniques, Design techniques of an R-OLAP System,
8.15	Unit D Topic 2	Dimension-Oriented Design techniques, Fact-oriented Design Techniques, Utilize Cubing Services to improve R-OLAP and M-OLAP performance,
8.16	Unit D Topic 3	Cubing Services performance and scalability, Scalability, Cubing Services security, Role-based security in Cubing Services.
8.17	Unit E	Non-Temporal Design - M-OLAP
8.18	Unit E Topic 1	IBM Cognos Architecture, Sparse and Dense Dimensions –
8.18	Unit E Topic 2	with Hyperion Essbase, MOLAP characteristics
8.20	Unit E Topic 3	, Online Data Analysis MOLAP and ROLAP

9	**Reading Content**	
9.1	Text book*	17. Data Warehouse & Multidimensional Modeling (IBM ICE Publication)
9.2	other references	12. Data Warehousing and Mining :Concepts, Methodologies, Toolls and Applications (Vol I to VI) by John Wang • The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, 3rd Edition by Ralph Kimball and Margy Ross • Open Source Data Warehousing and Business Intelligence by Lakshman Bulusu Auerach Pulications • Data Min ing and Data Warehousing by Bharat Bhushan Agarwal and Sumit Prakash ,Tayal Laxmi Publications.

	Course Code	
2	Course Title	**Introduction to Internet of Things (IOT)**
3	Credits	**(3-0-2)4**
4	Contact Hours	
5	Course Objective	**To understand IoT Technologies** **• To learn IoT Applications** **• To understand IoT Design, System Engg., IoT Security and Communincation Technologies.**
6	Course Outcomes	**Briefly gain knowledge of IoT Technologies, Applications, IoT Design, System Engg., IoT Security and Communincation Technologies.**
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Introduction**
8.02	Unit A Topic 1	IOT Concepts, Introduction to IOT Communications,
8.03	Unit A Topic 2	Telemetry vs IOT, Applications of IOT Communications,
8.04	Unit A Topic 3	People, Processes and Devices.
8.05	Unit B	**IOT Technologies behind smart and intelligent devices**
8.06	Unit B Topic 1	Automation, asset management, telemetry,
8.07	Unit B Topic 2	transportation, telematics. Telemetry and Telemetric
8.08	Unit B Topic 3	; Report location, logistics, tracking and remote assistance; Next generation kiosks, self-service technology; Cellular IOT connectivity services
8.09	Unit C	**IOT Applications**
8.10	Unit C Topic 1	IOT Verticals; IOT Hosted Services;.
8.11	Unit C Topic 2	IOT Application development.; IOT Connectivity
8.12	Unit C Topic 3	; IOT Software providers
8.13	Unit D	**IOT Systems and Networks**
8.14	Unit D Topic 1	Study of RF Wireless Sensors; Wireless networks.
8.15	Unit D Topic 2	; Computer Connected to Internet; Network Devices;
8.16	Unit D Topic 3	Device configuration and management; Exchange information in real time without human intervention
8.17	Unit E	**OT Design and System Engineering**
8.18	Unit E Topic 1	Discuss IOT Requirements; Hardware & Software; Study of IOT Sensors; Tagging and Tracking; Embedded Products; IOT Design; (U) SIM Card Technology; IOT Connectivity and Management; IOT Security & IOT Communication.
8.18	Unit E Topic 2	Discuss Wireless Sensor Networking (WSN); Cellular Machine-to- Machine (M2M) application networks; Software for M2M Applications, Hardware, IP

		Based Cellular Networks & 3G, 4G.
8.20	Unit E Topic 3	Discuss Security & Trust M2M Communications; Secure Communications;; M2M Security Framework; Securing Data input/output and internet communication.

10	**Reading Content**	
9.1	Text book*	**Introduction to IOT** (IBM ICE Publication)
9.2	other references	

	Course Code	
2	Course Title	**Social, Web & Mobile Analytics**
3	Credits	**(3-0-2) 4**
4	Contact Hours	
5	Course Objective	**To learn the Social, Web and Mobile analytics.** **• To learn data, KPIs/metrics** **• To manage the Social & Web media with analytics** **• To understand email marketing** **• To understand mobile analytics for content Publishers & operators.**
6	Course Outcomes	**Students would be able to – gain good knowledge of Social, Web & Mobile Analytics**
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Introduction to Web & Social Analytics**
8.02	Unit A Topic 1	Overview of web & social media. Need of using analytics, Web analytics technical requirements. Social media environment
8.03	Unit A Topic 2	, Impact of social media on business, how to leverage social media for better services,
8.04	Unit A Topic 3	current analytics platforms, Open source vs licensed platform, choosing right specifications & optimal solution.
8.05	Unit B	**Relevant Data & its collection, KPIs/ metrics**
8.06	Unit B Topic 1	Participating with people centric approach, organizing for social media, choosing focused Data sources & Social networks, collecting and understanding social media data, leverage qualitative data by understanding what, why and how much, usability alternatives, web enabled emerging user research, online surveys
8.07	Unit B Topic 2	Understand the discipline of social analytics, Aligning social objectives with business goals, Identify common social business objectives, developing KPIs; Standard vs Critical metrics. Bounce rate, exit rate, conversion rate, engagement, strategically aligned KPIs, Tactics to find out best web and social media metrics;
8.08	Unit B Topic 3	Moving from strategy to execution, Build scorecards & dashboards to track KPIs. Measuring Macro & micro conversions, Quantify Economic value, measuring success for non- ecommerce and B2B websites
8.09	Unit C	**Manage Web & Social media with Analytics, Future of Social Media Analytics and Monitoring**
8.10	Unit C Topic 1	Explore & evaluate - Dashboard, Relationships, Sentiments, Evolving Topics, Reports, Content creation & tracking, Competitive Intelligence analysis, website traffic analysis, search & keyword analysis
8.11	Unit C Topic 2	, audience identification & segment analysis, Optimizing social media strategy, Social media enablement audit, Understand signals and potential.

8.12	Unit C Topic 3	Mashing Up Data from Disparate Sources; Integrate solution to share outcome with others
8.13	Unit D	**Introduction to Mobile Analytics, Mobile Customer Experience Management**
8.14	Unit D Topic 1	mobile analytics, Basics of mobile computing – Smart phones, mobile browsers, Mobile applications, Bandwidth, transactions, sessions, handset types & operating systems, mobile operators & their services, WAP gateway or GGSN support, APNs or regional POPs support, Architecture components , mobile web-services, overview of mobile cloud. .
8.15	Unit D Topic 2	Mobile as next customer experience frontier, Customers expectations, business impact & criticality, Core metrics for deeper behavior analysis, Integration of different channels – SMS, Instant massaging, chatting, apps, HTML5 enabled sites on browsers for unique experience,
8.16	Unit D Topic 3	Multi-chennal campaning optimization, considerations for best mobile services, Location based media & support
8.17	Unit E	**Mobile Analytics for Content Publishers & Operators,e-mail marketing, Data Functionalities**
8.18	Unit E Topic 1	Mobile Handset Analysis, Mobile Handset Screen Resolution - supported screen resolutions of mobile handsets browsing site in terms of page views, visits and visitors, Mobile Operator Analysis - operator names and countries of subscribers browsing your site in terms of page views, visits and visitors.
8.18	Unit E Topic 2	The types of statistics & reports --Bandwidth (total, average per visit, total per file type), Transactions (average per visit, number of downloads, page view breakdown), Sessions (entry page, average duration, click paths, referring search engine), Subscribers (browser type, user agent, operating system), Operating system (iOS, Android, Blackberry, etc), Mobile applications (YouTube, Facebook, Twitter, etc), Content categorisation (Adult, Video, Social, Ad Networks, etc), Handsets (make, model, screen resolution
8.20	Unit E Topic 3	), Mobile Operator (country of origin, operator name), Geo Location (Visitor location tracking, country of origin, RDNS lookup)Referrer tracking, Search term performance, Specific visitor behaviour, Page views per visit by referrer/advert, Time spent on site by referrer/advert. **E**Logs users email address, Cold callers report. Page views per annum, Data recording timeframe, Data archiving timeframe, Historic comparison, Integration to client platforms through API, HTTPS Support

10	**Reading Content**	
9.1	Text book*	**Social, Web and Mobile Analytics**
9.2	other references	

	Course Code	
2	Course Title	**Backup & Disaster Recovery**
3	Credits	**(2-0-2)2**
4	Contact Hours	
5	Course	**The course should enable the students to - Understand Data backup and**

	Objective	**storage, High Availability and Disaster Recovery**
6	Course Outcomes	**The student should be able to – Gain knowledge of Data backup and storage, High Availability and Disaster Recovery**
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Fundamentals of Backup**
8.02	Unit A Topic 1	Disk Storage, Characteristics Of A Disk Drive, Types Of Disk Drives, Access Centric Drives, Capacity Centric Drives, Disk Systems, Tape, Specifications Of Lto-6, Worm,
8.03	Unit A Topic 2	Automated Tape Library, Backup, Recovery Objectives , Rpo: Recovery Point Objective, Rto: Recovery Time Objective, Types Of Backup, Full Backup, Incremental Backup,.
8.04	Unit A Topic 3	Differential Backup, Progressive Incremental Backup, Architectures Of Backup, Network Based Backup, Disk To Disk To Tape (d2d2t) Backup, Network Free (san) Backup, Server Free Or Server Less Backup, Network Data Management Protocol (ndmp) Backup, Virtual Tape Library, Archive
8.05	Unit B	**High Availability**
8.06	Unit B Topic 1	Overview Of High Availability, High Availability, Reliability, Serviceability & Availability, Need Of Availability, Terminologies,
8.07	Unit B Topic 2	Components That Affect Availability & The Need For High Availability,
8.08	Unit B Topic 3	Availability Levels And High Availability, How High Availability Can Be Achieved, Single System
8.09	Unit C	**Fault Tolerance**
8.10	Unit C Topic 1	, Fault Tolerant, Redundant Components, Monitoring, Alerting And Notification, Hot Swap And Hot Plug, High Availability Clustering, High Availability Components, Types Of Ha Solutions, Ha Clustering Advantages, High Availability Criteria, Network Layer High Availability
8.11	Unit C Topic 2	, Hardware Combinations And Ha Possibilities, Application & Operating System Layer, Hardware Layer: Storage, High Availability For Virtual Environments.
8.12	Unit C Topic 3	, Components Of A Virtual Machine, High Availability On Virtual Machines
8.13	Unit D	**Disaster Recovery**
8.14	Unit D Topic 1	Introduction, Disaster Recovery, Types Of Disasters, Business Continuity (bc) And Disaster Recovery (DR), Importance Of Disaster Recovery, DR Terminologies, Quantitative Terminologies
8.15	Unit D Topic 2	, Availability Terminologies, Networking / Communication Terminologies, Location Designations, Disaster Recovery Planning, Phases Of Planning,
8.16	Unit D Topic 3	Getting Acceptance, Form A DR Team, Agree On The Recovery Service Levels, Plan A DR Strategy, Implement The Strategy, Plan The Test And Test The Plan,
8.17	Unit E	**DR Technology**
8.18	Unit E Topic 1	DR Technology Tree, High Availability, Virtualization, Replication, Local Replication,
8.18	Unit E Topic 2	Remote Replication, Replication Tools, Deployment Topologies,
8.20	Unit E Topic 3	Two Site Replication, Multi-site Replication, DR Drill And The DR
10	**Reading Content**	
9.1	Text book*	

		Backup & Disaster Recovery (IBM ICE Publication) 18.
9.2	other references	13.

	Course Code	
2	Course Title	**Business Intelligence**
3	Credits	**(3-0-2)4**
4	Contact Hours	
5	Course Objective	**Learn the basics of Business Intelligence.** **• Learn dashboards design by utilizing key performance indicators that managers can use to improve day-to-day business operations.** **• To learn how to plan and implement BI development projects.** **• To know the administrative and deployment scenarios & issues in BI space.**
6	Course Outcomes	**Understand & appreciate the use of analytical skills and business principles in operational and strategic decision-making by means of BI.** **• Design and develop dashboards.** **• Learn the best practices to work on BI projects.** **• Use IBM Cognos BI tool to develop, implement and administrate wide range of BI artifacts.**
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Introduction to Business Intelligence**
8.02	Unit A Topic 1	Business Intelligence (BI), Scope of BI solutions and their fitting into existing infrastructure, BI Components and architecture, BI Components, Future of Business Intelligence, SaaS and Cloud computing techniques, Functional areas of BI tools, End user assumptions
8.03	Unit A Topic 2	, Setting up data for BI, Data warehouse, OLAP and advanced analytics, Supporting the requirements of senior executives including performance management,
8.04	Unit A Topic 3	Glossary of terms and their definitions specific to the field of BI and BI systems.
8.05	Unit B	**Elements of Business Intelligence Solutions**
8.06	Unit B Topic 1	Business Query and Reporting, Reporting,).
8.07	Unit B Topic 2	Dashboards and Scorecards Development, Development, Scorecards,
8.08	Unit B Topic 3	Metadata models, Automated Tasks and Events, Mobile Business Intelligence, Software development kit (SDK)
8.09	Unit C	**Building BI Project**
8.10	Unit C Topic 1	Stages of Business Intelligence Projects, Project Tasks
8.11	Unit C Topic 2	, Risk Management and Mitigation, Cost justifying BI solutions and measuring success.
8.12	Unit C Topic 3	, BI Design and Development
8.13	Unit D	**Report Authoring**
8.14	Unit D Topic 1	Building Reports, Building a Report ,
8.15	Unit D Topic 2	Drill-up,

8.16	Unit D Topic 3	Drill-down Capabilities.
8.17	Unit E	**BI Deployment, Administration and Security**
8.18	Unit E Topic 1	Centralized versus Decentralized Architecture, Phased and Incremental BI road map, Setting early expectations and measuring the results, EPM (Enterprise performance Management.
8.18	Unit E Topic 2	), End-User Provisos, OLAP Implementation, Implementation, Data Warehouse Architecture, Predictive Analysis, Text Mining , Authentication, Authorization, Access Permissions,
8.20	Unit E Topic 3	Group and Roles, Single Sign-on (SSO), Data Backup and Restoring

10	**Reading Content**	
9.1	Text book*	
9.2	other references	

	Course Code	
2	Course Title	**Cloud Computing Architecture & Deployment Models**
3	Credits	**(3-0-2)4**
4	Contact Hours	
5	Course Objective	**The course enables students to** • To learn cloud computing delivery model IaaS, • To learn cloud computing delivery model PaaS, • To learn cloud computing delivery model SaaS • To learn Public cloud deployment model, • To learn Private cloud deployment model, • To learn Hybrid cloud deployment model.
6	Course Outcomes	**The students will be able to** • Understand Cloud delivery models in details • Understand briefly Cloud Computing Reference Architecture. • Understands Cloud deployment models in details e.g., Public, Private and Hybrid.
7	**Prerequisite**	
8		
8.01	Unit A	**Overview of Delivery models in Cloud Computing**
8.02	Unit A Topic 1	Cloud Computing Platform Overview, Why Cloud Computing?, Evolution of Cloud Computing, What is Cloud Computing?, Cloud Computing Definition and Characteristics, Definition of Cloud Computing, Essential characteristics of Cloud Computing,
8.03	Unit A Topic 2	Types of Cloud, Cloud Computing Advantages, Illustration of the benefits of cloud computing , Cloud Computing Challenges, Illustration of cloud computing challenges, Cloud Computing Service models, Cloud Computing Deployment models, Cloud Service and Deployment models, Cloud adoption considerations, Cloud adoption.
8.04	Unit A Topic 3	Cloud History – Internet technologies (SOA, Web Services, Web 2.0, mashups), Distributed computing – Utility and Grid Computing, Hardware – VMWare ESXi, Xen, KVM; Virtual Appliances and the open Virtualization format; System Management; Anatomy of Cloud; Benefits of Cloud; Cloud Transformation roadmap; cloud delivery models and their advantages; Cloud computing architecture.
8.05	Unit B	**IaaS, PaaS and SaaS**
8.06	Unit B Topic 1	Introduction to Infrastructure as a Service delivery model, characteristics of IaaS, Architecture, examples of IaaS, Applicability of IaaS in the industry , Comparing ISPs and IaaS, Motivations for renting the infrastructure; IaaS Case studies; IaaS enabling Technology; Trusted cloud. Introduction to Platform as a Service delivery model, characteristics of PaaS,
8.07	Unit B Topic 2	patterns, architecture and examples of PaaS, Applicability of PaaS in the industry ; Integrated Lifecycle Platform; Anchored Lifecycle platform; Enabling Technologies as a Platform; PaaS – best option or not. Introduction to Software as a Service delivery model, characteristics of SaaS, SaaS Origin; Evolvement of

8.08	Unit B Topic 3	SaaS – Salseforce.com's approach; SaaS Economics and Ecosystem; Types of SaaS Platforms; Architecture, SaaS – Providers; Collaboration as a Service; Enabling and Management tools as a Service; Applicability of SaaS in the industry.
8.09	Unit C	**Cloud Computing Reference Architecture (CCRA)**
8.10	Unit C Topic 1	Introduction to Cloud computing reference architecture (CCRA), benefits of CCRA, Architecture overview – The conceptual Reference Model; Cloud Consumer; Cloud provider; Cloud Auditor; Cloud carrier; Scope of control between Provider and Consumer; CCRA
8.11	Unit C Topic 2	: Architectural Components – Service deployment , Service Orchestration, Cloud Service Management, Security; Cloud Taxonomy;
8.12	Unit C Topic 3	IBM's Cloud Computing Reference Architecture(CCRA 2.0) – Introduction, roles, Architectural elements; CCRA evolution; Examples of Cloud Services; versions and application of CCRA for developing clouds.
8.13	Unit D	**Private, Public and Hybrid Cloud Deployment Models**
8.14	Unit D Topic 1	What is a Private Cloud?, Illustration of Private Cloud, Advantages of Private Cloud, Limitations of Private Cloud, Service Management, Journey into Private Cloud, Planning and Strategy, Standardization, Virtualization, Automation, Cloud, Case study – VMware vCloud, Case Study – IBM SmartCloud Entry, Private cloud. What is a Public Cloud?, Illustration of Public Cloud, Why Public Cloud, Advantages of Public Cloud, Limitations of Public Cloud
8.15	Unit D Topic 2	, Low degree of security and control, Lack of control on infrastructure, configuration, Network latency and accessibility concerns, Highest long term cost, Public v/s Private, Journey into Public Cloud, Revisit the idea of adopting public cloud, Cloud vendor selection, Migrating to Cloud, Cloud vendor selection, SLA – Service Level Agreements, Credits/Compensation terms, Credit process, Disaster recovery plan, Exclusions, Security and Privacy, Periodic upgrade and maintenance, Data location and Jurisdiction, Pricing and Measurability, Interoperability and Lock-in, Exit process/Termination policies Proven track record, Public cloud vendors, Case studies
8.16	Unit D Topic 3	. What is a Hybrid Cloud?, Why Hybrid Cloud, Illustration of Hybrid Cloud, Advantages of Hybrid Cloud, Challenges of Hybrid Cloud, Develop and manage hybrid workloads, Developing applications for hybrid cloud, Develop applications using PaaS, Managing hybrid workloads, Journey into Hybrid Cloud, Step 1: Asses current IT infrastructure and business, Step 2: Explore cloud computing, Step 3: Create cloud deployment strategy plan, Step 4: hybrid cloud implementation.
8.17	Unit E	**Cloud Computing Platform Lab**
8.18	Unit E Topic 1	OpenStack Introduction, OpenStack Architecture
8.18	Unit E Topic 2	, Lab Environment, Hardware requirements,.
8.20	Unit E Topic 3	Software requirements, High level overview of setup

10	**Reading Content**	
9.1	Text book*	**Cloud Computing Architecture & Deployment Models** (IBM ICE Publication)

9.2	other references	1.Developing and Hosting Applications on the Cloud (July, 2012), Alex Amies, Harm Sluiman, Qiang Guo Tong, Guo Ning Liu 2 IBM Cloud Computing http://www.ibm.com/cloud-computing/us/en/ 3. Wikipedia page on Cloud Computing http://en.wikipedia.org/wiki/Cloud_computing

	Course Code	
2	Course Title	**Introduction to Internet of Things (IOT)**
3	Credits	**(3-0-2)4**
4	Contact Hours	
5	Course Objective	**To understand IoT Technologies** **• To learn IoT Applications** **• To understand IoT Design, System Engg., IoT Security and Communincation Technologies.**
6	Course Outcomes	**Briefly gain knowledge of IoT Technologies, Applications, IoT Design, System Engg., IoT Security and Communincation Technologies.**
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Introduction**
8.02	Unit A Topic 1	IOT Concepts, Introduction to IOT Communications,
8.03	Unit A Topic 2	Telemetry vs IOT, Applications of IOT Communications,
8.04	Unit A Topic 3	People, Processes and Devices.
8.05	Unit B	**IOT Technologies behind smart and intelligent devices**
8.06	Unit B Topic 1	Automation, asset management, telemetry,
8.07	Unit B Topic 2	transportation, telematics. Telemetry and Telemetric
8.08	Unit B Topic 3	; Report location, logistics, tracking and remote assistance; Next generation kiosks, self-service technology; Cellular IOT connectivity services
8.09	Unit C	**IOT Applications**
8.10	Unit C Topic 1	IOT Verticals; IOT Hosted Services;.
8.11	Unit C Topic 2	IOT Application development.; IOT Connectivity
8.12	Unit C Topic 3	; IOT Software providers
8.13	Unit D	**IOT Systems and Networks**
8.14	Unit D Topic 1	Study of RF Wireless Sensors; Wireless networks.
8.15	Unit D Topic 2	; Computer Connected to Internet; Network Devices;
8.16	Unit D Topic 3	Device configuration and management; Exchange information in real time without human intervention
8.17	Unit E	**OT Design and System Engineering**
8.18	Unit E Topic 1	Discuss IOT Requirements; Hardware & Software; Study of IOT Sensors; Tagging and Tracking; Embedded Products; IOT Design; (U) SIM Card Technology; IOT Connectivity and Management; IOT Security & IOT Communication.
8.18	Unit E Topic 2	Discuss Wireless Sensor Networking (WSN); Cellular Machine-to- Machine (M2M) application networks; Software for M2M Applications, Hardware, IP

		Based Cellular Networks & 3G, 4G.
8.20	Unit E Topic 3	Discuss Security & Trust M2M Communications; Secure Communications;; M2M Security Framework; Securing Data input/output and internet communication.

10	**Reading Content**	
9.1	Text book*	**Introduction to IOT** (IBM ICE Publication)
9.2	other references	

	Course Code	
2	Course Title	Introduction to IT infrastructure Landscape
3	Credits	**(2-0-2)2**
4	Contact Hours	
5	Course Objective	The course enables students to • To understand the Database, Application and Middleware along with System Server hardware and Directory Services
6	Course Outcomes	On successful completion of this module students will be able to: The students will be able to • Gains good knowledge of Database, Application and middleware software along with System Hardware and networking.
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Database Overview**
8.02	Unit A Topic 1	Understanding Database types, Database Terminology, Characteristics Of Databases, Introduction To Database Management Systems, Types Of Database Management Systems, Database Security And Recovery, Data Mining, Data Warehousing, And Data Marts, Data Mining (DM), Data Warehousing and Data Marts, SQL Overview , Introduction to SQL, History of SQL,
8.03	Unit A Topic 2	Relational database schema, Data Types, Dates and Times, Creating a table, Default Values, NULL values, Constraints, Referential integrity, Creating a schema, Creating a view, Creating other database objects, Modifying database objects, Renaming database objects, Data manipulation with SQL, Selecting data, Ordering the result set, Cursors, Inserting data, Deleting data, Updating data, Table joins, Inner joins , Equi-join, Natural join, Cross join, Outer joins, Left outer join, Right outer join, Full outer join, Union.
8.04	Unit A Topic 3	, intersection, and difference operations, Union, Intersection, Difference (Except), Relational operators, Grouping operators, Aggregation operators, HAVING Clause, Sub-queries, Sub-queries returning a scalar value, Sub-queries returning vector values, Correlated sub-query, Sub-query in FROM Clauses, Mapping of object-oriented concepts to relational concepts, JDBC, What is JDBC?, JDBC Architecture:, Common JDBC Components: Database APIs, ODBC and the IBM Data Server CLI driver, Indexes , Clustered And Non-clustered Indexes, Failure Management With Db2 Cluster Services
8.05	Unit B	**Storage Overview**
8.06	Unit B Topic 1	Storage Networking Technology,
8.07	Unit B Topic 2	Types Of Storage System, FC-AL (Fibre Channel Arbitrated Loop),
8.08	Unit B Topic 3	Fabric, Storage Area Network, Zoning, Storage Virtualization.
8.09	Unit C	**Systems & Directory Services Overview**
8.10	Unit C Topic 1	Server Technology, Operating System, Virtualization, Hypervisor, I/o Virtualization, Partitioning, Server Deployment, Server Management Console
8.11	Unit C Topic 2	, Server Availability Concepts And Techniques, Server Workload. Directory Server Concepts, Directory, LDAP PROTOCOL, Overview of LDAP, LDAP Architecture,

8.12	Unit C Topic 3	LDAP Models, LDAP Replication Topologies, LDAP Data Interchange Format (LDIF).
8.13	Unit D	**Network Security and Overview**
8.14	Unit D Topic 1	Network Overview, Network Topologies, Tree Topology, Firewalls
8.15	Unit D Topic 2	, Switching Concepts , What Is Routing? , Virtual Lan's, Security Basics, Loss Of Privacy,
8.16	Unit D Topic 3	Loss Of Integrity, Security Technology, Active Audit , Secure Messaging, Data Security, Network Security
8.17	Unit E	**Application and Middleware Overview**
8.18	Unit E Topic 1	Introduction To Common Messaging System (MQ SERIES), Application Integration – Business Need, Middleware, Message Oriented Middleware, Synchronous interaction
8.18	Unit E Topic 2	, Asynchronous interaction, Coupling, Reliability, Scalability, Availability, IBM Websphere MQ, Websphere MQ Objects, Web Tier Deployment, Application Servers And Clustered Deployment, EMAIL, Lotus Architecture, Lotus Domino Server Types, Lotus Notes Clients
8.20	Unit E Topic 3	, Types of Certificates, DATA WAREHOUSING, Warehouse Modeling Approaches , Basic Concepts, Dimension, Basic OLAP Operations.
Note :		
10	**Reading Content**	
9.1	Text book*	19. **Introduction to IT infrastructure Landscape** (IBM ICE Publication)
9.2	other references	

	Course Code	CCV201/CCL201
2	Course Title	**Introduction to Virtualixation & Cloud Computing**
3	Credits	**(3-0-2) 4**
4	Contact Hours	
5	Course Objective	**The course enables students to** **• To learn virtualization and cloud computing concepts.**
6	Course Outcomes	**The students will be able to** **• Gains introductory knowledge of Cloud computing along with Virtualization concepts and implementation**
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Introduction to Virtualization**
8.02	Unit A Topic 1	Traditional IT Infrastructure,.
8.03	Unit A Topic 2	Benefits of Virtualization,
8.04	Unit A Topic 3	Types of Virtualization, History of Virtualization
8.05	Unit B	**Server, Storage, Network and Application Virtualization**
8.06	Unit B Topic 1	Types of Server Virtualization, Hypervisors,
8.07	Unit B Topic 2	Anatomy of Server Virtualization, Benefits of Storage Virtualization, Types of Storage Virtualization, VPN,
8.08	Unit B Topic 3	VLAN, Benefits of Application Virtualization.
8.09	Unit C	**Introduction to Cloud Computing**
8.10	Unit C Topic 1	History, Importance of Virtualization in Cloud,
8.11	Unit C Topic 2	Anatomy of Cloud, Cloud deployment models, Cloud delivery models,
8.12	Unit C Topic 3	stepping stones for the development of cloud, Grid Computing, Cloud Computing.
8.13	Unit D	**- Cloud Implementations / Cloud Deployment Models, Cloud Delivery Models**
8.14	Unit D Topic 1	Decision Factors for Cloud Implementations, Public, Private and Hybrid Cloud, Overview,.
8.15	Unit D Topic 2	Infrastructure as a Service (IaaS) Cloud Delivery Model,
8.16	Unit D Topic 3	Platform as a Service (PaaS) Cloud Delivery Model, Software as a Service (SaaS) Cloud Delivery Model
8.17	Unit E	**Case Study On Virtualization, Cloud Workloads**
8.18	Unit E Topic 1	Customer IT Landscape, Triggers of Virtualization,
8.18	Unit E Topic 2	Preparation for Virtualization, Transition Tools for Virtualization, Cost savings
8.20	Unit E Topic 3	, Cloud workload Overview, Workloads most suitable for Cloud, Workloads not suitable for Cloud.
10		
9.1	Text book*	**Introduction to Virtualization and Cloud Computing** (IBM ICE

		Publication)
9.2	other references	IBM Redbooks | System x Virtualization Strategies • PowerVM Virtualization on IBM System p: Introduction and Configuration Fourth Ed

	Course Code	
2	Course Title	**Managing the cloud**
3	Credits	**(3-1-2)4**
4	Contact Hours	
5	Course Objective	**The course should enable the students to** **• Understand Service management in cloud, security management in cloud and cloud system administration**
6	Course Outcomes	**The student should be able to** **• Gain Knowledge of Service, security management in cloud and cloud system administration**
7	**Prerequisite**	
8		
8.01	Unit A	**Service Management in Cloud**
8.02	Unit A Topic 1	Concept Of Service Management, Characteristics Of Cloud Service Management
8.03	Unit A Topic 2	, Cloud Service Management, Workflows In Cloud
8.04	Unit A Topic 3	, Cloud Provisioning, Metering And Billing.
8.05	Unit B	**Cloud System Administration**
8.06	Unit B Topic 1	System Administration, The Systems Administrator Role, Tasks Involved In System Maintenance, Pc Health Check, Patching And Updates
8.07	Unit B Topic 2	, Maintenance Outages, Sending Notifications, Maintaining The Service Catalogs, Troubleshooting, Configuration Management, Configuration Management Principles
8.08	Unit B Topic 3	, Configuration Management And The Cloud, Configuration Management – Introducing Chef.
8.09	Unit C	**Cloud Growth Planning**
8.10	Unit C Topic 1	Forecasting The Requirements For Cloud Managed Resources, Establish Cloud Computing Infrastructure, Interoperability Between Cloud Providers, The Cloud Service Provider Business, Cloud Computing Is Important To Service Providers, Importance Of Cloud Computing To The Services Ecosystem, Cloud Computing Is Essential To Many Businesses, Market Opportunity For Cloud Service Providers, Entering The Cloud Computing Marketplace, General Cloud Service Provider Business Models, Application Hosting On Cloud, Customer Application Hosting, Provider Application Hosting, Third-party Models, Pure Hosting, Pure Aggregation, Ibm Cloud Computing Solution, The Ibm Cloud Computing Reference Architecture (ccra), Key Technical

		Capabilities, Access Capabilities, Support Systems Capabilities, Shared System Capabilities, High Availability, Interoperability, Implementing Cloud Computing Using Ibm Smartcloud For Service
8.11	Unit C Topic 2	Providers Offerings, Workload definition, Phased approach to deployment, Architectural Decisions, Cloud Service Provider Adoption Pattern Principles, Component Model, Operational Analytics And Financial Analytics And Reporting Reports, Operational Views
8.12	Unit C Topic 3	, Operational Environment, Operational View For Cloud Management, Operational View For Cloud Service Usage, Service Development And Onboarding, Creating A Plan To Implement Your Cloud Computing Solution, Influences On The Implementation Plan, Usage Of Existing Systems, Multiple Data Center Solutions, Ibm Cloud Service Provider Solutions, Ibm Smartcloud Integrated Infrastructure For Service Providers, Custom Service Provider Solutions, Storefront, Ibm Ecosystem Support,
8.13	Unit D	**Cloud service**
8.14	Unit D Topic 1	Cloud Service Provider Deployment Scenarios, Scenario One: Vertical Market Cloud Services Provider, Scenario Two: Using Cloud To Drive Mobile Applications Business, The Need For Service Catalog Design In Cloud Services Development, The Context :cloud Computing, The Front End
8.15	Unit D Topic 2	: Service Catalog, Developing An Optimum Service Catalog, Service Catalog Development Methodology And Framework, Current Environment (brownfield Vs. Greenfield), Requirement Analysis Aspects, Business Requirements, Service Capabilities, Role-based Access, Governance And Compliance, Purpose-built Clouds, Geographical Constraints, Service Catalog Work Flows, Business Drivers,
8.16	Unit D Topic 3	The Value Of Transformation, Transformation At Work, Closing Thoughts, Cloud Transformation, Enabling The Transformation Towards Delivering The Right It To Your Business, Challenges Of The It Function, Enhanced Quality Of Experience For The Business Based On Services And Usage, Transforming It Into A Value-added Service Partner For The Business, The Cloud Opportunity: A New Approach To Deliver The Right It, The Cloud Business Opportunity, A Need To Align Your Organization To The Cloud Strategy.
8.17	Unit E	**Managing Security and Resiliency**
8.18	Unit E Topic 1	Managing Security And Resiliency, Security Issues Associated With The Cloud, Cloud Security Controls, Dimensions Of Cloud Security, Security And Privacy, Compliance, Legal And Contractual Issues, Public Records, 9 Worst Cloud Security Threats, Data Breaches, Data Loss, Account Or Service Traffic Hijacking, Insecure Apis, Denial Of Service, Malicious Insiders, Abuse Of Cloud Services
8.18	Unit E Topic 2	, Insufficient Due Diligence, Shared Technology, Top Security Risks, Key Security And Privacy Issues In Public Cloud, Governance, Compliance, Trust, Architecture, Security Considerations, Security Best Practices, Security Considerations In Private Cloud, Best Security Practices, Security Considerations In Hybrid Cloud, General Security Countermeasures, Countermeasures For Challenges Inherited From Network Concept, Countermeasures For Cas Proposed Threats, Monitored Objects And The Probe Effect
8.20	Unit E Topic 3	, Event Log Analysis, Patching, Patch Management In Enterprise, Patch Management In Cloud, Major Areas Of Labor And Cost Inefficiencies, Standardize Patch Management Services, Solution Standardization For Patch

		Management, Managing The Operating System Resources, Policies And Mechanisms, Control The Cloud, Resource Management System, Resource Types, Enabling Technologies, Resource Management Functions.	
10	**Reading Content**		
9.1	Text book*		**Managing the cloud** (IBM ICE Publication)
9.2	other references		

	Course Code	
2	Course Title	**Security in Cloud**
3	Credits	
4	Contact Hours	
5	Course Objective	**The course should enable the students to** **• To learn the security, system & program threats** **• To learn security risks and addressing the security risk** **• To learn encryption and decryption**
6	Course Outcomes	**The student should be able to gain** **• Knowledge of security, system and program threats** **• Security risk knowledge** **• Knowledge of decryption and encryption**
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	**Security Overview**
8.02	Unit A Topic 1	Security Overview, Operating System – Security, Authentication, One Time passwords, Program Threats, System Threats,
8.03	Unit A Topic 2	Computer Security Classifications, Application Security, Application Code Review, Secure Developer Training, Data Center Security
8.04	Unit A Topic 3	, Security – Cloud Computing, Security Framework, Architecture Principles, System Management Components.
8.05	Unit B	**Understanding Security Risks**
8.06	Unit B Topic 1	Understanding Security Risks, Understanding security risks, Identifying the biggest risks, Cloud computing - Working definition , Top security benefits, Top security risks, Security benefits of cloud computing, Security and the benefits of scale, Risks, Virtualization, Overview, Hypervisor, I/O Virtualization, Partitioning, Server Deployment, Virtual Server Deployment , What is a Tenant?, Defining Multi-Tenancy, Securing the Multi-Tenant Environment, Vulnerability: An Overview, Defining Vulnerability
8.07	Unit B Topic 2	, Vulnerabilities and Cloud Risk, Cloud Computing, Core Cloud Computing Technologies , Essential Characteristics, Cloud-Specific Vulnerabilities, Core-Technology Vulnerabilities, Essential Cloud Characteristic Vulnerabilities, Defects in Known Security Controls, Prevalent Vulnerabilities in State-of-the-Art Cloud Offerings, Architectural Components and Vulnerabilities, Internal Security Breaches
8.08	Unit B Topic 3	, Cloud Software Infrastructure and Environment, Computational Resources, Storage, Communication, Cloud Web Applications, Services and APIs, Management Access, Identity, Authentication, Authorization, and Auditing Mechanisms, Provider, Data Corruption, User account and Server Hijacking, How to Secure Your Cloud..
8.09	Unit C	**Addressing security risks in cloud**
8.10	Unit C Topic 1	Introduction, Core Components of AAA.
8.11	Unit C Topic 2	, Example AAA Flow, Authorization Approaches
8.12	Unit C Topic 3	, Accounting Techniques
8.13	Unit D	**Identity Management**

8.14	Unit D Topic 1	Identity management, Isolated identity management, Federated identity management, Centralized identity management, Authentication and Authorization.
8.15	Unit D Topic 2	, Challenges of Identity Management, Identity Theft, Identity Management Adoption and Benefits, Benefits of Identity Management, Conclusion, Evolution of IAM — moving beyond compliance, Identity access Management life cycle phases, IAM and IT trends, Mobile computing, Cloud computing, Data loss prevention, Social media, IAM and cyber crime, Case study
8.16	Unit D Topic 3	— IAM in practice, Transforming IAM, Life cycle phase, Key considerations when transforming IAM, People, Process Technology, IAM tools, Key IAM capabilities, Conclusion, Detention, Field Acquisition & Analysis, Solid State Drives, Brief Discussion of Cylinders, Heads, and Sectors , Logical Block Addressing and Physical Block Addressing, "TRIM" Command
8.17	Unit E	**Encryption and Decryption**
8.18	Unit E Topic 1	Encryption and decryption, What is cryptography?, Strong cryptography, How does cryptography work?, Conventional cryptography, Caesar's Cipher, Key management and conventional encryption, Public key cryptography, How PGP works, Keys, Digital signatures, Hash functions, Digital certificates, Certificate distribution, Certificate servers, Public Key Infrastructures, Certificate formats, Validity and trust
8.18	Unit E Topic 2	, Checking validity, Establishing trust, Meta and trusted introducers, Trust models, Levels of trust in PGP , Certificate Revocation, Communicating that a certificate has been revoked , What is a passphrase?, Key Splitting, Encryption, Data Encryption - Overview , Symmetric Encryption and Asymmetric encryption, Conclusions. Digital signature, Secure Sockets Layer (SSL), Encryption Protects Data During Transmission
8.20	Unit E Topic 3	, Credentials Establish Identity Online, Authentication Generates Trust in Credentials, Extend Protection beyond HTTPS, Understanding SSL, Who Uses SSL?, How It Works, SSL Transactions , SSL Crypto Algorithms, SSL and the OSI Model, Secure messaging, Message digest, Security Technology, Identity, Integrity, Active Audit, Cryptography, Public key infrastructure, Non-repudiation, Public Key Encryption, Introduction to Authentication, Background, SSL authentication (server --> client), Mutual SSL Authentication (server <--> client), Capture and Analyze

10	**Reading Content**	
9.1	Text book*	**Security in Cloud** (IBM ICE Publication)
9.2	other references	www.bluecoat.com/documents 2. www.trustwave.com 3. An introduction to cryptography – By Network Associates 4. Identity and access management 5. http://www.ey.com

	Course Code	
2	Course Title	Web Programming through PHP
3	Credits	**(3-0-2) 4**
4	Contact Hours	
5	Course Objective	The course enables students to • Understand PHP Basics. • Learn operators, structures and functions in PHP. • Learn arrays and PHP file handling • Object Oriented programming features of PHP. • Learn advanced PHP programming
6	Course Outcomes	Write basic PHP programming • Embed PHP in HTML • Have learnt Javascript • Have understood advanced concepts in PHP programming.
7	**Prerequisite**	
8	**Course Contents**	
8.01	Unit A	- PHP BASICS
8.02	Unit A Topic 1	Introduction to PHP , Support for Database, PHP Installation, Working with PHP, Why PHP?, Basic Syntax of PHP,
8.03	Unit A Topic 2	PHP statement terminator and case insensitivity, Embedding PHP in HTML,
8.04	Unit A Topic 3	Comments, Variables, Assigning value to a variable, Constants, Managing Variables
8.05	Unit B	OPERATORS, CONTROLS STRUCTURES AND FUNCTIONS IN PHP
8.06	Unit B Topic 1	Arithmetic Operators, Bit-wise Operators, Comparison Operators, Logical Operators, Concatenation Operator, Incrementing/Decrementing Operator, Ternary Operator, Operator Precedence, String Manipulation: strtoupper(), strtolower(), ucfirst(), ucwords(), strcmp(), strlen(), substr(), trim(),
8.07	Unit B Topic 2	Conditional Control Structures: If statement, If- else statement, If- else if statement, Nested If, Switch statement, Looping Control Structures: For loop, While loop, Do- While loop, For-each, Loop control
8.08	Unit B Topic 3	: Break and Continue. Functions, User-Defined function, Function Definition, Function Call, Function with arguments, Function with return value, Call by value and call by references, Understanding variable scope, Global Variables, Static Variables, Include and Require, Built-in functions in PHP.
8.09	Unit C	ARRAYS AND PHP FILE HANDLING
8.10	Unit C Topic 1	Introduction to Array, Array in PHP, Creating an Array, Accessing Elements of an Array, Modifying Elements of an Array, Finding the Size of an Array, Printing an Array in the readable Way, Iterating Array Elements, Modifying Array while iteration,
8.11	Unit C Topic 2	Iterating Array with Numeric index, Removing Element from an Array, Converting an Array to String, Converting String to an Array, Array Sorting, Multidimensional Array, Accessing elements of a Multidimensional Array
8.12	Unit C Topic 3	, Iterating Multidimensional Array. Introduction, File Open, File Creation, Writing to files, Reading from File, Searching a record from a file, closing a File, Using PHP with HTML Forms.
8.13	Unit D	CLASS, OBJECT AND EXCEPTION HANDLING, JAVA SCRIPT
8.14	Unit D Topic	Introduction, Object, Class, Defining Class in PHP, Object in PHP, Usage of

	1	$this variable, Constructor, Constructor with Parameters.
8.15	Unit D Topic 2	Introduction to Exception, Exception Handling mechanisms, Creating Custom Exceptions, Multiple Catch Blocks, Exception Propagation,
8.16	Unit D Topic 3	Error Handling in PHP. Java Introduction, JavaScript Basics,
8.17	Unit E	Advanced PHP-Form Handling, Session Management, Database and MYSQL, XML, PHP Development using Eclipse
8.18	Unit E Topic 1	Creating Forms in HTML, GET and POST, Accessing form data, File Upload, Session Management, Starting a Session
8.18	Unit E Topic 2	, Manipulating with Existing Session. What is a Database? MYSQL, SQL, SQL Functions, PHP and MYSQL
8.20	Unit E Topic 3	, Execute Queries. XML, XML Syntax Rules, Creating a DOM Document. Eclipse Overview, Creating a PHP Project.
9	**Reading Content**	
9.1	Text book*	20. Web Technologies through PHP (IBM ICE Publication) • PHP Bible - Tim Converse
9.2	other references	14. PHP A beginners guide - Bill McCarthy • PHP and MySQL Web Development - Luke Welling • Learning PHP - OReilly Press • http://in.php.net/quickref.php • http://www.w3schools.com/php/default.asp • http://www.tizag.com/php/

B.Tech-Computer Science & Engineering with specialization in Cloud Technology & Information Security

Syllabus: CSE373, Ethical hacking

School: SET		Batch :2019-2023	
Program: B.Tech		Current Academic Year: 2019-20	
Branch: CSE		Semester: II	
1	Course Code	CSE373	Course Name:
2	Course Title	Ethical hacking	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	This course introduces fundamental concepts of Ethical hacking. Ethical hacking is the key to strengthen the network security. The ethical hacking detects vulnerabilities in a network by using modern hacking methodologies.	
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. Description of ethical Hacking CO2. Types of Ethical Hacking. CO3. Explanation about web and network hacking CO4. Perform report writing and Mitigation CO5: Identify Risk in ethical hacking CO6:Critically evaluate security techniques used to protect system and user data	
7	Course Description	This course is designed to impart a critical theoretical and detailed practical knowledge of a range of computer network security technologies as well as network security tools and services related to ethical hacking.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction of Network Security	
	A	Introduction: Security, Functionality and ease of use Triangle, Essential Terminology,.	CO1,CO6
	B	Elements of Security, Difference between Penetration Testing and Ethical Hacking,	CO1,CO2
	C	Deliverables ethics and legality, Computer Crimes and Implications	CO1,CO3
	Unit 2	Footprinting,Scanning, Trojans	
	A	Footprinting and Scanning: Footprinting, Scanning, Elaboration phase, active scanning, scanning tools NMAP	CO3,CO2
	B	Enumeration, System Hacking, Reconnaissance,Sniffer	CO3,CO2,CO6
	C	Trojans: Trojans and Black Box Vs White Box Techniques	CO3,CO2
	Unit 3	Hacking Methodology:	
	A	Denial of Service, Goal of DoS (Denial of Service), Impact and Modes of Attack. Sniffers,	CO2,CO4
	B	Session Hijacking and Hacking Web Servers: Session Hijacking, Hacking Web Servers. Web Application Vulnerabilities and Web Techniques Based Password Cracking:	CO2,CO5

	C	Web Application Vulnerabilities, Web Based Password Cracking Techniques	CO2,CO5,CO6
	Unit 4	Web and Network Hacking:	
	A	SQL Injection, Hacking Wireless Networking, Viruses, Worms and Physical Security: Viruses and Worms	CO4,CO6
	B	Physical Security,Linux Hackin g: Linux Hacking. Evading IDS	CO4,CO6
	C	Firewalls: Evading IDS and Firewalls	CO4
	Unit 5	Report writing & Mitigation, Social engineering	
	A	Introduction to Report Writing , requirements for low level reporting & high level reporting of Penetration testing results	CO2,CO5
	B	Mitigation of issues identified including tracking	CO2,CO5
	C	Social Engineering: Social Engineering, Art of Manipulation, Human Weakness, Common Types of Social Engineering,	CO2,CO5,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA 30% / MTE 20% / ETE 50%	
	Text book/s*	Hackers Beware, Eric Core, EC-Council Press, 2003	
	Other References	1. Network Security Essentials, William Stallings ,Prentice Hall, 5th Edition, 2013 2. Firewalls and Internet Security, William R. Cheswick and Steven M. Bellovin, Addison-Wesley Professional, 2ndEdition, 2003. 3. Cryptography and Network Security, W. Stallings , Prentice Hall, 5th Edition, 2010	

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1.Description of ethical Hacking	PO1, PO3, PSO3
2.	CO2. Types of Ethical Hacking.	PO1, PO2, PO3, PSO1, PSO2
3.	CO3. Explanation about web and network hacking	PO2, PO3, PO4, PO9, PSO1, PSO2
4.	CO4. Perform report writing and Mitigation	PO3, PO9, PSO1, PSO2
5.	CO5: Identify Risk in ethical hacking	PO1, PO2, PO9, PSO1,PSO3
6	CO6: Critically evaluate security techniques used to protect system and user data	PO3, PO2, PO7, PO8

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CSE	Network Security and Ethical Hacking															
	CO1	2		1										2		1
	CO2		2		1					2				3	1	
	CO3	3	3	2						3					3	
	CO4	3	3	2	3					3					3	
	CO5		1	2												2
	CO6			3	3	2										3

SHARDA UNIVERSITY
Beyond Boundaries

Syllabus: CSE221, Linux Administration

School: SET		Batch :2019-2023		
Program: B.Tech		Current Academic Year: 2019-20		
Branch: CSE		Semester:		
1	Course Code		Course Name:	
2	Course Title	Linux Administration		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status	Compulsory		
5	Course Objective	• This course introduces fundamental concepts of Linux OS. Students learn how to install, configure and maintain an Enterprise Linux system in a networked environment. RHEL is a high performing operating system that. RHEL 6 is the sixth generation of the long term and predictable operating platform.		
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. Description of Linux CO2. About system administration. CO3. Explanation about Linux administration. CO4. Monitoring linux system CO5: Red Hat system, installation, managing the boot processes, performing various operations, understanding Linux Kernel, testing and debugging. CO6: Understanding of Servers		
7	Course Description	This course is designed to impart a critical theoretical and detailed practical knowledge of a range of computer network security technologies as well as network security tools and services related to Linux Administration.		
8	Outline syllabus			CO Mapping
	Unit 1	Introduction to Linux		
	A	Introduction to Operating system - Types of Operating system - Multi user operating system - Open source licensing - History of Linux - Unix Vs Linux - Flavours of Linux - Benefits and characteristics of Linux		CO1
	B	Installation of Linux - Linux booting process - Log in and switch users in multiuser run levels - Shell and bash features - Linux kernel - sudo vs su - Date and time configuration – Linux run levels.		CO1,CO2
	C	Directories and files: Directory structure - System directory - Absolute path and relative path -Creating and removing directory - Changing directory path - Creating - removing - copying and moving files - File Permissions - Links – hard link and soft link - Input and output redirection - Filters and pipes - Locate - read - and use system documentation including man page		CO1,CO3, CO6
	Unit 2	Package, User and group Management		
	A	RPM - YUM - Archive - Compress - unpack and uncompress files using tar - star - gzip - and bzip2		CO3,CO2,CO6

	B	Create - delete - and modify local user accounts - Change passwords for local user accounts	CO3,CO2
	C	Create - delete - and modify local groups and group memberships - Changing owner and modes.	CO3,CO2
	Unit 3	Configuring local storage and filesystem	
	A	List - create - delete - and partition type for primary - extended - and logical partitions	C02,CO4,CO6
	B	Create and remove physical volumes - assign physical volumes to volume groups - Create and delete logical Volumes	C02,CO5
	C	- Create - mount - unmount - ext2 - ext3 - and ext4 file systems. - Mount - unmount - and LUKS-encrypted file systems - Access control list.	CO2,CO5
	Unit 4	Managing system and infrastructure services	
	A	Managing system services - Shutting down - suspending and hibernating the system	C04
	B	Controlling systemd on remote machine - Creating and modifying systemd unit files – DHCP Configuration - HTTP server Configuration	CO4
	C	FTP server Configuration - Mail server Configuration - Samba server Configuration - NTP server Configuration - NFS server Configuration	CO4, CO6
	Unit 5	OpenSSH and Linux security	
	A	OPENSSH - The SSH Protocol - Configuring OpenSSH and Starting an OpenSSH Server Key-Based Authentication in OpenSSH - OpenSSH Clients	C02,CO5
	B	- Using the ssh Utility - scp Utility and sftp Utility - Configure firewall settings using system-config-firewall or iptables	C02,CO5
	C	Set enforcing and permissive modes for SELinux - List and identify SELinux file and process context.	C02,CO5
	Mode of examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	Orsaria, Jang, "RHCSA/RHCE Red Hat Linux Certification Study Guide Exams EX200 & EX300", McGraw-Hill Education, July 2017	
	Other References	Sander Van Vugt, "Red Hat RHCSA/RHCE 7 Cert Guide: Red Hat Enterprise Linux 7 (EX200 and EX300)", Phi Learning Pvt Ltd, 2009.	

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. Description of Linux	PO1, PO3, PSO3
2.	CO2. About system administration.	PO1, PO2, PO3, PSO1, PSO2
3.	CO3. Explanation about Linux administration.	PO2, PO3, PO4, PO9,

		PSO1, PSO2
4.	**CO4. Monitoring linux system**	**PO3, PO9, PSO1, PSO2**
5.	**CO5: Red Hat system, installation, managing the boot processes, performing various operations, understanding** Linux **Kernel, testing and debugging**	**PO1, PO2, PO9, PSO1,PSO3**
6.	**CO6: Understanding of Servers**	**PO2, PO3, PO4, PO9**

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CSE	**Linux Administration**															
	CO1	**2**		**1**										**2**		**1**
	CO2		**2**		**1**					**2**				**3**	**1**	
	CO3	**3**	**3**	**2**						**3**					**3**	
	CO4	**3**	**3**	**2**	**3**					**3**					**3**	
	CO5		**1**	**2**												**2**
	CO6			**3**	**3**	**2**										**3**

Syllabus: CSP221 , Linux Administration Lab

School: SET		Batch: 2019	
Program: B.Tech		Current Academic Year: 2019-2020	
Branch:CSE		Semester: III	
1	Course Code	CSP 221	
2	Course Title	Linux Administration Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory/Elective	
5	Course Objective	This course is designed to provide a comprehensive introduction to Red Hat linux leading to the ability to understand and perform Perform essential Linux commands such as installation, searches and manipulating files.	
6	Course Outcomes	Students will be able to: CO1: Learn Basic commands of linux CO2: Understand about the concepts of Linux OS CO3: Learn How to install, manage & perform operations in linux CO4: Implement Network management commands CO5: Installation of servers CO6: creation of SSH connection in linux	
7	Course Description	This course is intended for students with a basic knowledge of Linux and its most common utilities & servers.	
8	Outline syllabus		CO Mapping
	Unit 1	Installation of Red HAT Linux operating system	CO1
	A	Partitioning drives	CO1
	B	Network configuration	CO1
	C	Creating password and user accounts	CO1
	Unit 2	Basic Commands	
	A	Linus foundation	CO1,CO2
	B	System, Display, Time and Date Settings	CO1,CO2
	C	Executing commands and command options	CO1,CO2
	Unit 3	Performing File Management Command	
	A	Regular Files, Directories	CO3,CO5
	B	Special Files	CO3,CO6
	Unit 4	General Purpose Commands,	
	A	Using Sample Filter Commands	CO4,CO6
	B	Advance Filter	CO4
	C	General purpose utility command listman,who,cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time,kill, history, chmod, chown, finger, pwd, cal, logout, shutdown.	CO4,CO5
	Unit 5	Advance Network Configuration Command	C06,CO5
	A	Linux network configuration	CO5
	B	Assigning an IP address	CO5
	C	Remote commands-rcp, rsh	CO5,CO6

	Mode of examination	Practical/Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	Linux For Beginners by Jason Cannon, Linux Bible by Christopher Negus			
	Other References	Web references-Udemy, Edureka			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Learn Basic commands of linux	PO1,PO2,PO3,PO4,PSO1
2.	CO2: Understand about the concepts of Linux OS	PO1, PO3, PO4, PSO2
3.	CO3: Learn How to install, manage & perform operations in linux	PO1,PO2,PO3,PO4
4.	CO4: Implement Network management commands	PO9, PO10,PO11, PSO5
5.	CO5: Installation of servers	PO10,PO11
6	CO6: creation of SSH connection in linux	PO 9,PO7,PO11

PO and PSO mapping with level of strength for Course Name Linux administration Lab (Course Code CSP221)

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	1	_	2	_	3	_	_	_	_	_	_	_	3	_	1
CO2	2	3	_	1	_	_	_	_	2	_	_	_	2	1	_
CO3	_	2	2	_	3	_	_	_	_	_	_	_	_	2	_
CO4	3	2	_	3	_	_	_	_	3	_	_	_	_	3	2
CO5	_	1	2	_	_	_	_	_	_	_	_	_	_	_	_
CO6	_	_	3	3	2	_	_	_	3	_	_	_	_	_	3

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Syllabus: CSE288, Principles of Virtualization

<table>
<tr><td colspan="2">School: SET</td><td colspan="3">Batch : 2018</td></tr>
<tr><td colspan="2">Program:B.Tech</td><td colspan="3">Current Academic Year: 2018-19</td></tr>
<tr><td colspan="2">Branch:CSE</td><td colspan="3">Semester:IV</td></tr>
<tr><td>1</td><td>Course Code</td><td>CSE288</td><td colspan="2">Course Name</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Principles of Virtualization</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="3">3</td></tr>
<tr><td>4</td><td>Contact Hours (L-T-P)</td><td colspan="3">3-0-0</td></tr>
<tr><td></td><td>Course Status</td><td colspan="3">DE-/ Semester-</td></tr>
<tr><td>5</td><td>Course Objective</td><td colspan="3">Students will try to learn:
1. To study the basic concepts of virtualization.
2. Deployment of virtualization in enterprise and overcoming disaster recovery.
3. Preparing and managing remote applications.
4. Configuration of Windows Virtual PC.
5. To understand and demonstrate how to access published applications.</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td colspan="3">On successful completion of this module students will be able to:
1. Demonstrate the basic concepts and requirement and type of virtualization.
2. Analyze the virtualization environment.
3. Explore the software of virtualization.
4. Investigate the basic concepts of Remote Application
5. Understand the Access method of published application
6. Use virtual machines of public cloud platform</td></tr>
<tr><td>7</td><td>Course Description</td><td colspan="3">This course introduces the virtualization concepts which are back bone of any data centers which uses virtual machines.</td></tr>
<tr><td>8</td><td colspan="3">Outline syllabus</td><td>CO Mapping</td></tr>
<tr><td></td><td>Unit 1</td><td colspan="2">Basics of Virtualization</td><td></td></tr>
<tr><td></td><td>A</td><td colspan="2">Understanding Virtualization, Need of Virtualization and Virtualization Technologies: ServerVirtualization, Storage Virtualization, I/O Virtualization, Network Virtualization.</td><td>CO1</td></tr>
<tr><td></td><td>B</td><td colspan="2">Client Virtualization, Application virtualization, Desktop virtualization, Understanding Virtualization</td><td>CO1</td></tr>
<tr><td></td><td>C</td><td colspan="2">Uses: Studying Server Consolidation, Development and Test Environments, Helping with Disaster Recovery.</td><td>CO1, CO2</td></tr>
<tr><td></td><td>Unit 2</td><td colspan="2">Deploying and Managing an Enterprise Desktop Virtualization Environment</td><td></td></tr>
<tr><td></td><td>A</td><td colspan="2">Configure the BIOS to support hardware</td><td>CO1,</td></tr>
</table>

		virtualization; Install and configure Windows Virtual PC			CO2,CO5
	B	Installing Windows Virtual PC on various platforms (32-bit, 64-bit), creating and managing virtual hard disks, configuring virtual machine resources including network resources			CO1, CO2
	C	Preparing host machines; create, deploy, and maintain images			CO1, CO2
	Unit 3	Deploying and Managing PresentationVirtualization Environment			
	A	Prepare and manage remote applications: configuring application sharing			CO1,CO2,CO3
	B	package applications for deployment by using RemoteApp			CO1,CO2,CO3
	C	Installing and configuring the RD Session Host Role Service on the server			CO1,CO2,CO3
	Unit 4	Accessing Published Applications			
	A	Access published applications: configuring Remote Desktop Web Access			CO3,CO4,CO6
	B	configuring role-based application provisioning, and configuring Remote Desktop client connections			CO3,CO4
	C	Configure client settings to access virtualized desktops: configuring client settings			CO3,CO4,CO6
	Unit 5	Understanding Virtualization Software			
	A	List of virtualization Software available			CO1,CO5
	B	VMware- introduction to Vsphere, ESXi, VCenterServer andVsphere client. Creating Virtual Machine.			CO1,CO5,CO6
	C	Introduction to HYPER-V, Create Virtual Machines. Create Hyper-V virtual networking, Use virtual Machine Snapshots. Monitor the performance of a Hyper-V server, Citrix XENDesktop fundamentals			CO1,CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	12. Virtualization with Microsoft Virtual Server 2005 by TwanGrotenhuis, RogierDittner, Aaron Tiensivu, Ken Majors, Geoffrey Green, David Rule, Andy Jones, Matthijs ten Seldam, Syngress Publications, 2006			
	Other References	9. Virtualization--the complete cornerstone guide to virtualization			

		best practices, Ivanka Menken, Gerard Blokdijk, Lightning Source Incorporated, 2008 10. Virtualization: From the Desktop to the Enterprise, Chris Wolf, Erick M. Halter, EBook, 2005

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1. To study the basic concepts of virtualization.	PO2, PO5
2.	CO-2. Deployment of virtualization in enterprise& Overcome Disater Recovery	PO2, PO5, PO6, PO12
3.	CO-3. Preparing and managing remote applications.	PO2, PO3, PO4, PO5, PO12
4.	CO-4. Configuration of Windows Virtual PC	PO2, PO3, PO10, PO12
5.	CO-5. To understand and demonstrate how to access published applications.	PO2, PO3, PO5, PO9, PO10
6.	CO6: Use virtual machines of public cloud platform	PO3, PO7, PO10, PO12

PO and PSO mapping with level of strength for Course Name Principles of Virtualization (Course Code yyyy)

Course Objectives	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
-CO1	_	3	1	_	3	_	_	_	_	_	1	_	2	_	2
-CO2	_	3	_	_	3	3	_	_	_	1	_	3	_	_	1
-CO3	_	3	3	3	3		_	_	_	_	_	3	_	1	1
-CO4	_	3	3	_	_	_	_	_	_	3	_	3	1	_	_
-CO5	_	3	3	_	3	_	_	_	3	3	_		1	_	_
CO6	_	2	_	3	_	2	_	_	3	3	_	2	2	1	2

1. Addressed to Slight (Low=1) extent   2. Addressed to Moderate (Medium=2) extent
3. Addressed to Substantial (High=3) extent

Syllabus: CSE , Mobile Security

School: SET		Batch :2018-2022	
Program: B.Tech		Current Academic Year: 2018-19	
Branch: CSE		Semester: V	
1	Course Code	CSE377	Course Name: Mobile Security
2	Course Title	Mobile Security	
3	Credits	4	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	The course deals with the security and privacy problems in the realm of wireless networks and mobile computing. The subject is useful for working in the fields of mobile and wireless security and privacy and to graduate students seeking new areas to perform research and pratical knowledge	
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. Gain in-depth knowledge on wireless and mobile network security and its relation to the new security based protocols. CO2. Apply proactive and defensive measures to counter potential threats, attacks and intrusions CO3. Explanation about security framework of android CO4. Design secured wireless and mobile networks that optimise accessibility whilst minimising vulnerability to security risks. CO5: Describe vulnerability feature of Mobile CO6: Understand Binder and Messenger Interfaces	
7	Course Description	This is a graduate-level course that provides an introduction to mobile security. It explore the unique challenges facing mobile This course provides a good conceptual overview of the security principles incorporated in the design of several generations of mobile networks, from GSM (2G), UMTS (3G) up until LTE (4G). It also explore platform security models of the popular mobile device platforms including IOS, Android and the Windows Phone..	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Security and Privacy for Mobile and Wireless Networks: -	CO1
	B	Introduction- State of the Art- Areas for Future Research, General Recommendation for Research. Pervasive System	CO1,CO2
	C	Enhancing Trust Negotiation with Privacy Support: Trust Negotiation- Weakness of Trust Negotiation- Extending Trust Negotiation to Support Privacy	CO1,CO3
	Unit 2	MOBILE SECURITY	
	A	Mobile system architectures, Overview of mobile cellular systems, GSM and UMTS Security & Attacks,	CO3,CO2
	B	Vulnerabilities in Cellular Services, Cellular Jamming Attacks & Mitigation,	CO3,CO2
	C	Security in Cellular VoIP Services, Mobile application security.	CO3,CO2
	Unit 3	SECURING WIRELESS NETWORKS	
	A	Overview of Wireless security, Scanning and Enumerating	C02,CO4

	B	802.11 Networks, Attacking 802.11 Networks, Attacking WPA protected 802.11 Networks,	C02,CO5
	C	Bluetooth Scanning and Reconnaissance, Bluetooth Eavesdropping, Attacking and Exploiting Bluetooth, Zigbee Security, Zigbee Attacks	CO2,CO5
	Unit 4	ADHOC NETWORK SECURITY	
	A	Issues and Challenges in Security Provisioning, Network Security Attacks	C04
	B	Key Management in Adhoc Wireless Networks, Secure Routing in Adhoc Wireless Networks	CO4
	C	RFID SECURITY: Introduction, RFID Security and privacy, RFID chips Techniques and Protocols, RFID anti-counterfeiting,	CO4,CO6
	Unit 5	Security in Android	
	A	Understand Android security in data storage, Internal Storage, External Storage, Content Providers, Android Sandboxes Applications, Resource sharing through permission, creating permission.	C02,CO5
	B	Understand Input validation, handling Users data, web view, handling credentials, Cryptography, Inter Process Communication.	C02,CO5
	C	Understand Binder and Messenger Interfaces, Broadcast Receivers, Dynamic Loading Codes, Secure Virtual machine and security in Native Code.	C02,CO5,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	1. C. Siva Ram Murthy, B.S. Manoj, "Adhoc Wireless Networks Architectures and Protocols", Prentice Hall, x ISBN 9788131706885, 2007	
	Other References	1-Kia Makki, Peter Reiher, "Mobile and Wireless Network Security and Privacy ", Springer, ISBN 978-0-387-71057-0, 2007. 2. NoureddineBoudriga, "Security of Mobile Communications", ISBN 9780849379413, 2010. 3. Kitsos, Paris; Zhang, Yan , "RFID Security Techniques, Protocols and System-On-Chip Design ", ISBN 978-0-387-76481-8, 2008.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO)
1.	CO1. Gain in-depth knowledge on wireless	PO1, PO2, PO4, PO9, PO10, PO11, PO12

	and mobile network security and its relation to the new security based protocols.	
2.	CO2. Apply proactive and defensive measures to counter potential threats, attacks and intrusions	PO1, PO2, PO4, PO7, PO9, PO10, PO11, PO12
3.	CO3. Explanation about security framework of android	PO1, PO2, PO5, PO9, PO10, PO11, PO12
4.	CO4. Design secured wireless and mobile networks that optimise accessibility whilst minimising vulnerability to security risks.	PO1, PO2, PO6, PO9, PO10, PO11, PO12
5.	CO5: Describe vulnerability feature of Mobile	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12
6.	CO6: Understand Binder and Messenger Interfaces	PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE	Mobile Security															
	CO1	2	_	1	_	_	_	_	_	_	_	_	_	2	_	1
	CO2	_	2	_	1	_	_	_	_	2	_	_	_	3	1	_
	CO3	3	3	2	_	_	_	_	_	3	_	_	_	_	3	_
	CO4	3	3	2	3	_	_	_	_	3	_	_	_	_	3	_
	CO5	_	1	2	_	_	_	_	_	_	_	_	_	_	_	2
	CO6	_	_	3	3	2	_	_	_	_	_	_	_	_	_	3

Syllabus: CSE377 , Information and Network Security

School: SET		Batch :2019-2023	
Program: B.Tech		Current Academic Year: 2019-20	
Branch: CSE		Semester:	
1	Course Code	CSE377	Course Name:
2	Course Title	Information and Network Security	
3	Credits	3	
4	Contact Hours (L-T-P)	3 – 0 – 1	
	Course Status	Compulsory	
5	Course Objective	• To help students understand the foundational concepts of information security. • To make it possible for students to appreciate the need for securing information from threats and risks. To help students understand various characteristics of network security, threats and risks to securing a network • To facilitate students, gain hands-on experience of identifying and providing solutions for common network security challenges using various security tools and techniques. • To make it possible for students to understand various types of algorithms and processes used in cryptography and how they are applied in achieving the goals of cryptography such as confidentiality, integrity and authentication.	
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. To enable students to understand the concepts of IT security, Threats, Vulnerabilities, Impact and control measures. CO2. And also to get familiarize with Asset management along with the objective to create awareness in Digital Rights management. CO3. Apply their understanding of network security in identifying common issues and propose suitable solutions CO4: Describe various algorithms and processes used in cryptography for authenticating users, securing information and communication CO5: Identify physical points of vulnerability in simple networks CO6: To understand various protocols for network security to protect against the threats in the networks	
7	Course Description	To make it possible for students to understand various types of algorithms and processes used in cryptography and how they are applied in achieving the goals of cryptography such as confidentiality, integrity and authentication.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Information Security	
	A	Definition of Information Security, Evolution of Information Security; Basics Principles of Information	CO1

		Security;	
	B	Critical Concepts of Information Security; Components of the Information System; Balancing Information Security and Access;	CO1,CO2
	C	Implementing IT Security, The System Development Life cycle, Security professional in the organisation.	CO1,CO3,CO6
	Unit 2	Network Security	
	A	Basic concept of network security: Computer security, Network security, Trusted and untrusted networks, unknown attack, network attack.	CO3, CO2,CO5
	B	Securing computer network: Hardware, Software. Forms of protection. VPN Security: need of VPN, role of VPN for an enterprise, use of tunnelling with VPN,	CO3,CO2
	C	working with VPN, authentication mechanism in VPN, types of VPN and their usage Network Security Issues and Vulnerabilities, Security best practices.	CO3,CO2,CO6
	Unit 3	Network Security Controls	
	A	Network attacks, Need for intrusion monitoring and detection, intrusion detection for information system security: intrusion detection methodologies	C02,CO4,CO5
	B	categories of IDS, characteristics of IDS, role of router in IDS, challenges for IDS, implementing IDS, future of IDS. Examining firewall in the context of IDS,	C02,CO4
	C	Network Intrusion Prevention, IPS signature categories, IPS system configuration.	CO2,CO4,CO6
	Unit 4	Introduction to Cryptography	
	A	Introduction to Cryptography and Cryptanalysis, Classical Encryption Techniques – Substitution Techniques	C04
	B	Transposition Techniques, Permutation Method. Advanced Encryption Techniques and Security Issues	CO4,CO5
	C	RC4, One-time Pad, RSA, DES, Triple DES, AES and Diffie Hellman	CO4,CO6
	Unit 5	Access Control	
	A	User Identity and Access Management- Account Authorization, Access and Privilege Management, System and Network Access Control.	C02,CO4,CO6
	B	Operating Systems Access Controls, Monitoring Systems Access Controls, Intrusion Detection System, Event logging, Cryptography.	C02,CO4
	C	Physical Security: Identify Assets to be Protected, Perimeter Security, Firewalls, Prevention and Detection Systems, Safe Disposal of Physical Assets. Email Security: PGP, MIME, IP Security: IP security overview, Case study.	C02,CO4,CO5
	Mode of examination	Theory	
	Weightage Distribution	CA / MTE / ETE 30% / 20% / 50%	
	Text book/s*	Orsaria, Jang, "RHCSA/RHCE Red Hat Linux Certification Study Guide Exams EX200 & EX300", McGraw-Hill Education, July 2017	

	Other References	**Sander Van Vugt, "Red Hat RHCSA/RHCE 7 Cert Guide: Red Hat Enterprise Linux 7 (EX200 and EX300)", Phi Learning Pvt Ltd, 2009.**	

S. No.	**Course Outcome**	**Program Outcomes (PO) & Program Specific Outcomes (PSO)**
1.	**CO1. To enable students to understand the concepts of IT security, Threats, Vulnerabilities, Impact and control measures.**	**PO1, PO3, PSO3**
2.	**CO2. And also to get familiarize with Asset management along with the objective to create awareness in Digital Rights management.**	**PO1, PO2, PO3, PSO1, PSO2**
3.	**CO3. Apply their understanding of network security in identifying common issues and propose suitable solutions**	**PO2, PO3, PO4, PO9, PSO1, PSO2**
4.	**CO4: Describe various algorithms and processes used in cryptography for authenticating users, securing information and communication**	**PO3, PO9, PSO1, PSO2**
5	**CO5 Identify physical points of vulnerability in simple networks**	**PO12,PO7,PO9,PO8**
6	**CO6: To understand various protocols for network security to protect against the threats in the networks**	**PO2,PO5,PO6**

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CSE	**Information and Network Security**															
	CO1	**2**		**1**										**2**		**1**
	CO2		**2**		**1**					**2**				**3**	**1**	
	CO3	**3**	**3**	**2**						**3**					**3**	
	CO4	**3**	**3**	**2**	**3**					**3**					**3**	
	CO5		**1**	**2**												**2**
	CO6			**3**	**3**	**2**										**3**

Syllabus: CSP377, Information and Network Security Lab

School: SET		Batch: 2019	
Program: B.Tech		Current Academic Year: 2019-2020	
Branch:CSE		Semester:	
1	Course Code	CSP377	
2	Course Title	Information and Network Security Lab	
3	Credits		
4	Contact Hours (L-T-P)		
	Course Status	Compulsory/Elective	
5	Course Objective		
6	Course Outcomes	Students will be able to: CO1: To demonstrate the security policies and configuration of Firewall CO2: To demonstrate the security policies and configuration of Virtual Private Network CO3: To demonstrate the security policies and configuration of Router CO4: To demonstrate the security policies and configuration of Intrusion Detection System CO5: To perform Online and Offline Banner Grabbing CO6: To perform Port Scanning using Super Scan	
7	Course Description		
8	Outline syllabus		CO Mapping
	Unit 1	Networking command	CO1
	A	Networking command ping path ping	CO1
	B	Hachcla tool for hashing	CO1
	Unit 2	Wireshark Tool	
	A	Packet capture (packet sniffing) and with the Wireshark tool	CO1,CO2
	B	Network traffic analysis with the Wireshark tool	CO1,CO2
	Unit 3	OpenSSL command	
	A	Generate RSA key using openSSL command tool	CO3
	B	Digital Certification creation, viewing, issuing a certificate using OpenSSL.	CO3
	Unit 4	Implementation of Rail Fence Technique	
	A	W.A.P. to implement Rail fence technique.	CO4
	B	W.A.P. to implement Simple Column Transposition technique	CO5
	Unit 5	Nmap and Maltego Tool	

	A	Full Scan, Half Open Scan and Stealth scan using "nmap"			**CO6**
	B	Scanning of Website using Maltego tool			**CO6**
	Mode of examination	**Practical/Viva**			
	Weightage Distribution	**CA**	**MTE**	**ETE**	
		60%	**0%**	**40%**	
	Text book/s*				
	Other References				

PO and PSO mapping with level of strength for Course Name Introduction to Cloud Technology (Course Code yyyy)

Course Objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	3	2	2	2	1	2	1	3
CO2	2	2	2	2	2	2	2	2	2	2	2	3
CO3	2	2	3	1	2	1	1	2	2	3	2	3
CO4	2	2	3	1	3	1	1	2	3	3	3	2
CO5	2	2	3	2	3	1	2	2	3	3	2	2
CO6	2	2	3	1	3	1	1	2	3	3	3	2

Course Objectives	PSO1	PSO2	PSO3
CO1	_	1	_
CO2	3	_	2
CO3	_	2	_
CO4	_	3	2
CO5	_	_	_
CO6	_	_	3

1. Addressed toSlight (Low=1)extent 2. Addressed toModerate (Medium=2) extent
3. Addressed toSubstantial (High=3) extent

Syllabus: CSE375, Introduction to Cloud Technology

School:		Batch : 2019-2023	
Program:		Current Academic Year: 2019	
Branch:		Semester: 03	
1	Course Code	CSE375	Course Name: B.Tech(CSE)
2	Course Title	Introduction to Cloud Technology	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Semester-04	
5	Course Objective	Students will try to learn: 1. To provide students with the fundamentals and essentials of Cloud Computing. 2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios 3. To provide a knowledge of some important cloud computing driven commercial systems such as GoogleApps, Microsoft Azure and Amazon Web Services and other businesses cloud applications.	
6	Course Outcomes	On successful completion of this module students will be able to: 7. Articulate the main concepts, key technologies, strengths, and limitations of cloud technology. 8. Choose the appropriate technologies, algorithms, and cloud provider for related issues. 9. Explain the core issues of cloud computing such as security, privacy, and interoperability. 10. Attempt to generate new ideas and innovations in cloud computing. 11. Understand the governance related issues like data privacy and others in maintain a cloud systems. 12. To provide a knowledge of some important cloud computing driven commercial systems such as GoogleApps, Microsoft Azure and Amazon Web Services and other businesses cloud applications.	
7	Course Description	This course provides a graduate-level comprehensive introduction to cloud technology with an emphasis on advanced topics.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction	
	A	Introduction to Cloud Computing, History and Evolution of Cloud Computing, Types of clouds, Private Public and hybrid clouds.	CO1, CO3
	B	Cloud Computing architecture, Cloud computing infrastructure, Merits of Cloud computing, , Cloud computing delivery models and services (IaaS, PaaS, SaaS), obstacles for cloud technology.	CO3, CO5
	C	Cloud vulnerabilities, Cloud challenges, Practical applications of cloud computing.	CO3

	Unit 2	**Cloud Computing Companies and Migrating to Cloud**	
	A	**Web-based business services, Delivering Business Processes from the Cloud: Business process examples, Broad Approaches to Migrating into the Cloud.**	**CO2, CO3**
	B	**The Seven-Step Model of Migration into a Cloud, Efficient Steps for migrating to cloud.**	**CO1, CO3**
	C	**Risks: Measuring and assessment of risks, Company concerns Risk Mitigation methodology for Cloud computing, Case Studies.**	**CO3, CO4**
	Unit 3	**Cloud Cost Management and Selection of Cloud Provider**	
	A	**Assessing the Cloud: software Evaluation, System Testing, Seasonal or peak loading, Cost cutting and cost-benefit analysis, Selecting the right scalable application, Considerations for selecting cloud solution**	**CO1,CO2,CO4**
	B	**Understanding Best Practices used in selection of Cloud service and providers, Clouding the Standards and Best Practices Issue: Interoperability, Portability, Integration, Security.**	**CO1,CO2**
	C	**Standards Organizations and Groups associated with Cloud Computing, Commercial and Business Consideration**	**CO2,CO4**
	Unit 4	**Governance in the Cloud**	
	A	**Industry Standards Organizations and Groups associated with Cloud Computing, Need for IT governance in cloud computing.**	**CO5,CO3**
	B	**Cloud Governance Solution: Access Controls, Financial Controls, Key Management and Encryption, Logging and Auditing, API integration, Legal Issues: Data Privacy and Security Issues.**	**CO5,CO1,CO3**
	C	**Cloud Contracting models, Jurisdictional Issues Raised by Virtualization and Data Location, Legal issues in Commercial and Business Considerations.**	**CO5,CO3**
	Unit 5	**5 ten cloud do an do nots**	
	A	**Don't be reactive, do consider the cloud a financial issue, don't go alone, do think about your architecture, don't neglect governance, don't forget about business purpose,**	**CO5, CO3**
	B	**Do make security the center piece of your strategy, don't apply the cloud to everything, Don't forget about Service Management, do start with a pilot project.**	**CO4**
	Mode of examination	**Theory**	
	Weightage Distribution	**CA** 30% / **MTE** 20% / **ETE** 50%	
	Text book/s*	13. **Bernard Golden "AWS for dummies",Edition:1 , Wiley Publisher** 14. **Thomas Erl, Ricardo puttini, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall Publication**	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO-1. Articulate the main concepts, key technologies, strengths, and limitations of cloud technology.	PO2, PO5, PO12, PSO3
2.	CO-2. Choose the appropriate technologies, algorithms, and cloud provider for related issues.	PO2, PO5, PO7, PO12, PSO2
3.	CO-3. Explain the core issues of cloud computing such as security, privacy, and interoperability.	PO2, PO11, PO5, PO12
4.	CO-4. Attempt to generate new ideas and innovations in cloud computing.	PO5, PO7, PO11, PO12, PSO5
5.	CO-5. Understand the governance related issues like data privacy and others in maintain a cloud systems.	PO2, PO5, PO9, PO10
6.	CO-6. Understand about AWS cloud.	PO7, PO11, PO12

PO and PSO mapping with level of strength for Course Name Introduction to Cloud Technology (Course Code yyyy)

Course Objectives	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	3	2	2	2	1	2	1	3
CO2	2	2	2	2	2	2	2	2	2	2	2	3
CO3	2	2	3	1	2	1	1	2	2	3	2	3
CO4	2	2	3	1	3	1	1	2	3	3	3	2
CO5	2	2	3	2	3	1	2	2	3	3	2	2
CO6	2	2	3	1	3	1	1	2	3	3	3	2

Course Objectives	PSO1	PSO2	PSO3
CO1	_	1	_
CO2	3	_	2
CO3	_	2	_
CO4	_	3	2
CO5	_	_	_
CO6	_	_	3

1. Addressed toSlight (Low=1)extent 2. Addressed toModerate (Medium=2) extent
3. Addressed toSubstantial (High=3) extent

School: SET		Batch: 2019			
Program: B.Tech		Current Academic Year: 2019-2020			
Branch:CSE		Semester: III			
1	Course Code	CSP375			
2	Course Title	Cloud Technology Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Compulsory/Elective			
5	Course Objective	This course is designed to provide a comprehensive introduction to Virtualization leading to the ability to understand contemporary terminology, progress, issues, and trends.			
6	Course Outcomes	Students will be able to: CO1: To know the practical implementations of Virtualization Software's. CO2: To implement the VMware and its products. CO3: To implement Virtual hard disks and Cloud Print. CO4:To implement Microsoft Azure product-Hyper-V. CO5:To implement Amazon Web Services Concepts. CO6: To implement security to AWS instance.			
7	Course Description	This course will give the idea of VMware Products and its practical implementations and Azure products and its implementations and Amazon Web services Concepts.			
8	Outline syllabus				CO Mapping
	Unit 1	Virtualization Softwares			CO1
	A	Implementation of Vmware Workstation			CO1
	B	Implementation of VMware Setting and Clone of it.			CO1
	C	Implementation of Hyper-V.			CO1
	Unit 2	VMware Products			
	A	Implementation of VMware ESXi Server and its use.			CO1,CO2
	B	Implementation of Vmware vcenter server and its use.			CO1,CO2
	C	Implementation of Vmware VSphere and its use.			CO1,CO2
	Unit 3	Virtual Hard Disk and Cloud Printing			
	A	Implementation of creating and managing virtual hard disks.			CO3,CO5
	B	Implementation of cloud printing service in public network.			CO3,CO6
	Unit 4	Microsoft Azure product-Hyper-V			
	A	Implementation of Hyper-V			CO4
	B	Implementation of Windows Virtual PC			CO4
	C	Implementation of Hyper –V Virtual Networking			CO4
	Unit 5	Amazon Web Services			
	A	Implementation of AWS Basics			CO5
	B	Implementation of AWS instances			CO5
	C	Implementation of Snapshots is AWS			CO5
	Mode of examination	Practical/Viva			
	Weightage	CA	MTE	ETE	

	Distribution	60%	0%	40%	
	Text book/s*	Virtualization--the complete cornerstone guide to virtualization best practices, Ivanka Menken, Gerard Blokdijk, Lightning Source Incorporated, 2008			
	Other References	Web references-Udemy			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: To know the practical implementations of Virtualization Software's.	PO1,PO2,PO3,PO4,PSO1
2.	CO2: To implement the VMware and its products.	PO1, PO3, PO4, PSO2
3.	CO3: To implement Virtual hard disks and Cloud Print.	PO1,PO2,PO3,PO4
4.	CO4:To implement Microsoft Azure product-Hyper-V.	PO9, PO10,PO11, PSO5
5.	CO5:To implement Amazon Web Services Concepts.	PO10,PO11
6	CO6: To implement security to AWS instance.	PO 9,PO7,PO11

PO and PSO mapping with level of strength for Course Name Database management System Lab (Course Code CSP288)

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	3	3	3	3	–	–	–	2	2	1	2	1	3	2	2
CO2	3	2	3	3	_	_	_	2	2	2	1	1	2	3	2
CO3	3	3	3	3	_	_	_	1	1	1	3	2	3	2	1
CO4	2	2	2	2	1	_	_	2	3	3	3	1	2	2	2
CO5	_	3	_	3	2	_	3		2	3	3	--	--	--	2
CO6	2	_	_	3	_	2	3	2	3	3	3	_	_	_	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SET		Batch :2019-2023		
Program: B.Tech		Current Academic Year: 2019-20		
Branch: CSE		Semester: V		
1	Course Code	CSE057	Course Name: Cloud Forensics	
2	Course Title			
3	Credits	2		
4	Contact Hours (L-T-P)	2-0-0		
	Course Status	Compulsory		
5	Course Objective	The field of digital forensics is all about retrieving digital data from a wide range of digital and computer devices. The most obvious reason that this data would need to be identified and extracted is to be used as evidence in some sort of case related to computer crime.		
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. Aware from Cyber Forensic and Data Recovery Tools CO2. Know the Cyber Crimes and Cyber Laws CO3. Aware from Cyber Security rules CO4. Knowledge of Mobile Hacking and Digital Forensic Challenges CO5: Forensic Software, Evidence Analysis and Reporting CO6: Develop a preliminary research on a self-selected topic in cloud forensics and security		
7	Course Description	This course is designed to impart a critical theoretical and detailed practical knowledge of a range of Digital Forensics.		
8	Outline syllabus			CO Mapping
	Unit 1	Cyber Forensic and Data Recovery Tools		
	A	Cyber Forensic Basics- Introduction to Cyber Forensics, Storage Fundamentals, File System Concepts, Data Recovery, Operating System Software and Basic Terminology.		CO1
	B	Data Recovery Tools, Data Recovery Procedures and Ethics, Preserve and safely handle original media, Document a “Chain of Custody”, Complete time line analysis of computer files based on file creation, file modification and file access, Recover Internet Usage Data, Recover Swap Files/Temporary Files/Cache Files		CO1
	C	Introduction to Encase Forensic Edition, Forensic Tool Kit (FTK) etc, Use computer forensics software tools to cross validate findings in computer evidence-related cases.		CO1,CO6
	Unit 2	Cyber Crimes and Cyber Laws		
	A	Introduction to IT laws & Cyber Crimes – Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property, Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits.		CO1,CO2
	B	Introduction to Cyber Forensic Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation		CO1,CO2
	C	E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Encryption and Decryption methods,		CO1,CO2

		Search and Seizure of Computers, Recovering deleted evidences, Password Cracking.	
	Unit 3	Cyber Security	
	A	Introduction to Cyber Security, Implementing Hardware Based Security, Software Based Firewalls	CO2,CO3
	B	Security Standards, Assessing Threat Levels, Forming an Incident Response Team, Reporting Cyber Crime	CO2,CO3
	C	Operating System Attacks, Application Attacks, Reverse Engineering & Cracking Techniques and Financial Frauds.	CO2,CO3
	Unit 4	Mobile Hacking and Digital Forensic Challenges	
	A	Technical Aspects of Mobile Forensics (What are the challenges) , Trace, Seize and investigate – Cyber Crime Case Scenarios ,Criminal / Civil Incidents , Cyber Fraud	CO4,CO6
	B	Advanced Mobile Attack Analysis- How Mobile Devices get Hacked , Debuggers and Decompiles , ReverseEngineering.	CO4
	C	Penetration Testing and Exploitation Vectors- Information Gathering, Manual Exploitation, Exploit Frameworks, Cracking Passwords.	CO4,CO6
	Unit 5	Forensic Software, Evidence Analysis and Reporting	
	A	Disclaimer/ Legal , Introduction to software packages, Forensics Reports	CO4,CO5
	B	Best Evidence Rule , Evidence Report Documentation	CO6,CO5
	C	Categorizing Evidence , Evidence Tampering ,The various software used	CO2,CO5
	Mode of examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	Digital Forensic: The Fascinating World of Digital Evidences by Nilakshi Jain,Wiley Precise Textbook series.	
	Other References	1. Fundamentals of Digital Forensics-Theory, Methods, and Real-Life Applications- Joakim Kävrestad,Springer 2. Digital Forensics Basics-A Practical Guide Using Windows OS-Nihad A. Hassan, Apress	

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1. Aware from Cyber Forensic and Data Recovery Tools	PO1, PO3, PSO3
2.	CO2. Know the Cyber Crimes and Cyber Laws	PO1, PO2, PO3, PSO1, PSO2
3.	CO3. Aware from Cyber Security rules	PO2, PO3, PO4, PO9, PSO1, PSO2
4.	CO4. Knowledge of Mobile Hacking and Digital Forensic Challenges	PO3, PO9, PSO1, PSO2

5.	CO5. Forensic Software, Evidence Analysis and Reporting	PO1, PO2, PO9, PSO1,PSO3
6	CO6: Develop a preliminary research on a self-selected topic in cloud forensics and security	PO4,PO7,PO10,PO11

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE	Cloud Forensics															
	CO1	2		1										2		1
	CO2		2		1					2				3	1	
	CO3	3	3	2						3					3	
	CO4	3	3	2	3					3					3	
	CO5		1	2												2
	CO6			3	3	2										3

School: SET		Batch : 2019		
Program: B.Tech		Current Academic Year:2019-2020		
Branch:CSE		Semester: VI		
1	Course Code	CSE016	Course Name	
2	Course Title	Cloud Computing Solutions		
3	Credits	3		
4	Contact Hours (L-T-P)	3-0-0		
	Course Status			
5	Course Objective	The objective of this course is to provide the importance of data centre, requirement and design of data server and importance of data in business.		
6	Course Outcomes	After the successful completion of this course, students will be able to : CO1: Understand the importance of data centre in current scenario. CO2: Demonstrate the requirement and design of data centre. CO3: Analysis the Business continuance infrastructure services. CO4: Apply the concept of data centre in real world. CO5: Configurations and Migrating on premise Database CO6: Setting up Default page for website		
8	Outline syllabus			CO Mapping
	Unit 1	Introduction		
	A	Introduction to MS. Azure, Virtual Machines: Creating Virtual Machines, Difference,		CO1, CO2
	B	Between Basic and Standard VMs,Logging in to a VM and Working, Attaching an empty Hard Disk to VM, Hosting a Website in VM , Configuring End Points		CO1, CO2
	C	Scaling up and Down, Creating a custom Image from VM,Creating a VM from a custom Image, Shut down VM without Getting Billed,VM Pricing		CO1, CO2
	Unit 2	Managing Infrastructure in Azure		
	A	Managing Infrastructure in Azure: Azure Virtual Networks, Highly Available Azure Virtual Machines,		CO1, CO2

	B	Virtual Machine Configuration Management, Customizing Azure Virtual Machine Networking			CO1, CO2
	C	. Load Balancing: Creating Cloud Services, Adding Virtual Machines to a Cluster, Configuring Load Balancer.			CO1, CO2
	Unit 3	Windows Azure			
	A	Azure Storage: What is a Storage Account, Advantages, Tables, blobs, queues and drives,			CO3,CO4
	B	Azure Appfabric: Connectivity and Access control			CO3,CO4
	C	Automation: Introduction Windows Power Shell ,Creation of Run books, Uploading a Shell Script, Authoring a Shell Script, ,			CO3,CO4
	Unit 4	SQL Azure			
	A	: Creating a SQL Server, Creating a SQL DB, Creating Tables,			CO3,CO4
	B	Adding Data to the Tables, View Connection Strings, Security			CO5,CO3
	C	Configurations, Migrating on premise DB to SQL Azure.			CO3,CO4
	Unit 5	Websites			
	A	Creating a Website, Setting deployment credentials, Choosing a platform,			CO5,CO6
	B	Setting up Default page for website, Scaling ,Auto Scaling by Time, Auto Scaling by Metric,			CO5,CO6
	C				CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Cengage Course Tech. Book: Photography Applications For Cloud Computing (1st Edition)			
	Other References	2. Guidelines on Security and Privacy in Public Cloud Computing, NIST, NIST SP - 800-144, December 9, 2011, http://www.nist.gov/customcf/get_pdf.cfm?pub_id=909494. 3. Securing The Cloud: Cloud Computing Security Techniques and Tactics by Vic (J.R.) Winkler (Syngress/Elsevier) - 978-1-59749-592-9 4. Cloud Computing Design Patterns by Thomas Erl (Prentice Hall) - 978-0133858563			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Understand the importance of data centre in current scenario.	PO1,PO2,PO3,PO4,PSO1
2.	CO2: Demonstrate the requirement and design of data centre.	PO1, PO3, PO4, PSO2
3.	CO3: Analysis the Business continuance infrastructure services.	PO1,PO2,PO3,PO4
4.	CO4: Apply the concept of data centre in real world.	PO9, PO10,PO11, PSO1
5.	CO5: Configurations and Migrating on premise Database	PO8, PO6,PO11, PSO3
6.	CO6: Setting up Default page for website	PO5, PO7,PO9, PSO2

PO and PSO mapping with level of strength for Course Name Cloud Computing Solutions (Course Code CSE)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	--	--	--	2	2	1	2	1	3	2	2
CO2	3	3	3	3	--	--	--	2	2	2	1	1	2	3	2
CO3	3	3	2	3	--	--	--	1	1	1	3	2	3	2	1
CO4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
CO5	3	3	3	3	--	--	--	2	2	2	1	1	2	3	2
CO6	3	3	2	3	--	--	--	1	1	1	3	2	3	2	1

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Syllabus: CSE378, Advanced Linux Administration

School: SET		Batch :2019-2023	
Program: B.Tech		Current Academic Year: 2019-20	
Branch: CSE		Semester:	
1	Course Code	CSE378 Course Name:	
2	Course Title	Advanced Linux Administration	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	• This course introduces fundamental concepts of Linux OS. Students learn how to install, configure and maintain an Enterprise Linux system in a networked environment. RHEL is a high performing operating system that. RHEL 6 is the sixth generation of the long term and predictable operating platform.	
6	Course Outcomes	Upon successful completion of this course, the student will be able to: CO1. Description of Linux operating system CO2. About system administration. CO3. Explanation about Linux administration. CO4. Configuring Servers CO5: Red Hat system, installation, managing the boot processes, performing various operations, CO6. Understanding Linux Kernel, testing and debugging.	
7	Course Description	This course is designed to impart a critical theoretical and detailed practical knowledge of a range of computer network security technologies as well as network security tools and services related to Linux Administration.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Red Hat Linux System & Servers	
	A	Introduction to servers, Linux Origin, Introduction to Linux , Duties of the system administration, Linux Disk Management.	CO1
	B	Planning the network, Installing the red hat linux, Red hat linux file system: Understanding File system, File System Commands, Working with Linux supported file system.	CO1,CO2
	C	Red Hat System Configuration File: Examining the system configuration file, examining the network configuration file.	CO1,CO3
	Unit 2	Linux Network Services	
	A	TCP/IP Networking: Understanding Network Classes, Setting up NIC, Understanding Subnetting, CIDR, Configuring DHCP, Configuring PPP connection	CO3,CO2
	B	Network File System: NFS Overview, Configuring NFS client and server, Controlling Services and daemons : Systemd, Systemctl Unit dependencies.	CO3,CO2

	C	Other network services ntpd ,httpd ,sshd, sendmail , snmpd , iptables ,nfsd , nscd, named,smbd	CO3,CO2
	Unit 3	Linux Internet Services	
	A	Introduction to internet services: secure services, less secure services, Inetd Server.	C02,CO4
	B	Domain Name System (DNS): Understanding DNS, Installing software, types of domain servers, Configuring mail services: Introduction to Email and SMTP, Configuring the email Client, maintaining the E-mail security	C02,CO5
	C	Configuring web server: Introducing Apache, How web server works, Installing and configuring Apache	CO2,CO5
	Unit 4	Linux System Maintenance	
	A	Using the Red Hat Networks: Upgrading and Customizing the Kernel, Configuring on Command Line, Administering User and Groups: Understanding the root accounts, working with users and groups, Using File System Quotas.	C04
	B	Backing and Restoring the File system: Choosing media for backup, Understanding backup methods, using backup tools. Installing and upgrading software package: Package Installation and Removal	CO4,CO6
	C	Checking Software Version, Obtaining Newer software, Installing software. Managing network Via Network Manager , Red hat package manager	CO4
	Unit 5	Installation & Configuration of Windows Server 2012	
	A	Performing a Clean Installation, Installing Third-Party Drivers, Working with Installation Partitions, Using Server Core, Server Core Defaults	C06,CO5
	B	Server Core Capabilities, Using the Minimal Server Interface, Upgrade paths, Preparing to Upgrade Installation, Installing Windows Server Migration Tools.	C06,CO5
	C	Configuring Local Storage : Planning Server Storage, Determining the Number of Servers Needed, Estimating Storage Requirements, Selecting a Storage Technology, Selecting a Physical Disk Technology	C02,CO5
	Mode of examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	Orsaria, Jang, “RHCSA/RHCE Red Hat Linux Certification Study Guide Exams EX200 & EX300”, McGraw-Hill Education, July 2017	
	Other References	Sander Van Vugt, “Red Hat RHCSA/RHCE 7 Cert Guide: Red Hat Enterprise Linux 7 (EX200 and EX300)”, Phi Learning Pvt Ltd, 2009.	

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific

		Outcomes (PSO)
1.	**CO1. Description of Linux operating system**	**PO1, PO3, PSO3**
2.	**CO2. About system administration.**	**PO1, PO2, PO3, PSO1, PSO2**
3.	**CO3. Explanation about Linux administration.**	**PO2, PO3, PO4, PO9, PSO1, PSO2**
4.	**CO4. Configuring Servers**	**PO3, PO9, PSO1, PSO2**
5.	**CO5: Red Hat system, installation, managing the boot processes, performing various operations**	**PO1, PO2, PO9, PSO1,PSO3**
6.	**CO6: Understanding** Linux **Kernel, testing and debugging.**	**PO2, PO3, PO9, PSO1, PSO2**

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE	Advanced Linux Administration															
	CO1	2		1										2		1
	CO2		2		1					2				3	1	
	CO3	3	3	2						3					3	
	CO4	3	3	2	3					3					3	
	CO5		1	2												2
	CO6			3	3	2										3

School: SET		Batch : 2019	
Program: B.Tech		Current Academic Year:2019-2020	
Branch:CSE		Semester: VI	
1	Course Code	CSE046	Course Name
2	Course Title	Cloud Security & Data Protection	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	1. This course provides the ground-up coverage on the high- level concepts of cloud landscape, architectural principles, techniques, data protection services, design patterns and real-world best practices applied to Cloud service providers and consumers and delivering secure Cloud based services. 2. The course will describe the Cloud security architecture and explore the guiding security design principles, design patterns, industry standards, applied technologies and addressing regulatory compliance requirements critical to design, implement, deliver and manage secure cloud based services.	
6	Course Outcomes	After the successful completion of this course, students will be able to : CO1: Fundamentals of cloud computing architectures based on current standards, protocols, and best practices intended for delivering Cloud based enterprise IT services and business applications. CO2: Identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based IT services. CO3: Understand the concepts and guiding principles for designing and implementing appropriate safeguards, Common attack vectors, threats and countermeasures for Cloud based IT services. CO4: Approaches to designing cloud services that meets essential Cloud infrastructure characteristics – on- demand computing, shared resources, elasticity and measuring usage. CO5: Design security architectures that assures secure isolation of physical and logical infrastructures including compute, network and storage, CO6: Comprehensive data protection at all layers, end-to-end identity and access management, monitoring and auditing processes and compliance with industry and regulatory mandates	
		The course will leverage cloud computing security & Data Protection guidelines set forth by ISO, NIST, ENISA and Cloud Security Alliance (CSA).	
8	Outline syllabus		CO Mapping
	Unit 1	Fundamentals of Cloud Computing and Architectural	

		Characteristics	
	A	Understand what is Cloud computing ,Architectural and Technological Influences of Cloud Computing ,Understand the Cloud deployment models : Public, Private, Community and Hybrid models, Scope of Control : Software as a Service (SaaS) ,Platform as a Service (PaaS) ,Infrastructure as a Service (IaaS) , Cloud Computing Roles , Risks and Security Concerns	CO1, CO2
	B	Security Design and Architecture for Cloud Computing: Guiding Security design principles for Cloud Computing, Secure Isolation ,Comprehensive data protection , End-to-end access control ,Monitoring and auditing	CO1, CO2
	C	Quick look at CSA, NIST and ENISA guidelines for Cloud Security, Common attack vectors and threats.	CO1, CO2
	Unit 2	Secure Isolation of Physical & Logical Infrastructure	
	A	Isolation ,Compute, Network and Storage , Common attack vectors and threats	CO1, CO2
	B	Secure Isolation Strategies : Multi-tenancy, Virtualization strategies ,Inter-tenant network segmentation strategies ,Storage isolation strategies	CO1, CO2
	C	Design and Implementation.	CO1, CO2
	Unit 3	Data Protection for Cloud Infrastructure and Services	
	A	Understand the Cloud based Information Life Cycle, Data protection for Confidentiality and Integrity ,Common attack vectors and threats	CO3,CO4
	B	Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key Management, Assuring data deletion	CO3,CO4,CO6
	C	Data retention, deletion and archiving procedures for tenant data, Data Protection Strategies.	CO3,CO4
	Unit 4	Enforcing Access Control for Cloud Infrastructure based Services	
	A	Understand the access control requirements for Cloud infrastructure , Common attack vectors and threats , Enforcing Access Control Strategies:: Compute, Network and Storage : Authentication and Authorization	CO3,CO4
	B	Roles-based Access Control, Multi-factor authentication ,Host, storage and network access control options , OS Hardening and minimization	CO3,CO6
	C	Securing remote access, Verified and measured boot, Firewalls, IDS, IPS and honey pots.	CO3,CO4
	Unit 5	Monitoring, Auditing and Management	
	A	Proactive activity monitoring, Incident Response ,Monitoring for unauthorized access, malicious traffic, abuse of system privileges	CO5,CO6
	B	intrusion detection, events and alerts ,Auditing – Record generation, Reporting and Management , Tamper-proofing audit logs , Quality of Services	CO5,CO6

	C	Secure Management, User management, Identity management ,Security Information and Event Management.			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Cloud Security: Introduction to Cloud Security and Data Protection			
	Other References	2. Guidelines on Security and Privacy in Public Cloud Computing, NIST, NIST SP - 800-144, December 9, 2011, http://www.nist.gov/customcf/get_pdf.cfm?pub_id=909494. 3. Securing The Cloud: Cloud Computing Security Techniques and Tactics by Vic (J.R.) Winkler (Syngress/Elsevier) - 978-1-59749-592-9 4. Cloud Computing Design Patterns by Thomas Erl (Prentice Hall) - 978-0133858563			

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Fundamentals of cloud computing architectures based on current standards, protocols, and best practices intended for delivering Cloud based enterprise IT services and business applications.	PO1,PO2,PO3,PO4,PSO1
2.	CO2: Identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based IT services.	PO1, PO3, PO4, PSO2
3.	CO3: Understand the concepts and guiding principles for designing and implementing appropriate safeguards and countermeasures for Cloud based IT services.	PO1,PO2,PO3,PO4
4.	CO4: Approaches to designing cloud services that meets essential Cloud infrastructure characteristics – on- demand computing, shared resources, elasticity and measuring usage.	PO9, PO10,PO11, PSO2
5.	CO5: Design security architectures that assures secure isolation of physical and logical infrastructures including compute, network and storage	PO1,PO2,PO3,PO4,PSO1
6.	CO6: Comprehensive data protection at all layers, end-to-end identity and access management, monitoring and auditing processes and compliance with industry and regulatory mandates.	PO1, PO5, PO7, PSO2

PO and PSO mapping with level of strength for Course Name Cloud Security & Data Protection (Course Code CSE)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	--	--	--	2	2	1	2	1	3	2	2
CO2	3	3	3	3	--	--	--	2	2	2	1	1	2	3	2
CO3	3	3	2	3	--	--	--	1	1	1	3	2	3	2	1
CO4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
CO5	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
CO6	3	3	2	3	--	--	--	1	1	1	3	2	3	2	1

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SET		Batch : 2019	
Program: B.Tech		Current Academic Year:2019-2020	
Branch:CSE		Semester:	
1	Course Code		Course Name
2	Course Title	Server Administration	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	• To install and configure the Windows Server. • To configure server for optimised storage and container services. • To create and configure directory service for authentication. • To apply policies to users and computers in domain level. • To monitor the performance of Server.	
6	Course Outcomes	After the successful completion of this course, students will be able to : CO1 Installing and configuring the Nano and Core Versions of Windows Server 2016. CO2: Understanding Server activation models. CO3: Configuring the server for storage spaces and data deduplications. CO4: Configuring the server for container service Docker. CO5: Installing and configuring ADDS to create own domains. CO6: Applying policies to users and computers in domain level using GPO.	
8	Outline syllabus		CO Mapping
	Unit 1	Installing Windows Server 2016	
	A	Introducing Windows Server 2016, Preparing and installing Nano Server and Server Core,	CO1, CO2
	B	Preparing for upgrades and migrations, Migrating server roles and workloads, Windows Server activation models, managing disks in Windows Server,	CO1, CO2
	C	Managing volumes in Windows Server, Implementing Storage Spaces, Managing Storage Spaces, Implementing Data Deduplication.	CO1, CO2
	Unit 2	Deploy and Manage Windows Containers	
	A	Install and configure Windows Server container host in physical or virtualised environments, install and configure Windows Server container host to Windows Server Core or Nano Server in a physical or virtualised environment,	CO1, CO2
	B	install Docker on Windows Server and Nano Server, configure Docker start-up options, install PowerShell	CO1, CO2

		for Docker, install a base container image, tag an image, remove a container, create Windows Server containers, create Hyper-V containers, Manage Windows containers by using Docker CLI and PowerShell for Docker,			
	C	manage container networking, manage container data volumes, manage Resource Control, create new container images using Docker file, manage container images using Docker Hub repository for public and private scenarios, manage container images using Microsoft Azure.			CO1, CO2
	Unit 3	Installing and configuring domain controllers			
	A	Overview of AD DS, Overview of AD DS domain controllers, Deploying a domain controller, Managing user accounts, Managing groups in AD DS,			CO3,CO4
	B	Managing computer objects in AD DS, Using Windows PowerShell for AD DS administration, Implementing and managing OUs, Overview of advanced AD DS deployments, Deploying a distributed AD DS environment,			CO3,CO4,CO6
	C	Configuring AD DS trusts, Overview of AD DS replication, Configuring AD DS sites, Configuring and monitoring AD DS replication.			CO3,CO4
	Unit 4	Implementing Group Policy			
	A	Introducing Group Policy, Implementing and administering GPOs,			CO3,CO4
	B	Group Policy scope and Group Policy processing, Troubleshooting the application of GPOs, Implementing administrative templates,			CO3,CO4
	C	Configuring Folder Redirection, software installation and scripts, Configuring Group Policy preferences			CO3,CO4,CO6
	Unit 5	Monitoring and managing windows server			
	A	WSUS overview and deployment options, Update management process with WSUS, Overview of Windows PowerShell DSC,			CO5,CO6
	B	Overview of Windows Server 2016 monitoring tools, Using Performance Monitor, Monitoring event logs, Monitoring AD DS,			CO5,CO6
	C	Managing the Active Directory database, Active Directory backup and recovery options for AD DS.			CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Exam Ref 70-740 Installation, Storage and Compute with Windows Server 2016 by Craig			

		Zacker. ISBN 9780735697508 2. Exam Ref 70-742: Identity with Windows Server 2016 Paperback by Andrew James Warren. ISBN-13: 978-8120353527	
	Other References	1. Mastering Windows Server 2016 (Paperback) by Brian Svidergol, Vladimir Meloski. 2. MCSA Windows Server 2016 Complete Study Guide By William Panek. 3. Windows Server 2016 Administration Fundamentals by Bekim Dauti. 4. Mastering Active Directory by Dishan Francis.	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1 Installing and configuring the Nano and Core Versions of Windows Server 2016.	PO1,PO2,PO3,PO4,PSO1
2.	CO2: Understanding Server activation models.	PO1, PO3, PO4, PSO2
3.	CO3: Configuring the server for storage spaces and data deduplications.	PO1,PO2,PO3,PO4
4.	CO4: Configuring the server for container service Docker.	PO9, PO10,PO11, PSO5
5.	CO5: Installing and configuring ADDS to create own domains.	PO1,PO2,PO3,PO4,PSO1,PSO9
6.	CO6: Applying policies to users and computers in domain level using GPO.	PO3,PO4,PSO1

PO and PSO mapping with level of strength for Course Name Server Administration (Course Code CSE)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	--	--	--	2	2	1	2	1	3	2	2
CO2	3	3	3	3	--	--	--	2	2	2	1	1	2	3	2
CO3	3	3	2	3	--	--	--	1	1	1	3	2	3	2	1
CO4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
CO5	2	2	2	2	2	--	--	1	3	2	3	1	2	3	1
CO6	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

School: SET		Batch : 2019-2023	
Program: B.Tech		Current Academic Year:2019-2020	
Branch:CSE		Semester: VII	
1	Course Code	CSE472	Course Name
2	Course Title	Security Operations & Incident Management	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	1. This course provides the Security Operations and Incident Management looks at the broad range of topics that make up information security management concepts. 2. The course gives an overview of information security operations, access control, risk management, systems and application life cycle management, physical security, business continuity planning, telecommunications security, disaster recovery, software piracy, investigations, ethics and more. There will be extensive reporting, planning and policy writing.	
6	Course Outcomes	After the successful completion of this course, students will be able to : CO1: Student will understand the basic concepts of information security and how they apply to security operations CO2: Understand options for the layout and management of a security operations center and how these choices affect performance and abilities of the center. CO3: Understand the lifecycle of a security incident from discovery to reporting to executives. CO4: Understand the function of currently used security operations center tools including both analysis environments and instrumentation of the enterprise environment. CO5: Understand the importance of and be able to perform vulnerability management. CO6: Understand the background information and skill sets necessary to operate as an effective cyber security operations staff member and leader.	
7	Course Description	The course will define Code of Ethics, describe the security concepts, Document and operate security controls, also describe the asset management process.	
8	Outline syllabus		CO Mapping
	Unit 1	Security Architecture and Models	
	A	Information protection environment, confidentiality and integrity models, protection mechanisms, security evaluation criteria, systems certification and accreditation.	CO1, CO2
	B	Application and Systems Development :Software environment, software and system life cycle, system	CO1, CO2

		and software development methods, security in development methods, configuration management, information integrity, information accuracy and auditing.	
	C	**Operation Security: Identify security events, alerting of proper authorities, understanding using types of controls, taking appropriate corrective or recovery actions, backups, data retention, redundancy, data handling, residual data, change management, policies and procedures.**	**CO1, CO2**
	Unit 2	**Cryptography and Telecommunications/Network Security Management**	
	A	**Basics of cryptography, ciphers, pki, etc. Where they are used and issues associated with using encryption.**	**CO1, CO2**
	B	**Operation overview, telecommunications/network environment, protection, network intrusion detection and remediation, vulnerabilities**	**CO1, CO2**
	C	**Access controls, securing the traffic, communication specific policies**	**CO1, CO2**
	Unit 3	**Physical Security & Security Incident Handling**	
	A	**Electrical power and threats, environmental designs, inside and outside building security designs, vulnerability and penetration testing, fire suppression, physical controls.**	**CO3,CO4**
	B	**Business impact analysis, recovery strategies, policies/requirements, plan testing, plan maintenance, plan awareness and training, disaster recovery processes.**	**CO3,CO4**
	C	**Security incidents, Incident response, detection, remediation**	**CO3,CO4**
	Unit 4	**Law, Investigations and Ethics**	
	A	**Licensing, intellectual laws, privacy laws, investigations, ethics**	**CO3,CO4**
	B	**Anatomy of the problem, Critical infrastructure, Social & ethical Consequences**	**CO3,CO4**
	C	**Ethics and Information Security, Information Systems Audit and Control Association (ISACA)**	**CO3,CO4**
	Unit 5	**Incident Management**	
	A	**Incident identification, Incident logging, Incident categorization, Incident prioritization, Initial diagnosis, Escalation,**	**CO5,CO6**
	B	**Incident process, Incident statuses, Problem Management**	**CO5,CO6**
	C	**Incident resolution, Incident closure, Communication with the user community throughout the life of the incident**	**CO5,CO6**
	Mode of	**Theory**	

	examination				
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*				
	Other References				

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Student will understand the basic concepts of information security and how they apply to security operations	PO1,PO2,PO3,PO4,PSO1
2.	CO2: Understand options for the layout and management of a security operations center and how these choices affect performance and abilities of the center.	PO1, PO4, PSO2
3.	CO3: Understand the lifecycle of a security incident from discovery to reporting to executives.	PO1,PO2,PO3,PO4
4.	CO4: Understand the function of currently used security operations center tools including both analysis environments and instrumentation of the enterprise environment.	PO9, PO10,PO11, PSO3
5.	CO5: Understand the importance of and be able to perform vulnerability management.	PO1,PO2,PO3,PO4,PSO1
6.	CO6: Understand the background information and skill sets necessary to operate as an effective cyber security operations staff member and leader.	PO3, PO4, PSO1

PO and PSO mapping with level of strength for Course Name Security Operations & Incident Management (Course Code CSE)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	--	--	--	2	2	1	2	1	3	2	2
CO2	3	2	3	2	--	--	--	2	2	2	1	1	2	3	2
CO3	3	3	2	3	--	--	--	1	1	1	3	2	3	2	1
CO4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
CO5	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
CO6	3	2	3	2	--	--	--	2	2	2	1	1	2	3	2

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

Syllabus: CSE376, Emerging Technology and Digital Transformation

School: SET		**Batch :2019-2023**	
Program: B.Tech		**Current Academic Year: 2019-20**	
Branch: CSE		**Semester: V**	
1	**Course Code**	**CSE376**	**Course Name: Emerging Technology and Digital Transformation**
2	**Course Title**		
3	**Credits**	**2**	
4	**Contact Hours (L-T-P)**	**2-0-0**	
	Course Status	**Compulsory/Elective**	
5	**Course Objective**	**Emerging technologies are contemporary advances and innovations in various fields of technology and Through investments in technology, the essence of digital strategy is about enhancing your customers experience and increasing your organization's competitive advantage.**	
6	**Course Outcomes**	**Upon successful completion of this course, the student will be able to:** **CO1: Introduction to Emerging technologies** **CO2: Category: Emerging Technologies** **CO3: Benefits of emerging technologies** **CO4: Understanding the basic of Blockchain Technology** **CO5: Introduction to digital transformation** **CO6: Digital transformation advantages**	
7	**Course Description**	**This course is designed to impart a critical theoretical and detailed practical knowledge of a range of Emerging technologies and digital transformation.**	

8	**Outline syllabus**		**CO Mapping**
	Unit 1	**Emerging Technologies**	
	A	Emerging technology-definition, History, Examples	**CO1**
	B	Category: Emerging Technologies**,** Advantages: Efficiency, Safety, Health, Environmental Conservation	**CO1**
	C	Disadvantages of Emerging technologies, Innovations in Emerging technologies.	**CO1**
	Unit 2	**Artificial Intelligence**	
	A	Introduction to AI, Applications and examples of AI, AI issues, concerns and ethical consideration.	**CO1,CO2**
	B	Approaches to AI, Knowledge Representation, Planning	**CO1,CO2**
	C	Natural Language Processing, Multi Agent Systems, Genetic Algorithms	**CO1,CO2**
	Unit 3	**Machine Learning**	
	A	Problems Machine Learning Can Solve, Supervised Learning, Unsupervised Learning and Preprocessing and Reinforcement Learning	**CO2,CO3**
	B	Supervised Machine Learning Algorithms: K-nearest neighbours, Linear Models, Decision Trees, Naive Bayes Classifiers	**CO2,CO3**
	C	Types of Unsupervised learning algorithms, challenges, Dimensionality Reduction, Feature Extraction, Clustering	**CO2,CO3**
	Unit 4	**Block Chain Technology**	
	A	Blockchain basics and the role of money, Applications and Exchanges, Blockchain Network	**CO4**
	B	Blockchain philosophy and cryptonomics, Life of Blockchain	**CO4**

<table>
<tr><td></td><td></td><td colspan="3">application, Private and Public blockchain</td><td></td></tr>
<tr><td></td><td>C</td><td colspan="3">Cryptocurrency, Cryptocurrency, Regulation, Distributed Consensus</td><td>CO4</td></tr>
<tr><td></td><td>Unit 5</td><td colspan="3">Digital Transformation</td><td></td></tr>
<tr><td></td><td>A</td><td colspan="3">Definition, Historic development ,Development-Digitization, Digitalization ,Connecting old and new technology</td><td>CO6,CO5</td></tr>
<tr><td></td><td>B</td><td colspan="3">Opportunities and challenges-ecommerce ,banking, hospitality management, healthcare, More customer centric focus, Improved customer Strategy, Reduced Costs</td><td>CO6,CO5</td></tr>
<tr><td></td><td>C</td><td colspan="3">Analytics, New product or services, Reduced Costs</td><td>CO6,CO5</td></tr>
<tr><td>s</td><td>Mode of examination</td><td colspan="3">Theory</td><td></td></tr>
<tr><td></td><td rowspan="2">Weightage Distribution</td><td>CA</td><td>MTE</td><td>ETE</td><td></td></tr>
<tr><td></td><td>30%</td><td>20%</td><td>50%</td><td></td></tr>
<tr><td></td><td>Text book/s*</td><td colspan="3">Designing for Emerging Technologies: UX for Genomics, Robotics, and the Internet of Things-O'reilly
Digital Transformation: Build Your Organization's Future for the Innovation Age- Lindsay Herbert</td><td></td></tr>
<tr><td></td><td>Other References</td><td colspan="3">1. Digital Transformation: A Model to Master Digital Disruption- Dado Van Peteghem and Jo Caudron</td><td></td></tr>
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S. No.	**Course Outcome**	**Program Outcomes (PO) & Program Specific Outcomes (PSO)**
1.	**CO1. Introduction to Emerging technologies**	**PO1, PO3, PSO3**
2.	**CO2. Category: Emerging Technologies**	**PO1, PO2, PO3, PSO1, PSO2**
3.	**CO3. Benefits of emerging technologies**	**PO2, PO3, PO4, PO9, PSO1, PSO2**
4.	**CO4: Understanding the basic of Blockchain Technology**	**PO1, PO2, PSO2**
5.	**CO5. Introduction to digital transformation**	**PO3, PO9, PSO1, PSO2**
6.	**CO6: Digital transformation advantages**	**PO1, PO2, PO9, PSO1,PSO3**

Course Code	**Course Name**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CSE	**Emerging Technology and Digital Transformation**															
	CO1	**2**		**1**										**2**		**1**
	CO2		**2**		**1**					**2**				**3**	**1**	
	CO3	**3**	**3**	**2**						**3**					**3**	
	CO4	**3**	**3**	**2**	**3**					**3**					**3**	
	CO5		**1**	**2**												**2**
	CO6			**3**	**3**	**2**										**3**

Course Name: CSE026, Cloud Web Services

School:		Batch : 2019	
Program:		Current Academic Year:	
Branch:			
1	Course Code	CSE026	Course Name
2	Course Title	Cloud Web Services	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Semester-05	
5	Course Objective	Students will try to learn: 1. To impart the basic concepts of AWS Ecosystem and Security Services 2. To understand concepts about Compute and Networking Services 3. To Understand basic concepts about storage services and Database engines 4. To understanding about developing, deploying and publishing the application in AWS cloud.	
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Ability to analyze the cloud service categories CO2: Ability to summarize compute services and implementation CO3: Ability to describe the Networking services and connecting from on premise to cloud CO4: Ability to have knowledge of development, deployment and monitoring of cloud services. CO5: To understand about developing, deploying and publishing the application in AWS cloud. CO6: To Understand Amazon CloudWatch, Amazon CloudWatch Event, Amazon CloudWatch Logs	
7	Course Description	This course introduces the Cloud web services	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Cloud Services	
	A	Introduction to AWS Ecosystem, AWS Certifications, Reference Architecture,	CO1,CO3,
	B	Introduction to AWS Cloud Services, Security on AWS, Security your AWS Account with AWS Identity and Access Management,	CO1,CO6
	C	Securing AWS Cloud Services, Monitoring to enhance Security, AWS Cloud Service-Specific Security.	CO1, CO3
	Unit 2	Compute and Networking Services	

	A	Introduction to AWS Compute Services, Amazon EC2, Amazon EC2 Container Services, AWS Elastic Beanstalk, AWS Lambda, Amazon Lightsail,			CO1, CO2
	B	Mapping Elastic IP to running EC2 Instance, Mapping Elastic IP to Domain, AWS Batch, Introduction to Networking on AWS, Amazon Virtual Private Cloud ,			CO1, CO2
	C	AWS Direct Connect, Load Balancing, Virtual Private Network (VPN), Amazon Route53, Amazon Cloud Front			CO1, CO2,CO3
	Unit 3	Storage System and Database			
	A	Understanding Different Storage Options, Block Storage On AWS, Object Storage on AWS,			CO3
	B	System Operator Scenario, Additional Storage Solutions, Introduction to AWS Databases, Monitoring Amazon RDS,			CO3
	C	Non Rational Databases, Amazon DynamoDB, Amazon Redshift , Monitoring Clusters, Amazon Elastic ache.			CO3,CO6
	Unit 4	Application Development			
	A	Introduction to Application Development and Management, Deployment Strategies,			CO1,CO2,CO3,CO4
	B	Deployment Services, AWS Elastic Beanstalk, EC2 Container Service, AWS OpsWorks Stacks, AWS CloudFormation, Installing a LAMP Web Server			CO1,CO2,CO3,CO4
	C	High Availability: Introduction to high Availability, Simple Queue Services, Simple Notification Service, Simple Email Service, highly available Architectures, Multi region high Availability, Disaster recovery			CO1,CO2,CO3,CO4,CO6
	Unit 5	Monitoring and Metrics:			
	A	Introduction to Monitoring and Metrics, Overview of Monitoring,			CO1,CO2,CO3,CO5
	B	Amazon CloudWatch, Amazon CloudWatch Event, Amazon CloudWatch Logs,			CO1,CO2,CO3,CO5
	C	Monitoring AWS Charges AWS CloudTrail, AWSConfig.			CO1,CO2,CO3,CO5
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. AWS Certified SysOps Administrator Official Study Guide: Associate Exam by Stephen Cole, ISBN No – 978- 1- 119-37742-9 2. AWS Certified Solutions Architect Official Study Guide by Joe Baron			
	Other	1. Implementing DevOps on AWS by Veselin Kantsev (Author) 2. AWS Automation Cookbook by Nikit Swaraj (Author)			

	References	3. AWS Administration Cookbook by Lucas Chan , Rowan Udell 4. Cloud Computing for Dummies by Judith Hurwitz

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Ability to analyze the cloud service categories	PO1, PO3, PSO3
2.	CO2: Ability to summarize compute services and implementation	PO1, PO2, PO3, PSO1, PSO2
3.	CO3: Ability to describe the Networking services and connecting from on premise to cloud	PO2, PO3, PO4, PO9, PSO1, PSO2
4.	CO4: Ability to have knowledge of development, deployment and monitoring of cloud services.	PO3, PO9, PSO1, PSO2
5.	CO5: To understand about developing, deploying and publishing the application in AWS cloud.	PO2, PO4, PO9, PSO1, PSO2
6.	CO6: To Understand Amazon CloudWatch, Amazon CloudWatch Event, Amazon CloudWatch Logs.	PO2, PO3, PO9, PSO1

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
CSE	Cloud web services															
	CO1	2	3	1	_	_	_	_	_	_	_	_	_	2	_	1
	CO2		2		1	3		_	_	2	_	_	_	3	1	_
	CO3	3	3	2	2	_		_	_	3	_	_	_	_	3	_
	CO4	3	3	2	3	_	3	_	_	3	_	_	_	_	3	_
	CO5	3	3	2	2	_	_	_	_	3	_	_	_	_	3	_
	CO6	3	1	2	3	_	2	_	_	1	_	_	_	_	3	_

School: SET		Batch : 2019	
Program: B.Tech		Current Academic Year:2019-2020	
Branch:CSE		Semester: VI	
1	Course Code	CSE475	Course Name
2	Course Title	Security & Privacy of Online Social Networks	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	1. This course describes the digital interactions for more than half a billion users around the world. The various personal information sharing practices that online social network providers promote have led to their success as innovative social interaction platforms. 2. In this study, we have designed the course to learn about user views of online privacy, user knowledge about OSNs privacy settings, and user awareness of privacy disclosure. Our goal is to find out from the users whether and how well users are knowledgeable of, satisfied with, and able to effectively use available privacy settings.	
6	Course Outcomes	After the successful completion of this course, students will be able to : CO1: Fundamentals of OSN, Security & privacy objectives in online social networks. CO2: Identify the data sets & collecting data from social networks and learn how to do analytics of the data set. CO3: Understand the concepts of information obtained from this study can be used to help OSNs adjust their privacy settings to better match user expectations, and help privacy advocates design better ways to help users control the disclosure of their online information. CO4: Understands the Privacy and security of online social media need to be investigated, studied and characterized from various perspectives (computational, cultural, psychological, etc.). CO5: Identify the security Protection Tools & access control methods to secure the data in OSN. CO6: Able to understand intrusion detection & methods	
7	Course Description	This course takes a multi-disciplinary perspective of information security and privacy, looking at technologies as well as business, legal, policy and usability issues.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Online Social Networks	
	A	Introduction to OSN, Social network providers & their customers, Functional Overview of OSN: Networking functions, Data Functions, Access control functions, Data contained in Online Social Networks.	CO1, CO2
	B	Main threats in OSN: Security and privacy objectives :	CO1, CO2

		Privacy ,Integrity ,Availability ,Attack Spectrum and Countermeasures ,The Big Brother's problem	
	C	Representation of Social, challenges, opportunities, and pitfalls in online social networks.	CO1, CO2
	Unit 2	Introduction to Social media API	
	A	Introduction to APIs, purpose of API, Working of API, basics of python, Collecting data from Online Social Media.	CO1, CO2
	B	How to use Facebook/Twitter API ,Retrieval & Storage of structured & unstructured data, Data analysis using python, Storage tools	CO1, CO2
	C	Trust & credibility on OSM, Security and Privacy-related Threats to Social Networks	CO1, CO2
	Unit 3	Online social Media and Policing	
	A	Current landscape of Social media, Intelligence & Surveillance, Social Media Policies, Types of protections, challenges and opportunities	CO3,CO4
	B	Using Social Media and Social Network Analysis in Law Enforcement, Active Monitoring of High-Risk Situations.	CO3,CO4
	C	User-anonymity on Social Networks, Professional issues, Legal Issues and Aspects	CO3,CO4
	Unit 4	Privacy Disclosure	
	A	Information privacy disclosure, Revelation and its effects in OSM and online social networks	CO3,CO4
	B	Phishing in OSM & Identifying fraudulent entities in online social networks	CO3,CO4
	C	Collaborative Privacy Management for Third-Party Applications in Online Social Networks	CO3,CO4
	Unit 5	Access Control and Methodology	
	A	Information protection requirements and environment, security technology and tools, access control methodologies.	CO5,CO6
	B	Information intrusion detection, analysis methods, authentication considerations.	CO5,CO6
	C	Access control Models, Access control in OSN	CO5,CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 30% / MTE: 20% / ETE: 50%	
	Text book/s*	Privacy and Security for Online Social Networks: Challenges and Opportunities, Chi Zhang and Jinyuan Sun, University of Florida Xiaoyan Zhu, Xidian University Yuguang Fang, University of Florida and Xidian University	
	Other References	http://www.eurecom.fr/en/publication/3069/download/rs-publi-3069.pdf	

CO and PO Mapping

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1: Fundamentals of OSN, Security & privacy objectives in online social networks.**	**PO1,PO2,PO3,PO4,PSO1**
2.	**CO2: Identify the data sets & collecting data from social networks and learn how to do analytics of the data set, Basics of API's.**	**PO1, PO3, PO4, PSO2**
3.	**CO3: Describes the concepts of information obtained from this study can be used to help OSNs adjust their privacy settings to better match user expectations, and help privacy advocates design better ways to help users control the disclosure of their online information.**	**PO1,PO2,PO3,PO4**
4.	**CO4: Understands the Privacy and security of online social media need to be investigated, studied and characterized from various perspectives (computational, cultural, psychological, etc.).**	**PO9, PO10,PO11, PSO5**
5.	**CO5: Identify the security Protection Tools & access control methods to secure the data in OSN.**	**PO1,PO2,PO3,PO4,PSO1**
6.	**CO6: Able to understand intrusion detection & methods**	**PO1,PO2, PO4**

PO and PSO mapping with level of strength for Course Name Security & Privacy of Online Social Networks (Course Code)

Cos	PO1	P O 2	PO 3	PO 4	PO 5	P O 6	PO 7	PO 8	PO9	PO 10	P O 1 1	PO 12	P S O 1	PSO 2	PSO 3
CO1	3	2	2	3	--	--	--	2	2	1	2	1	3	2	2
CO2	3	2	3	3	--	--	--	2	2	2	1	1	2	3	2
CO3	3	--	--	3	--	--	--	1	1	1	3	2	3	2	1
CO4	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
CO5	2	2	2	2	1	--	--	2	3	3	3	1	2	2	2
CO6	_	3	_	1	2	_	1	_	2	2	_	3	3	_	1

1-Slight (Low) 2-Moderate (Medium) 3-Substantial (High)

CSE473, Critical Infrastructure Security

School: SET		**Batch :2019-2023**	
Program: B.Tech		**Current Academic Year: 2019-20**	
Branch: CSE		**Semester: VII**	
1	**Course Code**	**CSE473**	**Course Name: Critical Infrastructure Security**
2	**Course Title**		
3	**Credits**	**3**	
4	**Contact Hours (L-T-P)**	**3-0-0**	
	Course Status	**Elective**	
5	**Course Objective**	**Identify the key research questions in the area of cyber-security of critical infrastructure, Apply research methods which includes survey, experiments, and articulation of research problems in this area, and methods for finding solutions to selected problems.**	
6	**Course Outcomes**	**Upon successful completion of this course, the student will be able to:** CO1. Critical Infrastructure Introduction CO2. Cyber threat modeling CO3. Machine Learning Techniques CO4. Game Theoretic formulation CO5: Critical infrastructure risk management CO6: Understanding advantages of game theoretic modelling	
7	**Course Description**	**This course is designed to impart a critical theoretical and detailed practical knowledge of a range of Critical infrastructure Security.**	

8	**Outline syllabus**		**CO Mapping**
	Unit 1	**Critical Infrastructure**	
	A	Introduction, Critical Infrastructures such as Power Grid, Railways Systems, Transportation Systems, Water/Sewage Systems	**CO1**
	B	Automation architecture, Vulnerabilities, and Past Cases of Cyber Security Compromises and Trends Stuxnet Case Study	**CO1**
	C	Industry Automation and SCADA Systems	**CO1**
	Unit 2	Cyber Threat Modeling	
	A	Various Types of Cyber Threats to Industrial Critical System	**CO1,CO2**
	B	System Modeled in a 3 dimensional Attack Space in terms of adversary Model	**CO1,CO2**
	C	Understanding various attacks in this Model	**CO1,CO2**
	Unit 3	Machine Learning Techniques	
	A	Cyber Physical Systems under attacks and study of their physical dynamic	**CO2,CO3,CO6**
	B	distinguish between a normal behavior vs. behavior under attack	**CO2,CO3**
	C	use of machine learning techniques to distinguish and detect in real-time	**CO2,CO3,CO6**
	Unit 4	Game Theoretic formulation	
	A	Modeling an attacker vs. Defender game	**CO4**
	B	Nash Equilibrium criteria	**CO4**
	C	Understanding advantages of game theoretic modelling	**CO4,CO6**

	Unit 5	**Critical infrastructure risk management**			
	A	**Physical security ,Cybersecurity , Insider threats (including personnel security)**			**CO4,CO5**
	B	**Systems dependencies/interdependencies**			**CO4,CO5**
	C	**Jurisdictional considerations, Sector approaches**			**CO4,CO5**
s	**Mode of examination**	**Theory**			
	Weightage Distribution	**CA**	**MTE**	**ETE**	
		30%	**20%**	**50%**	
	Text book/s*	**1. Handbook on Securing Cyber-Physical Critical Infrastructure, Sajal K. Das, Krishna Kant, Nan Zhang, Morgan Kaufmann (Elsevier), ISBN 978-0-12-415815-3, Publication: 2012.**			
	Other References	**1. Lewis, Ted G. (ed.), Critical Infrastructure Protection in Homeland Security: Defending a Networked Nation, Second Edition, John Wiley & Sons, Inc., 2015.** **2. Collins, Pamela A. and Baggett, Ryan K., Homeland Security and Critical Infrastructure Protection, Praeger Security International, 2009.**			

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	**CO1. Critical Infrastructure Introduction**	**PO1, PO3, PSO3**
2.	**CO2. Cyber threat modeling**	**PO1, PO2, PO3, PSO1, PSO2**
3.	**CO3.** Machine Learning Techniques	**PO2, PO3, PO4, PO9, PSO1, PSO2**
4.	**CO4.** Game Theoretic formulation	**PO3, PO9, PSO1, PSO2**
5.	**CO5: Critical infrastructure risk management**	**PO1, PO2, PO9, PSO1,PSO3**

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE	Critical Infrastructure Management															
	CO1	2		1										2		1
	CO2		2		1					2				3	1	
	CO3	3	3	2	2					3					3	
	CO4	3	3	2	3		3			3					3	
	CO5		1	2												2
	CO6			3	3	2										3

Course Name: CSE067, Disaster Recovery and Business Continuity Management (DRBCM1)

School : SET		Batch : 2019	
Program:		Current Academic Year:	
Branch:		Semester: VII	
1	Course Code	CSE067	Course Name: B.Tech(CSE)
2	Course Title	Disaster Recovery and Business Continuity Management (DRBCM1)	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status		
5	Course Objective	Students will try to learn: 1. The importance of disaster recovery (DR) and business continuity management (BCM) in achieving the availability objective of Information Security. 2. Important steps and documentation involved in developing a business continuity plan (BCP) and how BCP, DRP and BCM are inter-related. 3. Various recovery strategies that are useful in BCP.	
6	Course Outcomes	On successful completion of this module students will be able to: CO1: Explain DR and BCP are useful in ensuring availability of information. CO2: Elaborate on the various steps stages and strategies in developing BCP. CO3: Identify data storage technologies appropriate for secure data backups. CO4: Investigate existing industry software and tools which support competent continuity strategies. CO5: Conduct a case study on IT organization and create a BCP. CO6: Able to prepare business continuity plan	
7	Course Description	This course provides a graduate-level comprehensive introduction to subject named Disaster Recovery and Business Continuity Management (DRBCM1).	
8	Outline syllabus		CO Mapping
	Unit 1	Business Continuity Management (BCP)	
	A	Introduction to Business Continuity Planning (BCP), Business Resumption Plan (BRP) or Disaster Recovery Plan (DRP)	CO1, CO2
	B	Common terminologies used in BCP and DRP, Business Continuity Management (BCM), NIST SP800-34 Emergency Action plan which includes the phases of Recover/Resume, Protect and Sustain, Causes of Disasters.	CO1
	Unit 2	Stages in BCP	
	A	BCP objectives. Information Protection Environment. Security Technology and Tools.	CO1, CO2
	B	Steps involved in creating a BCP, Phase 1: Project Management and Initiation. Phase 2: Business Impact Analysis. Phase 3: Recovery Strategies, Phase 4: Plan Development and Implementation..	CO1, CO2,CO3

	Unit 3	Business Recovery strategies			
	A	Facility and Supply Recovery strategies. User Recovery strategies. Technical Recovery strategies, Data Recovery strategies, Activation Phase- Major Disaster or Disruption, Intermediate Disaster or Disruption			CO1, CO3
	B	Minor Disaster, Activating BC/DR Teams, Developing Triggers, Transition Trigger. Defining BC/DR Team and Key Personnel, Defining Tasks, Assigning Resources, Communication Plan.			CO2,CO3,CO6
	Unit 4	Testing, Maintenance, Awareness & Training Mechanisms			
	A	Different types of tests including structured walk-through.			CO2, CO3,CO4
	B	Checklist test, simulation, parallel test and full interruption test. Steps required to maintain a BCP			CO2, CO3, CO4,CO6
	Unit 5	Preparation of BCP			
	A	Requirements for BCP awareness and training			CO4,CO5
	B	Conduct a case study of IT Organization and prepare a Business Continuity Plan for the same using the learning from this course			CO4,CO5,CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Business Continuity and Disaster Recovery Planning for IT Professionals by Susan Snedaker, Syngress; 2 edition (31 October 2013) 2. Business Continuity and Disaster Recovery Planning by Stuart Hotchkiss, BCS, The Chartered Institute for IT, 1st ed; 2011 3. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices by Nina Godbole, Wiley, 1st ed; 2008 4. Planning for Disaster: A Business Survival Guide by Harry Flowers, CreateSpace Independent Publishing Platform; 1 edition (15 August 2015)			

S. No.	Course Outcome	Program Outcomes (PO) & Program Specific Outcomes (PSO)
1.	CO1: Explain DR and BCP are useful in ensuring availability of information.	PO1, PO3, PSO3
2.	CO2: Elaborate on the various steps stages and strategies in developing BCP.	PO1, PO2, PO3, PSO1, PSO2
3.	CO3: Identify data storage technologies appropriate for secure data backups.	PO2, PO3, PO4, PO9, PSO1, PSO2
4.	CO4: Investigate existing industry software and tools which support competent continuity strategies.	PO3, PO9, PSO1, PSO2
5.	CO5: Conduct a case study on IT organization and create a BCP.	PO1, PO2, PO9, PSO1,PSO3
6.	CO6: Able to prepare business continuity plan	PO2, PO9, PSO1,PSO3

Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CSE	**Disaster Recovery and Business Continuity Management (DRBCM1)**															
	CO1	2		1										2		1
	CO2		2		1					2				3	1	
	CO3	3	3	2	2					3					3	
	CO4	3	3	2	3		3			3					3	
	CO5		1	2												2
	CO6			3	3	2										3