SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

Puducherry

(As per UGC - 2018 Regulations and Affiliated to Pondicherry University)

PUDUCHERRY – 605107

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.TECH.

COMPUTER SCIENCE AND ENGINEERING

(REGULATIONS - 2023)

CURRICULUM AND SYLLABI

Dr.K.PREMKUMAR
Professor & Head
Dept. of Computer Science and Engg.
Sri Manakula Vinayagar Engg. College
[An Autonomous Institution]

COLLEGE VISION AND MISSION

VISION

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society.

MISSION

M1: Quality Education : To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

M2: Research and Innovation : To foster value-based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

M3: Employability and Entrepreneurship : To inculcate the employability and entrepreneurial skills through value and skill based training.

M4: Ethical Values : To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

DEPARTMENT VISION AND MISSION

VISION

To create a productive learning and research environment for graduates to become highly dynamic, competent, ethically responsible, professionally knowledgeable in the field of computer science and engineering to meet the industrial needs on par with global standards.

MISSION

M1: Quality Education: Empowering the students with the necessary technical skills through quality education to grow professionally.

M2: Innovative Research: Advocating the innovative research ideas by incorporating with industries for developing products and services.

M3: Placement and Entrepreneurship: Advancing the education by strengthening the Industry-academic relationship through hands-on training to seek placement in the top most industries or to develop a start-ups.

M4: Ethics and Social Responsibilities: Stimulating professional behaviour and good ethical values to improve the leadership skills and social responsibilities.

PROGRAMME OUTCOMES (POs)

PO1: Exploration of Research:

An ability to independently carry out research/investigation and development work to solve practical problems.

PO2: Technical Skill:

An ability to write and present a substantial technical report/document.

PO3: Expertise in Academics:

Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: Problem solving:

An ability to discriminate, analyzes, evaluate and synthesize the technologies to provide solution for multidimensional engineering problems.

PO5: Usage of Modern Tools:

Create, select, learn 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: Ethical Practices and Social Responsibility:

Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Technical Knowledge: To acquire a comprehensive knowledge in computer science engineering concepts and apply them for the investigation of real world problems.

PEO2: Research and Development: To prepare graduates who will demonstrate analytical, research, design and implementation skills offering techno-commercially feasible and socially acceptable solutions.

PEO3: Leadership: To prepare graduates who will demonstrate analytical, research, design and implementation skills offering techno-commercially feasible and socially acceptable solutions

PEO4: Professional Behavior: To deliver graduates to design and implement solutions for rapidly changing computing problems and information system environments to adapt innovation.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Technical Knowledge in Computer Science and Engineering: Graduates with the ability to apply basic knowledge of Computer Science in solving the critical problems.

PSO2: Multidisciplinary Competency: Ability to convert innovative ideas into research or society oriented projects through current trending technologies.

PSO3: Employability: Acquire placement in highly reputed industries or accomplish new technical business skills with the contemporary trends in the industry.

STRUCTURE FOR POST GRADUATE ENGINEERING PROGRAM

Sl.No	Course Category	Breakdown of Credits
1	Humanities and Social Sciences (HS)	6
2	Basic Sciences(BS)	3
3	Engineering Sciences (ES)	-
4	Professional Core (PC)	25
5	Professional Electives (PE)	18
6	Open Electives (OE)	-
7	Project Work and Internship(PA)	20
8	Ability Enhancement Courses (AEC)	-
9	Mandatory courses (MC)	-
Total		**72**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	Course Category	Credits per Semester				Total Credits
		I	II	III	IV	
1	Humanities and Social Sciences (HS)	4	2	-	-	6
2	Basic Sciences(BS)	3	-	-	-	3
3	Engineering Sciences (ES)	-	-	-	-	-
4	Professional Core (PC)	11	14	-	-	25
5	Professional Electives (PE)	3	6	9	-	18
6	Open Electives (OE)	-	-	-	-	-
7	Project Work and Internship(PA)			8	12	20
8	Ability Enhancement Courses (AEC)*	-	-	-	-	-
9	Mandatory Courses (MC)*	-	-	-	-	-
Total		**21**	**22**	**17**	**12**	**72**

**** AEC, MC Credits are not included for CGPA calculation***

CURRICULUM

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23MAT103	Mathematical Foundation of Formal Approach	BS	2	1	0	3	40	60	100
2	P23CSTD01	Advanced Data Structures and Algorithms	PC	3	0	0	3	40	60	100
3	P23CST102	Cloud and Big Data Analytics	PC	3	0	0	3	40	60	100
4	P23CSTD02	Speech and Language Processing	PC	3	0	0	3	40	60	100
5	P23HSTC01	Research Methodology and IPR	HS	2	0	0	2	40	60	100
6	P23CSE1XX	Professional Elective – I *	PE	3	0	0	3	40	60	100
Practical										
7	P23CSP101	Advanced Data Structures and Algorithms Laboratory	PC	0	0	4	2	50	50	100
8	P23HSPC01	Technical Report Writing and Seminar	HS	0	0	4	2	100	-	100
Ability Enhancement Course										
9	P23CSC1XX	Certification Course-I #	AEC	0	0	4	-	100	-	100
10	P23ACT10X	Audit Course-I**	AEC	0	0	2	-	100	-	100
							21	590	410	1000

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23CST203	Advanced Software Engineering and Testing	PC	3	0	0	3	40	60	100
2	P23CST204	Adhoc and Wireless Sensor Networks	PC	3	0	0	3	40	60	100
3	P23CST205	Advanced Operating Systems	PC	3	0	0	3	40	60	100
4	P23CST206	Advanced Python Programming	PC	3	0	0	3	40	60	100
5	P23CSE2XX	Professional Elective - II	PE	3	0	0	3	40	60	100
6	P23CSE2XX	Professional Elective - III	PE	3	0	0	3	40	60	100
Practical										
7	P23CSP202	Advanced Python Programming Laboratory	PC	0	0	4	2	50	50	100
8	P23HSPC02	Seminar on ICT: A Hands - On Approach	HS	0	0	4	2	100	-	100
Ability Enhancement Course										
9	P23CSC2XX	Certification Course-II #	AEC	0	0	4	-	100	-	100
10	P23ACT20X	Audit Course-II**	AEC	0	0	2	-	100	-	100
							22	590	410	1000

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23CSE1XX	Professional Elective – IV *	PE	3	0	0	3	40	60	100
2	P23CSE1XX	Professional Elective – V *	PE	3	0	0	3	40	60	100
3	P23CSE1XX	Professional Elective – VI *	PE	3	0	0	3	40	60	100
Project Work										
4	P23CSW301	Project Phase - I	PA	0	0	12	6	50	50	100
5	P23CSW302	Internship	PA	0	0	0	2	100	-	100
Ability Enhancement Course										
6	P23CSC301	NPTEL/SWAYAM/MOOC	AEC	0	0	0	-	100	-	100
							17	370	230	600

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Project Work										
1	P23CSW403	Project Phase - II	PA	0	0	24	12	50	50	100
							12	50	50	100

*** Professional Elective Courses are to be selected from the list given in Annexure I**
 # Ability Enhancement Courses are to be selected from the list given in Annexure II
**** Audit Courses are to be selected from the list given in Annexure III**

BS- Basic Sciences

PC – Professional Core

PE – Professional Elective

HS - Humanities and Social Sciences

PA - Professional Activity

CC- Common Course

AC- Audit Course

AEC - Ability Enhancement Course

CREDIT DISTRIBUTION

Semester	I	II	III	IV	Total
Credits	21	22	17	12	72

Total number of credits required to complete
M.Tech in Computer Science and Engineering : 72 credits

ANNEXURE- I

PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title
Professional Elective-I		
1	**P23CSE101**	Programming for Data Science
2	**P23CSE102**	Cyber Attacks Detection and Prevention Systems
3	**P23CSE103**	Bio-Inspired Computing
4	**P23CSE104**	Block Chain and Crypto Currency
5	**P23CSE105**	IoT Applications Engineering
Professional Elective-II		
1	**P23CSEC01**	Information Visualization
2	**P23CSE206**	Malware Analysis
3	**P23CSEC02**	Soft Computing
4	**P23BDEC01**	Neural Networks
5	**P23CSE207**	Robotic Process Automation
Professional Elective-III		
1	**P23CSEC03**	Text, Web and Social Media Analytics
2	**P23CSEC04**	Data Storage Technologies and Networks
3	**P23CSE208**	Reinforcement Learning
4	**P23CSE209**	Mobile Application and Development
5	**P23CSE210**	Wireless Sensor Networks and IoT
Professional Elective-IV		
1	**P23BDEC03**	Analytics of Things
2	**P23CSE311**	Cloud Security and Analytics
3	**P23CSE312**	Pattern Recognition
4	**P23CSEC05**	Game Design and Augmented Reality
5	**P23CSE313**	IoT Security and Trust
Professional Elective-V		
1	**P23CSEC06**	Image and Video Analytics
2	**P23CSE314**	Web Application Security
3	**P23CSE315**	Cognitive Science
4	**P23CSE316**	Cloud Application Development and Management
5	**P23CSE317**	Intelligent Internet of Things
Professional Elective-VI		
1	**P23CSE318**	Big Data Technologies
2	**P23CSE319**	Digital Forensics
3	**P23CSE320**	Knowledge Engineering and Expert Systems
4	**P23BDTD01**	NoSQL Databases
5	**P23CSE321**	Industrial IoT

ANNEXURE- II

ABILITY ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1	P23XXCX01	Adobe Photoshop
2	P23XXCX02	Adobe Animate
3	P23XXCX03	Adobe Dreamweaver
4	P23XXCX04	Adobe After Effects
5	P23XXCX05	Adobe Illustrator
6	P23XXCX06	Adobe InDesign
7	P23XXCX07	Autodesk AutoCAD -ACU
8	P23XXCX08	Autodesk Inventor - ACU
9	P23XXCX09	Autodesk Revit - ACU
10	P23XXCX10	Autodesk Fusion 360 - ACU
11	P23XXCX11	Autodesk 3ds Max - ACU
12	P23XXCX12	Autodesk Maya - ACU
13	P23XXCX13	Cloud Security Foundations
14	P23XXCX14	Cloud Computing Architecture
15	P23XXCX15	Cloud Foundation
16	P23XXCX16	Cloud Practitioner
17	P23XXCX17	Cloud Solution Architect
18	P23XXCX18	Data Engineering
19	P23XXCX19	Machine Learning Foundation
20	P23XXCX20	Robotic Process Automation / Medical Robotics
21	P23XXCX21	Advance Programming Using C
22	P23XXCX22	Advance Programming Using C ++
23	P23XXCX23	C Programming
24	P23XXCX24	C++ Programming
25	P23XXCX25	CCNP Enterprise: Advanced Routing
26	P23XXCX26	CCNP Enterprise: Core Networking
27	P23XXCX27	Cisco Certified Network Associate - Level 2
28	P23XXCX28	Cisco Certified Network Associate- Level 1
29	P23XXCX29	Cisco Certified Network Associate- Level 3
30	P23XXCX30	Fundamentals Of Internet of Things
31	P23XXCX31	Internet Of Things / Solar and Smart Energy System with IoT
32	P23XXCX32	Java Script Programming
33	P23XXCX33	NGD Linux Essentials
34	P23XXCX34	NGD Linux I
35	P23XXCX35	NGD Linux II

36	P23XXCX36	Advance Java Programming
37	P23XXCX37	Android Programming / Android Medical App Development
38	P23XXCX38	Angular JS
39	P23XXCX39	Catia
40	P23XXCX40	Communication Skills for Business
41	P23XXCX41	Coral Draw
42	P23XXCX42	Data Science Using R
43	P23XXCX43	Digital Marketing
44	P23XXCX44	Embedded System Using C
45	P23XXCX45	Embedded System with IOT / Arduino
46	P23XXCX46	English For IT
47	P23XXCX47	Plaxis
48	P23XXCX48	Sketch Up
49	P23XXCX49	Financial Planning, Banking and Investment Management
50	P23XXCX50	Foundation Of Stock Market Investing
51	P23XXCX51	Machine Learning / Machine Learning for Medical Diagnosis
52	P23XXCX52	IOT Using Python
53	P23XXCX53	Creo (Modelling & Simulation)
54	P23XXCX54	Soft Skills, Verbal, Aptitude
55	P23XXCX55	Software Testing
56	P23XXCX56	MX-Road
57	P23XXCX57	CLO 3D
58	P23XXCX58	Solid works
59	P23XXCX59	Staad Pro
60	P23XXCX60	Total Station
61	P23XXCX61	Hydraulic Automation
62	P23XXCX62	Industrial Automation
63	P23XXCX63	Pneumatics Automation
64	P23XXCX64	Agile Methodologies
65	P23XXCX65	Block Chain
66	P23XXCX66	Devops
67	P23XXCX67	Artificial Intelligence
68	P23XXCX68	Cloud Computing
69	P23XXCX69	Computational Thinking
70	P23XXCX70	Cyber Security
71	P23XXCX71	Data Analytics
72	P23XXCX72	Databases
73	P23XXCX73	Java Programming

74	P23XXCX74	Networking
75	P23XXCX75	Python Programming
76	P23XXCX76	Web Application Development (HTML, CSS, JS)
77	P23XXCX77	Network Security
78	P23XXCX78	MATLAB
79	P23XXCX79	Azure Fundamentals
80	P23XXCX80	Azure AI (AI-900)
81	P23XXCX81	Azure Data (DP -900)
82	P23XXCX82	Microsoft 365 Fundamentals (SS-900)
83	P23XXCX83	Microsoft Security, Compliance and Identity (SC-900)
84	P23XXCX84	Microsoft Power Platform (PI-900)
85	P23XXCX85	Microsoft Dynamics Fundamentals 365 – CRM
86	P23XXCX86	Microsoft Excel
87	P23XXCX87	Microsoft Excel Expert
88	P23XXCX88	Securities Market Foundation
89	P23XXCX89	Derivatives Equinity
90	P23XXCX90	Research Analyst
91	P23XXCX91	Portfolio Management Services
92	P23XXCX92	Cyber Security
93	P23XXCX93	Cloud Security
94	P23XXCX94	PMI – Ready
95	P23XXCX95	Tally – GST & TDS
96	P23XXCX96	Advance Tally
97	P23XXCX97	Associate Artist
98	P23XXCX98	Certified Unity Programming
99	P23XXCX99	VR Development

ANNEXURE-III

AUDIT COURSES
(Common to all M.Tech Programme)

Sl. No.	Course Code	Course Title
1	P23ACTX01	English for Research Paper Writing
2	P23ACTX02	Disaster Management
3	P23ACTX03	Sanskrit for Technical Knowledge
4	P23ACTX04	Value Education
5	P23ACTX05	Constitution of India
6	P23ACTX06	Pedagogy Studies
7	P23ACTX07	Stress Management by Yoga
8	P23ACTX08	Personality Development Through Life Enlightenment Skills
9	P23ACTX09	Unnat Bharat Abhiyan

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **BS**			*End Semester Exam Type: **TE**			
Course Code	**P23MAT103**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Mathematical Foundation of Formal Approach**	**2**	**1**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basic Mathematics		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Basic knowledge of matrix, Set theory, functions and relations concepts needed for designing and solving problems.	**K2**
	CO2	Logical operations and predicate calculus needed for computing skill.	**K3**
	CO3	Design and solve Boolean functions for defined problems.	**K3**
	CO4	Apply the acquired knowledge of formal languages to engineering areas like Compiler Design.	**K3**
	CO5	Apply the acquired knowledge of finite automata theory and to design discrete problems to solve by Computers.	**K3**

UNIT- I	**Matrix Algebra**	**Periods: 9**	
Matrices - Rank of a matrix - Solving system of equations – Eigen values and Eigenvectors - Cayley - Hamilton theorem - Inverse of a matrix.			**CO1**
UNIT- II	**Basic Set Theory**	**Periods: 9**	
Basic definitions - Venn diagrams and set operations - Laws of set theory - Principle of inclusion and exclusion – Partitions - Permutation and combination – Relations - Properties of relations - Matrices of relations - Closure operations on relations - Functions - Injective, subjective and objective functions.			**CO2**
UNIT- III	**Mathematical Logic**	**Periods: 9**	
Propositions and logical operators - Truth table - Propositions generated by a set - Equivalence and implication - Basic laws - Some more connectives - Functionally complete set of connectives - Normal forms - Proofs in propositional calculus - Predicate calculus.			**CO3**
UNIT- IV	**Formal Languages**	**Periods: 9**	
Languages and grammars - Phrase structure grammar - Classification of grammars -Pumping lemma for regular languages - Context free languages.			**CO4**
UNIT- V	**Finite State Automata**	**Periods: 9**	
Finite state automata - Deterministic finite state automata (DFA) - Non deterministic finite state automata (NFA) - Equivalence of DFA and NFA - Equivalence of NFA and Regular Languages.			**CO5**

Lecture Periods: 30	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. David Makinson, “Sets, Logic and Maths for Computing”, Springer Indian Reprint, 2011.
2. Grimaldi, R.P and Ramana, B.V. "Discrete and Combinatorial Mathematics", Pearson Education, Fifth Edition, 2006.
3. Hopcroft J.E and Ullman,J.D, “Introduction to Automata Theory, Languages and Computation”, Narosa Publishing House, Delhi, 2002.
C W. Evans, “Engineering Mathematics”, A Programmed Approach, 3rd Edition, 2019.

Reference Books

1. Kenneth H. Rosen, “Discrete Mathematics and Its Applications”, Tata McGraw Hill, 4th Edition, 2002.
2. Sengadir, T. “Discrete Mathematics and Combinatorics" Pearson Education, New Delhi, 2009.
3. Trembley, J.P. and Manohar, R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, New Delhi, 2007.
4. Venkataraman, M.K., “Engineering Mathematics”, Volume-II, National Publishing Company, Second Edition, 1989.
5. Dr. A. Singaravelu, “Engineering Mathematics - I”, Meenakshi publications, Tamil Nadu, 2019.

Web References

1. https://sites.math.northwestern.edu/~mlerma/courses/cs310-05s/
2. https://csd.cs.cmu.edu/course-profiles/15-151-Mathematical-Foundations-for-Computer-Science
3. https://www.coursera.org/learn/mathematics-for-computer-science
4. https://www.cse.iitb.ac.in/~supratik/courses/cs719/index.html
5. https://www.irif.fr/~jep/PDF/MPRI/MPRI.pd

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	1	2	1
2	3	2	1	1	-	1	2	2	1
3	3	2	1	1	-	1	2	2	1
4	3	2	1	1	-	-	2	2	1
5	3	2	1	1	-	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23CSTD01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Data Structures and Algorithms**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

(Common to M.Tech CSE and CSE(BDA))

Prerequisite	**Basics of Data Structures and Algorithms**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Demonstrate various algorithm notations and algorithm correctness.	**K2**
	CO2 Construct various applications based on sorting and tree data structure.	**K2**
	CO3 Experiment with the performance of various Text Processing operations.	**K3**
	CO4 Apply graph data structures to the real time applications	**K3**
	CO5 Illustrate the performance of the polynomial time algorithm.	**K2**

UNIT- I	**Algorithm Notations And Representations**	**Periods: 9**	
Mathematical Induction - Asymptotic Notations – Algorithm Analysis - NP-Hard and NP-Completeness – Recurrence Equations – Solving Recurrence Equations – Memory Representation of Multi-dimensional Arrays – Time-Space Tradeoffs.			**CO1**
UNIT- II	**Sorting and Trees**	**Periods: 9**	
Heapsort – Quicksort – Topological sort - Sorting in Linear Time – Elementary Data Structures – Hash Tables – Hash Functions- Binary Search Trees – AVL Trees – Red Black trees – Multi-way Search Trees –B-Trees- Fibonacci Heaps – van Emde Boas Trees – Data Structures for Disjoint Sets.			**CO2**
UNIT- III	**Text Processing Operations**	**Periods: 9**	
Text Processing: String Operations - Brute-Force Pattern Matching - The Boyer-Moore Algorithm - The Knuth-Morris-Pratt Algorithm - Standard Tries - Compressed Tries - Suffix Tries - The Huffman Coding Algorithm - The Longest Common Subsequence Problem (LCS) - Applying Dynamic Programming to the LCS Problem.			**CO3**
UNIT- IV	**Graph Algorithms**	**Periods: 9**	
Elementary graph Algorithms – Minimum Spanning Trees – Single Source Shortest Paths- All Pairs Shortest Paths – Maximum Flow - Multithreaded Algorithms – Matrix Operations.			**CO4**
UNIT- V	**Dynamic Programming**	**Periods: 9**	
Linear programming – Polynomials and Fast Fourier Transform – Number Theoretic Algorithms – Computational Geometry –NP-Completeness – Approximation Algorithms.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, PHI, Third Edition, 2016
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education, Second Edition, 2004.
3. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, Computational Geometry: Algorithms and Applications, Springer, Third edition, 2008.

Reference Books

1. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, “Data Structures and Algorithms”, Addison Wesley, Fifth Edition, 2017.
2. Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company, Sixth Edition, 2016.
3. Narasimha karumanchi, Data Structures and algorithms made easy, Fifth Edition, 2017.
4. E. Horowitz, S.Sahni and Dinesh Mehta, “Fundamentals of Data structures in C++”, University Press, Fourth Edition, 2007.
5. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, Second Edition, 2002.

Web References

1. https://www.javatpoint.com/data-structure-tutorial/
2. https://www.studytonight.com/data-structures/
3. https://www.tutorialspoint.com/data_structures_algorithms/
4. https://www.w3schools.in/data-structures-tutorial/intro/
5. https://www.geeksforgeeks.org/data-structures

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	2	1	2	2	3	2	2
2	1	2	2	2	2	2	3	2	2
3	2	3	3	1	3	3	3	3	3
4	2	3	3	1	3	3	3	3	3
5	2	3	3	1	3	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23CST102**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Cloud and Big Data Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Cloud computing	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the core concepts of the cloud computing paradigm.	**K3**
	CO2 Apply fundamental concepts in cloud infrastructures.	**K4**
	CO3 Illustrate the fundamental concepts of network virtualization and geo-distributed cloud.	**K4**
	CO4 Identify Big Data and its Business Implications.	**K3**
	CO5 List the components of Hadoop and Hadoop Eco-System, Access and Process Data on Distributed File System.	**K4**

UNIT- I	**Introduction**	**Periods: 9**	
Introduction to Cloud Computing- The Evolution of Cloud Computing – Hardware Evolution – Internet Software Evolution – Server Virtualization - Cloud Services - Cloud Service Administration - Cloud Data Management.			**CO1**
UNIT- II	**Cloud Infrastructure**	**Periods: 9**	
Cloud Infrastructure: Introduction - Advancing towards a Utility Model – Evolving IT infrastructure – Evolving Software Applications – Continuum of Utilities- Standards and Working Groups - Standards Bodies and Working Groups – Service Oriented Architecture – Business Process Execution Language – Interoperability Standards for Data Center Management - Utility Computing Technology – Virtualization – Hyper Threading – Blade Servers - Automated Provisioning - Policy Based Automation – Application Management – Evaluating Utility Management Technology - Virtual Test and development Environment - Data Center Challenges and Solutions - Automating the Data Center.			**CO2**
UNIT- III	**Network Virtualization and Geo-Distributed Cloud**	**Periods: 9**	
Cloud computing and server virtualization-networking of virtual machines inside hypervisor – Docker – software defined network – Network virtualization in multi-tenant data centers - VL2 - NVP – Geo distributed cloud data centers			**CO3**
UNIT- IV	**Introduction To Big Data and Hadoop**	**Periods: 9**	
Types of Digital Data - Introduction to Big Data - Big Data Analytics - History of Hadoop - Apache Hadoop - Analysing Data with Unix tools - Analyzing Data with Hadoop - Hadoop Streaming - Hadoop Echo System - IBM Big Data Strategy - Introduction to Ionosphere Big Insights and Big Sheets.			**CO4**
UNIT- V	**HDFS (Hadoop Distributed File System) and Map Reduce**	**Periods: 9**	
The Design of HDFS - HDFS Concepts - Command Line Interface - Hadoop file system interfaces - Data flow - Data Ingest with Flume and Scoop and Hadoop archives - Hadoop I/O: Compression – Serialization Avro and File-Based Data structures. Anatomy of a Map Reduce Job Run – Failures - Job Scheduling - Shuffle and Sort - Task Execution - Map Reduce Types and Formats - Map Reduce Features.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. RajivMisra, Yashwant singh patel, "Cloud and Distributed Computing: Algorithm and systems", Wiley, First edition, 2020.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Ritting house, John W., and James F. Ransome, Cloud Computing: Implementation, Management and Security, CRC Press, 2017.

Reference Books

1. John W. Rittinghouse and James F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, Taylor & Francis Group, Boca Raton London New York, 2010.
2. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC, 2007.
3. Bunker and Darren Thomson, "Delivering Utility Computing", John Wiley & Sons Ltd, 2006.
4. Tom White, "Hadoop : The Definitive Guide", O'reily Media, Third Edition, 2012.
5. Pete Warden, "Big Data Glossary", O'Reily, 2011

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1. www.coltdatacentres.net/Cloud Technology
2. www.redhat.com/en/topics/cloud-computing/what-is-cloud-infrastructure
3. www.digitalocean.com/community/tutorials/an-introduction-to-big-data-concepts-and-terminology
4. https://www.zdnet.com/article/what-is-cloud-computing-everything-you-need-to-know-about-the-cloud/
5. https://www.tutorialspoint.com/hadoop/hadoop_big_data_overview.htm

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	2	2	1	-	1	3	-
2	1	1	2	2	1	2	1	-	3
3	2	1	1	2	1	2	1	3	-
4	3	1	2	1	-	1	-	3	1
5	3	1	1	2	-	-	-	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme : **M.Tech.**						
Semester	**I/II**	Course Category :**PC**			*End SemesterExamType:**TE**			
Course Code	**P23CSTD02**	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Speech and Language Processing**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

(Common to M.Tech CSE and CSE(BDA))

Prerequisite	No prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basics of NLP	**K3**
	CO2 Apply the basic ML and DL techniques for NLP	**K3**
	CO3 Understand and realize the advanced NLP Techniques.	**K2**
	CO4 Make use of Language understanding, Generation and Information Retrieval	**K3**
	CO5 Apply ethics to be followed while building NLP Applications and how to use NLP Libraries	**K3**

UNIT – I	**Introduction**	**Periods:9**
Phases of NLP, Text Preprocessing: Tokenization, Stemming and Lemmatization, Pos Tagging, Named Entity Recognition. NLP Feature Engineering, Word Count Vector, Word Sense Disambiguation		**CO1**
UNIT – II	**Language Modelling**	**Periods:9**
N -gram Models, Hidden Markov Models, Maximum Likelihood Estimation. Supervised, Unsupervised and Semi Supervised Learning. Text Classification and Sentiment Analysis, Topic Modelling and Clustering, Word Embeddings, RNN & LSTMs for NLP, CNN for NLP.		**CO2**
UNIT – III	**Advanced NLP Techniques**	**Periods:9**
Sequence- to -Sequence Models, Attention Mechanisms, Transformer Architecture: BERT, GPT		**CO3**
UNIT – IV	**Language Understanding and Generation, Information Retrieval**	**Periods:9**
Text Generation, Question Answering, Dialogue Systems and Chatbots. Machine Translation, Cross Lingual Transfer Learning. Text Indexing and Search, Text Summarization.		**CO4**
UNIT – V	**NLP Tools, Libraries, Applications, Ethics**	**Periods:9**
Bias and Fairness in NLP, Privacy Concerns in NLP Applications. NP libraries: NLTK, Spacy, Tensor Flow, Pytorch. NLP Applications: Sentiment Analysis, Named Entity Recognition in Real World Data Sets, Text Classification for Various Domains.		**CO5**

LecturePeriods:45	**TutorialPeriods:0**	**PracticalPeriods:-0**	**TotalPeriods:45**

Text Books

1. Christopher D. Manning and Hinrich Schutze, " Foundations of Natural Language Processing" ,13th Edition, The MIT Press Cambridge, Massachusetts London, England, 2018
2. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 16th edition, Prentice Hall, 2021.
3. Rajesh Arumugam, Rajalingappa Shanmugamani "Hands-on natural language processing with python: A practical guide to applying deep learning architectures to your NLP application".PACKT publisher, 2018

Reference Books

1. NitinIndurkhya, Fred J. Damerau "Handbook of Natural Language Processing", Second Edition, CRC Press, 2010.
2. James Allen "Natural Language Understanding", Pearson Publication 8th Edition. 2012.
3. Chris Manning and HinrichSchütze, "Foundations of Statistical Natural Language Processing", 2nd edition, MITPress Cambridge, MA, 2003.
4. Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action" MANNING Publications, 2019.
5. Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley-Blackwell, 2012

Web References

1. https://www.udemy.com/course/chatbot/
2. https://gtuematerial.in/natural-language-processing-3170723/
3. https://chatbotsmagazine.com/understanding-the-need-for-nlp-in-your-chatbot-78ef2651de84?gi=ecca664b642a
4. https://www.ultimate.ai/blog/ai-automation/how-nlp-text-based-chatbots-work
5. https://www.javatpoint.com/nlp

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	2	3	3	2	2	2	2
2	2	3	3	3	2	1	2	2	1
3	2	3	3	2	1	-	2	2	1
4	2	2	3	2	3	2	2	3	1
5	3	2	2	3	3	1	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **HS**			*End Semester Exam Type: **TE**			
Course Code	**P23HSTC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Research Methodology and IPR**	**2**	**-**	**-**	**2**	**40**	**60**	**100**

(Common to all M.Tech Courses)

Prerequisite	No prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Gain Knowledge to formulate the research problem.	**K2**
	CO2 Understand the concepts to carry out the literature review, ethics and research analysis.	**K2**
	CO3 Explain the way of writing technical paper and presentation methods.	**K2**
	CO4 Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.	**K2**
	CO5 Ability to understand about IPR and filing patents in R & D.	**K3**

UNIT- I	**Research Problem Formulation**	**Periods: 6**	
Meaning of research problem- Sources of research problem - criteria characteristics of a good research problem - errors in selecting a research problem - scope and objectives of research problem. Approaches of investigation of solutions for research problem - data collection – analysis – interpretation - necessary instrumentations.			**CO1**
UNIT- II	**Literature Review**	**Periods: 6**	
Effective literature studies approaches – analysis – plagiarism and research ethics			**CO2**
UNIT- III	**Technical Writing /Presentation**	**Periods: 6**	
Effective technical writing - how to write report – paper - developing a research proposal - format of research proposal - Presentation and assessment by a review committee.			**CO3**
UNIT- IV	**Introduction To Intellectual Property Rights (IPR)**	**Periods: 6**	
Nature of Intellectual Property: Patents – Designs - Trade and Copyright. Process of Patenting and Development: Technological research – innovation – patenting - development. International Scenario: International cooperation on Intellectual Property - Procedure for grants of patents - Patenting under PCT.			**CO4**
UNIT- V	**Intellectual Property Rights (IPR)**	**Periods: 6**	
Patent Rights: Scope of Patent Rights - Licensing and transfer of technology - Patent information and databases - Geographical Indications - New Developments in IPR - Administration of Patent System - IPR of Biological Systems - Computer Software etc. Traditional knowledge Case Studies - IPR and IITs.			**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Books

1. Stuart Melville and Wayne Goddard, "Research methodology: An introduction for science & Engineering students', Kenwyn Publisher, 1996.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Lansdowne Publisher, Second Edition, 2001.
3. C.R. Kothari, Gaurav Garg, "Research Methodology: Methods and Techniques", New Age International, Fourth Edition, 2018.

Reference Books

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Limited, 2007.
2. Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners", Second Edition, 2010.
3. Trochim, "Research Methods: The concise knowledge base", Atomic Dog Publishing, 2005.
4. Fink A, "Conducting Research Literature Reviews: From the Internet to Paper", Sage Publications, 2009.

Web References

1. https://www.scribd.com/document/427419672/Research-Methodology-and-Ipr
2. https://www.isical.ac.in/~palash/research-methodology/RM-lec9.pdf
3. https://www.wipo.int/edocs/pubdocs/en/intproperty/958/wipo_pub_958_3.pdf
4. https://lecturenotes.in/m/21513-research-methodology
5. https://iare.ac.in/sites/default/files/MTECH-CAD.CAM-R18-RM-IP-NOTES.pd

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	2	1	1	2	1	3	3	2
2	3	2	1	1	2	1	3	2	2
3	3	2	1	1	2	1	3	2	2
4	3	2	1	1	3	1	3	2	3
5	3	2	1	1	2	1	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PC**			*End Semester Exam Type: **LE**			
Course Code	**P23CSP101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Data Structures and Algorithms Laboratory**	**-**	**-**	**4**	**2**	**50**	**50**	**100**

Prerequisite	Knowledge about Data Structures and Algorithms	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Evaluate the algorithm's / program's efficiency in terms of time and space complexity.	**K4**
	CO2 Solve the given problem by identifying the appropriate Data Structure.	**K3**
	CO3 Construct various applications based on sorting and tree data structure.	**K2**
	CO4 Apply graph data structures to solve real time applications such as network flow and linear programming.	**K3**
	CO5 Illustrate the performance of the polynomial time algorithm.	**K2**

List of Experiments:

. 1. Implementation of the following Heap Structures.
   a. Min Heap (Insertion, Delete Min, Delete Max)
   b. Skew Heap(Priority Queue operations)
   c. Fibonacci Heap (Priority Queue operations).
2. Implementation of the following Search Structures
   a. AVL Trees (Insertion, Deletion and Search)
   b. Splay Trees (Insertion, Deletion and Search)
   c. B-Trees (Insertion, Deletion and Search) d. Red- Black Trees.
3. Implementation of Convex Hull.
4. Implementation of Topological sort.
5. Implementation of Graph search algorithms.
6. Implementation of Randomized algorithms.
7. Implementation and application of network flow and linear programming problems.
8. Implementation of algorithms using the hill climbing and dynamic programming design techniques.
9. Implementation of recursive backtracking algorithms.
10. Implementation of Branch and Bound Algorithms.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 4 5**	**Total Periods: 45**

Reference Books

1. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, Fifth Edition, 2007.
2. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, Introduction to Algorithms, PHI/Pearson Education, Third Edition, 2009.
3. Michael T. Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, Wiley India, Second Edition, 2006.
4. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI, Third Edition, 2016.
5. Michael T. Goodrich, Roberto Tamassia, David M. Mount," Data Structures and Algorithms in C++",Wiley, Second Edition, 2011.

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1. https://www.javatpoint.com/data-structure-tutorial/
2. https://www.studytonight.com/data-structures/
3. https://www.tutorialspoint.com/data_structures_algorithms/
4. https://www.w3schools.in/data-structures-tutorial/intro/
5. https://www.geeksforgeeks.org/data-structures/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
1	2	2	2	3	2	2	3	2	2
2	1	2	2	2	2	2	3	2	2
3	1	3	3	3	3	3	3	3	3
4	2	3	3	3	3	3	3	3	3
5	1	3	3	3	3	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **HS**			*End Semester Exam Type: **LE**			
Course Code	**P23HSPC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Technical Report Writing and Seminar**	**-**	**-**	**4**	**2**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite								

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Select a subject, narrowing the subject into a topic.	**K2**
	CO2 State an objective and collecting the relevant bibliography (at least 15 journal papers).	**K2**
	CO3 Study the papers and understanding the author's contributions and critically analyzing each paper.	**K3**
	CO4 Prepare a working outline and linking the papers and preparing a draft of the paper.	**K2**
	CO5 Prepare a working outline and linking the papers and preparing a draft of the paper.	**K2**

List of Experiments:

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic	Select an area of interest, topic and state an objective	2nd week	3 % Based on clarity of thought, current relevance and clarity in writing
Stating an Objective			
Collecting Information about area & topic	1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia or workshops 4. List 1 thesis title 5. List 3 web presences (mailing lists, forums, news sites) 6. List 3 authors who publish regularly in your area 7. Attach a call for papers (CFP) from your area.	3rd week	3% (the selected information must be area specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filte	• provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar • When picking papers to read - try to: - Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them. - Favour papers from well-known journals and conferences, in the field (as indicated in other Favour more recent papers, - Pick a recent survey of the field so you can quickly gain an overview, Find relationships with respect to each other and to your topic area(classification scheme/categorization) - Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered	4th week	6% (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process For each paper form a Table answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research?	6th week	8% (The table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

	• Conclude with limitations/issues not addressed by the paper (from the perspective of survey)		
Reading and notes for next 5 papers	Repeat Reading Paper Process	7 th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper
Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8 th week	8% (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9 th week	6%(Clarity, purpose and conclusion) 6% Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	5% (clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11th week	10% (this component will be evaluated based on the linking and classification among the papers)
Conclusions	Write your conclusions and future work	12th week	5% (conclusions)
Final Draft	Complete the final draft of your paper	13th week	10% (formatting, English, Clarity and linking) 4% Plagiarism Check Repor
Seminar	A brief 15 slides on your paper	14th & 15th week	10% (based on presentation and Vivavoce)
Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 4 5**	**Total Periods: 45**

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	3	1	3	3	2	1	2
2	2	3	2	1	3	2	2	1	2
3	2	3	2	1	3	2	2	1	2
4	2	3	2	1	3	2	2	1	2
5	2	3	2	1	3	2	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)				Attendance	End Semester Examination (ESE) Marks	Total Marks
	Weekly Progress	Seminar	Record work	Viva			
Marks	40	30	10	10	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **AEC**			*End Semester Exam Type: **-**			
Course Code	**P23CSC1XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Ability Enhancement Courses**	**-**	**-**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23CST203**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Software Engineering and Testing**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Software Engineering	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Illustrate Software Engineering Lifecycle Models	**K3**
	CO2 Perform Project management and cost estimation	**K3**
	CO3 Make use of the System Analysis and Design concepts	**K4**
	CO4 Illustrate different testing techniques**.**	**K3**
	CO5 Make use of different levels of testing in their software**.**	**K4**

UNIT- I	**Introduction**	**Periods: 9**
Software engineering concepts – Development activities – Software lifecycle models - Classical Waterfall - Iterative waterfall – Prototyping – Evolutionary - Spiral – Software project management – Project planning – Estimation – Scheduling – Risk management – Software configuration management.		**CO1**
UNIT- II	**Software Requirement Specification**	**Periods: 9**
Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram		**CO2**
UNIT- III	**Architecture and Design**	**Periods: 9**
Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command– Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client-server - Tiered -Pipe and filter.- User interface design		**CO3**
UNIT- IV	**Testing Techniques and Testing Tools**	**Periods: 9**
Testing Techniques – Verification vs Validation – Software Testing Methodologies – White Box, Black Box and Grey Box – Static and Dynamic Techniques – Informal Reviews, Walkthroughs, Technical Reviews, Inspection – Structural Techniques, Black Box Techniques, Experienced Based Techniques. Testing Tools: Selenium – Jmeter		**CO4**
UNIT- V	**Levels of Testing**	**Periods: 9**
Levels of Testing – Test Case Design – Building Test Cases – Test data mining – Test execution – Test reporting – Functional Testing – Unit, Integration, System, Acceptance, Regression, Retest – Non Functional Testing – Performance, Memory, Scalability, Compatibility, Security, Cookie, Session, Recovery, Adhoc, Risk Based Testing.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Glenford J Myers, Corey Sandler, Tom Badgett," The Art of Software Testing", Wiley, 3rd Edition 2015.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning, 3rd Edition, 2013.
3. Ian Sommerville, "Software Engineering", Pearson Education, 8th Edition, 2008.

Reference Books

1. Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 2nd edition, Pearson Education, 2004.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.
3. Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.
4. Len Bass, Ingo Weber and Liming Zhu, —DevOps: A Software Architect's Perspectivell, Pearson Education, 2016
5. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007

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1. https://nptel.ac.in/courses/106/105/106105150/
2. https://onlinecourses.nptel.ac.in/noc19_cs71/preview
3. https://www.coursera.org/lecture/introduction-software-testing/stages-of-software-testing-process-UMOpe
4. https://cosmolearning.org/courses/introduction-to-software-engineering/video-lectures/
5. https://freevideolectures.com/course/2318/software-engineering

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	3	2	-	-	3	1	1
2	3	3	3	2	-	-	3	1	1
3	3	3	3	2	2	-	3	1	1
4	3	3	3	2	2	-	3	1	1
5	3	3	3	2	2	-	3	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23CST204**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Adhoc and Wireless Sensor Networks**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Wireless Network	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify different issues in wireless ad hoc and sensor networks.	**K1**
	CO2 Analyze protocols developed for ad hoc and sensor networks.	**K4**
	CO3 Identify and understand security issues in ad hoc and sensor networks.	**K1**
	CO4 Build the routing mechanism and improving QoS.	**K3**
	CO5 Apply Channel allocation strategy to improve the connectivity in Ad-Hoc Networks.	**K3**

UNIT- I	**Introduction**	**Periods: 9**	
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel - mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.			**CO1**
UNIT- II	**MAC Protocols for Ad Hoc Wireless Networks**	**Periods: 9**	
Issues in designing a MAC Protocol - Classification of MAC Protocols - Contention based protocols - Contention based protocols with Reservation Mechanism - Contention based protocols with Scheduling Mechanisms – Multi channel MAC - IEEE 802.11.			**CO2**
UNIT- III	**Routing Protocols Transport Layer in Ad hoc Networks**	**Periods: 9**	
Issues in designing a routing and Transport Layer protocol for Ad hoc networks - proactive routing, reactive routing (on-demand) - hybrid routing - Classification of Transport Layer solutions -TCP over Ad hoc wireless Networks.			**CO3**
UNIT- IV	**Wireless Sensor Networks (WSNS) and MAC Protocols**	**Periods: 9**	
Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies - MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC - IEEE 802.15.4.			**CO4**
UNIT- V	**WSN Routing, Localization and QOS**	**Periods: 9**	
Issues in WSN routing – OLSR - Localization – Indoor and Sensor Network Localization - absolute and relative localization, triangulation - QOS in WSN - Energy Efficient Design – Synchronization - Transport Layer issues			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. C. Siva Ram Murthy, and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols “, Prentice Hall Professional Technical Reference, Third Edition, 2008.
2. Thomas Krag and Sebastin Buettrich, “Wireless Mesh Networking”, O‘Reilly Publishers, First Edition, 2007.
3. Al-Sakib Khan Pathan, Shafiullah Khan, Nabil Ali Alrajeh, “Wireless Sensor Networks Current Status and Future Trends”, CRC Press, 2016.

Reference Books

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, Second Edition, 2006.
2. Feng Zhao and Leonides Guibas, “Wireless Sensor Networks”, Elsevier Publication – 2002.
3. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, Third Edition, 2005. 4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks-Technology, Protocols, and Applications”, John Wiley, Fourth Edition, 2007.
5. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, Second Edition,2003.

Web References

1. https://nptel.ac.in/courses/106105160/
2. https://en.wikipedia.org/wiki/Wireless_ad_hoc_network
3. https://shodhganga.inflibnet.ac.in/bitstream/10603/77730/12/12_chapter_02.pdf
4. https://www.youtube.com/playlist?list=PLV8vIYTIdSnaoFjclogMhXiBFrHSL2Ar1
5. https://www.youtube.com/watch?v=HjAxGPd0Oto

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	-	-	-	-	-	-	-
2	3	2	3	3	-	1	-	2	-
3	3	1	3	3	-	1	2	2	-
4	1	1	2	3	3	1	-	2	-
5	2	1	2	3	2	3	2	-	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23CST205**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Operating Systems**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Operating Systems		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Explain the functionality of an operating system by reading its internal source.	**K2**
	CO2	Revise any algorithm present in an internal system namely system calls.	**K1**
	CO3	Describe the implementation of inter process communication.	**K2**
	CO4	Modify and use the data structures of the windows operating system.	**K3**
	CO5	Identify the different features of real time and mobile operating systems.	**K3**

UNIT- I	**Introduction to Kernel**	**Periods: 9**	
Introduction to Kernel - Architecture of the UNIX operating system - System concepts - Data structures. Buffer Cache: Buffer header - Structure of Buffer pool - Reading and writing disk blocks. Files INODES - Structure of a regular file - Directories- Super block- Inode assignment.			**CO1**
UNIT- II	**System Calls**	**Periods: 9**	
System calls: OPEN-Read – Close – Write – Create – CHMOD – CHOWN – Pipes - Mounting and Unmounting. Process: Layout the system memory – Context - Process control - process creation – signals - Process scheduling – time - clock.			**CO2**
UNIT- III	**Inter- Process Communications**	**Periods: 9**	
Inter-Process Communications: Process tracing- System V IPC-Shared Memory - Semaphores. Network Communications: Socket programming – Sockets – descriptors – Connections - Socket elements - Stream and Datagram Sockets.			**CO3**
UNIT- IV	**Windows Operating System**	**Periods: 9**	
Windows Operating system: versions - Concepts and tools - Windows internals - System Architecture - Requirements and design goals - Operating system mode l- Architecture overview - Key system components. System mechanisms: Trap dispatching - object manager – Synchronization - System worker threads -Windows global flags - Local procedural calls - Kernel event tracing.			**CO4**
UNIT- V	**Real Time and Mobile Operating Systems**	**Periods: 9**	
Basic Model of Real Time Systems – Characteristics - Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems - Micro Kernel Design - Client Server Resource Access - Processes and Threads -Memory Management - File system – TinyOS – Architecture - Applications			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Maurice J. Bach, “The Design of the Unix Operating System”, Prentice Hall of India, First Edition 1991.
2. Brian Catlin, Jamie Hanrahan, Mark E. Russinovich, David A. Solomon and Alex Ionescu “Windows Internals, Book 1 – User Mode (Developer Reference)”, Microsoft Press, Seventh Edition, 2014.
3. William Stallings, “Operating Systems: Internals and Design Principles”, Pearson Education, Fifth Edition, 2019.

Reference Books

1. Daniel P. Bovet and Marco Cesati, "Understanding the Linux Kernel", O'Reilly Publications, Third Edition, 2005.
2. Harold Abelson, Gerald Jay Sussman and Julie Sussman, “Structure and Interpretation of Computer Programs”, Universities Press, Second Edition, 2013.
3. Michael Beck, Harald Bohme, MirkoDziadzka, Ulrich Kunitz, Robert Magnus, Dirk Verworner, “Linux Kernel Internals”, Addison-Wesley, Third Edition, 2017.
4. Robert Love, “Linux Kernel Development”, Addison-Wesley, Third Edition, 2010.
5. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System concepts, John Wiley & Sons, Tenth Edition (kindle edition), 2018.

Web References

1. http://www.softpanorama.org/Internals/index.shtml
2. https://www.udemy.com/course/understanding-the-internals-of-the-unix-kernel-architecture/
3. https://www.britannica.com/technology/Windows-OS
4. https://www.tutorialspoint.com/operating_system/index.htm
5. https://www.geeksforgeeks.org/operating-systems/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	-	-	-	-	2	3	2
2	2	2	3	3	2	-	3	3	2
3	2	2	3	3	2	-	2	1	1
4	2	2	3	3	2	-	1	1	2
5	2	2	3	3	2	3	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**II**	Course Category : **PC**			*End Semester Exam Type: **TE**		
Course Code	**P23CST206**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Python Programming**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Python Programming	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret Object Oriented Concepts using Python.	**K2**
	CO2 Implement Graphical User Interface using Tkinter Package.	**K3**
	CO3 Paraphrase Python and MySQL connectivity and manipulations.	**K2**
	CO4 Demonstrate Network Programming with Python.	**K3**
	CO5 Implement Web Application Development using Django.	**K4**

UNIT- I	**OOPS in Python**	**Periods: 9**
Classes and Objects - Constructor - Encapsulation - Inheritance. Polymorphism: Method Overloading - Method Overriding - Operator Overloading. Static Methods and Class Methods - Abstraction - Composition - Aggregation - Association		**CO1**
UNIT- II	**GUI in Python (TKINTER)**	**Periods: 9**
Introduction to Tkinter: Canvas - Widgets - Layout Management - Dialogs and Message Boxes - Frames and Containers - Menus. Event Handling: Event-driven Programming. Customizing Widgets - Building Multi-window Applications		**CO2**
UNIT- III	**Python Database Connectivity**	**Periods: 9**
Installing MySQL Connector - Connecting to MySQL Database - Prepared Statements - Parameterized Queries - Fetching Data - Transactions - CRUD Processes		**CO3**
UNIT- IV	**Network Programming**	**Periods: 9**
Socket Programming - Networking with Sockets - TCP/IP Communication - UDP Communication - HTTP Requests - WebSocket Programming - Networking Protocols - DNS Resolution - Network Monitoring.		**CO4**
UNIT- V	**Web Application Development (DJANGO)**	**Periods: 9**
Django Basics - Forms and Form Handling - Django Admin - User Authentication and Authorization - Static Files and Media Handling - Middleware - Working with APIs - Session Management.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Eric Matthes, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", No Starch Press, 2nd Edition, 2019.
2. Alan D. Moore, "Python GUI Programming with Tkinter: Develop responsive and powerful GUI applications with Tkinter", Packt Publishing, 1st Edition, 2018.
3. Brandon Rhodes and John Goerzen, "Foundations of Python Network Programming", Apress, 3rd Edition, 2014.
4. William S. Vincent, "Django for Beginners: Build websites with Python and Django", Leanpub, 3rd Edition, 2021.

Reference Books

1. John Zelle, Franklin, "Python Programming: An Introduction to Computer Science", Beedle & Associates Inc., 3rd Edition, 2016.
2. Albert Lukaszewski, "MySQL for Python", Packt Publishing, 1st Edition, 2010.
3. Abhishek Ratan, "Python Network Programming: Conquer all your networking challenges with the powerful Python language", Packt Publishing, 2nd Edition, 2017.
4. Burkhard Meier,"Python GUI Programming Cookbook: Develop functional and responsive user interfaces with tkinter and PyQt5", Packt Publishing, 1st Edition, 2019.
5. Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", O'Reilly Media, 5th Edition, 2013.

Web References

1. https://docs.python.org/3/tutorial/classes.html
2. https://www.tutorialspoint.com/python3/python_gui_programming.htm
3. https://dev.mysql.com/doc/connector-python/en/
4. https://www.tutorialspoint.com/python3/python_networking.htm
5. https://docs.djangoproject.com/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	3	3	2	3	3	3	2
2	3	2	2	2	1	2	2	2	1
3	3	1	1	1	2	1	1	1	2
4	3	1	1	2	2	1	2	1	2
5	3	2	2	2	3	2	2	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PC**			*End Semester Exam Type: **LE**			
Course Code	**P23CSP202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Python Programming Laboratory**	**-**	**-**	**4**	**2**	**50**	**50**	**100**

Prerequisite	Basics of Python Programming	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret Object Oriented Concepts using Python.	**K2**
	CO2 Implement Graphical User Interface using Tkinter Package.	**K3**
	CO3 Paraphrase Python and MySQL connectivity and manipulations.	**K2**
	CO4 Demonstrate Network Programming with Python.	**K3**
	CO5 Implement Web Application Development using Django.	**K4**

List of Experiments:

1. Create classes for BankAccount, SavingsAccount, and CheckingAccount and implement methods for deposit, withdrawal, balance inquiry, and interest calculation.
2. Create classes for Employee, Payroll, and Salary and implement methods for calculating employee salaries, generating pay slips and managing payroll records using Inheritance.
3. Create a graphical calculator with buttons for numeric input, arithmetic operations, and a display to show the result.
4. Develop a GUI-based to-do list application where users can add, delete, and manage their tasks.
5. Develop a Python program to fetch the records from a table in MySQL and display in python console.
6. Develop a CRUD program using Python-MySql connectivity.
7. Create a client-server based chat application where multiple clients can connect to a server and exchange messages.
8. Build a network port scanner program that scans a given IP address or range of IP addresses to detect open ports on remote machines.
9. Create a fully functional blogging platform where users can register, create blog posts, add comments, and browse through published posts.
10. Develop an e-commerce store application with features like product listings, user authentication, shopping cart management, and secure payment integration.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 45**	**Total Periods: 45**

Reference Books

1. Eric Matthes, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", No Starch Press, 2nd Edition, 2019.
2. Alan D. Moore, "Python GUI Programming with Tkinter: Develop responsive and powerful GUI applications with Tkinter", Packt Publishing, 1st Edition, 2018.
3. Brandon Rhodes and John Goerzen, "Foundations of Python Network Programming", Apress, 3rd Edition, 2014..
4. Burkhard Meier,"Python GUI Programming Cookbook: Develop functional and responsive user interfaces with tkinter and PyQt5", Packt Publishing, 1st Edition, 2019.
5. Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", O'Reilly Media, 5th Edition, 2013.

Web References

1. https://docs.python.org/3/tutorial/classes.html
2. https://www.tutorialspoint.com/python3/python_gui_programming.htm
3. https://dev.mysql.com/doc/connector-python/en/
4. https://www.tutorialspoint.com/python3/python_networking.htm
5. https://docs.djangoproject.com/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	3	3	2	3	3	3	2
2	3	2	2	2	1	2	2	2	1
3	3	1	1	1	2	1	1	1	2
4	3	1	1	2	2	1	2	1	2
5	3	2	2	2	3	2	2	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **HS**			*End Semester Exam Type: **LE**			
Course Code	**P23HSPC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Seminar on ICT: A Hands - On Approach**	**-**	**-**	**4**	**2**	**100**	**-**	**100**

(Common to all M.Tech Programmes)

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Select a topic, narrowing the topic into presentation.	**K2**
	CO2 State an objective and use the relevant ICT tools to make the presentation effective.	**K3**
	CO3 Study the topic and understanding the contributions and prepare report.	**K2**
	CO4 Prepare a working demo.	**K3**
	CO5 Prepare conclusions based on the reading of the topic and giving final Presentation.	**K4**

List of Experiments:

The methodology used is "learning by doing", a hands-on approach, enabling the students to follow their own pace. The teacher, after explaining the project, became a tutor, answering questions and helping students on their learning experience.

ICT skills
- Understand ICT workflow in the respective domain choosed.
- Manage multitasking.
- Deal with main issues using tech in class.
- Record, edit and deliver audio and video.
- Automate assessments and results.

Scope
- Perspective in order to design activities in class.
- Understand the process of creating audiovisuals.

Teaching tools
- Different ways to create audiovisual activities.
- Handle audiovisual editors.
- Collaborative working.
- Individualize learning experience.
- Get instant feedback from students.

Each one of the students will be assigned an ICT Topic and the student has to conduct a detailed study on the assigned topic and prepare a report, running to 30 or 40 pages for which a demo to be performed followed by a brief question and answer session. The demo will be evaluated by the internal assessment committee (comprising of the Head of the Department and two faculty members) for a total of 100 marks.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 4 5**	**Total Periods: 45**

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	**Program Outcomes (POs)**						**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
1	-	3	1	1	3	3	3	2	1
2	-	3	1	1	3	2	3	2	1
3	-	3	1	1	3	2	3	2	1
4	-	3	1	1	3	2	3	2	1
5	-	3	1	1	3	2	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Attendance		
	Presentation using ICT	Report	viva			
Marks	50	30	10	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **AEC**			*End Semester Exam Type: **-**			
Course Code	**P23CSC2XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Ability Enhancement Courses**	**-**	**-**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**I**	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23CSE101**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming for Data Science**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Data Science	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify the need for data science and solve basic problems using Python built-in data types and their methods.	**K2**
	CO2 Employ efficient storage and data operations using NumPy arrays.	**K3**
	CO3 Apply powerful data manipulations using Pandas	**K3**
	CO4 Identify and execute basic syntax and programs in R	**K2**
	CO5 Exploit the graph using ggplot2	**K3**

UNIT- I	**Introduction to Data Science and Python Programming**	**Periods: 9**	
Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types.			**CO1**
UNIT- II	**Introduction to NumPy**	**Periods: 9**	
NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-SortingUnique and Other Set Logic			**CO2**
UNIT- III	**Data Manipulation with Pandas**	**Periods: 9**	
Introduction to pandas Data Structures: Series, DataFrame, Essential Functionality: Dropping Entries -Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.			**CO3**
UNIT- IV	**Introduction to Data Science and R Programming**	**Periods: 9**	
R for Basic Math- Arithmetic- Logarithms and ExponentialsE-Notation- Assigning Objects- Vectors- Creating a Vector- Sequences, Repetition, Sorting, and Lengths- Subsetting and Element Extraction- Vector-Oriented Behaviour			**CO4**
UNIT- V	**Basic Plotting**	**Periods: 9**	
Using plot with Coordinate Vectors-Graphical Parameters-Automatic Plot Types-Title and Axis LabelsColor-Line and Point Appearances-Plotting Region Limits-Adding Points, Lines, and Text to an Existing Plot-ggplot2 Package-Quick Plot with qplot-Setting Appearance Constants with Geoms-- READING AND WRITING FILES- R-Ready Data Sets- Contributed Data Sets-Reading in External Data Files- Writing Out Data Files and Plots- Ad Hoc Object Read/Write Operations			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Tilman M.Davies,“The Book of R - A First Programming and Statistics” Library of Congress Cataloging-in-Publication Data,2016.
2. Bruce, Peter, and Andrew Bruce. Practical statistics for data scientists: 50 essential concepts. " O'Reilly Media, Inc.", 2017.
3. Steven Keller, “R Programming for Beginners”, CreateSpace Independent Publishing Platform 2016.

Reference Books

1. Roger D. Peng,”R Programming for Data Science”Lean Publishing, 2016.
2. Hadley Wickham, Garrett Grolemund,” R for Data Science”,OREILLY Publication,2017
3. Kun Ren ,”Learning R Programming”, Packt Publishing,2016
4. Dodge, Yadolah, ed. Statistical data analysis and inference. Elsevier, 2014.
5. Ismay, Chester, and Albert Y. Kim. Statistical Inference via Data Science: A Modern Dive into R and the Tidyverse. CRC Press, 2019.

Web References

1. https://docs.python.org/3/tutorial/classes.html
2. https://www.tutorialspoint.com/python3/python_gui_programming.htm
3. https://dev.mysql.com/doc/connector-python/en/
4. https://www.tutorialspoint.com/python3/python_networking.htm
5. https://www.youtube.com/playlist?list=PLeo1K3hjS3us_ELKYSj_Fth2tIEkdKXvV

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	3	3	2	3	3	3	2
2	3	2	2	2	1	2	2	2	1
3	3	1	1	1	2	1	1	1	2
4	3	1	1	2	2	1	2	1	2
5	3	2	2	2	3	2	2	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE102**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Cyber Attacks Detection and Prevention Systems**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand Intrusion Detection and Prevention System	**K2**
	CO2 Illustrate Network Intrusion Detection and Prevention System	**K3**
	CO3 Make use of Network behavior analysis	**K3**
	CO4 Exploit SNORT IDS	**K4**
	CO5 Make use of IDPS Technologies	**K3**

UNIT- I	**Introduction to IDPS**	**Periods: 9**	
IDPS Technologies, Components and Architecture Implementation Uses of IDPS Technologies, Key Functions, Common Detection Methodologies Signature, Anomaly and Stateful Protocol Analysis, Types of IDPS Technologies			**CO1**
UNIT- II	**Host and Network IDPS**	**Periods: 9**	
Application, Transport, Network and Hardware Layer attacks, Sniffing Network Traffic, Replay Attacks,Command Injection, Internet Control Message Protocol Redirect, DDoS, Dangers and defenses with Man-in the Middle, Secure Socket Layer attacks, DNS Spoofing, Defense- in-Depth Approach, Port Security, Use Encrypted Protocols			**CO2**
UNIT- III	**Network Behaviour Analysis**	**Periods: 9**	
Components and Architecture Typical, Network Architecture, Sensor Locations. Honeynets- Gen I, II and III, Honeymole, Detecting the Attack - Intrusion Detection, Network Traffic Capture, Monitoring on the box, Setting up the Realistic Environment.			**CO3**
UNIT- IV	**Working with Snort IDS**	**Periods: 9**	
Introduction to Snort, Snort Alert Modes and Format, Working with Snort Rules, Rule Headers, Rule Options,The Snort Configuration File etc, Plugins, Preprocessors and Output Modules, Using Snort with MySQL.			**CO4**
UNIT- V	**Multiple IDPS Technologies**	**Periods: 9**	
Need for multiple IDPS Technologies, Integrating Different IDPS Technologies -Direct and Indirect,Firewalls, Routers and Honeypots, IPS using IP Trace back - Probabilistic and De- terministic Packet Marking, Marking WLAN Standards, WLAN Components, Threats against WLANs, 802.11 Wireless Infrastruc- ture Attacks,WEP Attacks, Wireless Client Attacks, Bluetooth Attacks, Cellphones, Personal Digital Assistance and OtherHybrid Devices Attack Detection, Jailbreaking.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1.Shui Yu, “Distributed Denial of Service Attack and Defense”, Springer, 2014
2.Bradd Lhotsky, “OOSEC Host based Intrusion detection”, PACKT Publication, 2013
3.John Hoopes, “Virtualization for Security: Including Sandboxing, Disaster Recovery, High Availability, Forensic Analysis, and Honeypotting”, Syngress,2009.

Reference Books

1. Karen Scarfone and Peter Mell, “Guide to Intrusion Detection and Prevention Systems (IDPS)”, NIST Special Publication 800-94, 2007
2. Padmavathi Ganapathi,”Cyber Security : Fundamentals, Attacks and Threats, Intrusion Detection and Prevention Systems”,2021
3. Mano Paul P, Ravi R, Diana Jeba Jingle,” Prevention of Cyber Attacks Using Email Spam Detection and Mitigation”,2021.
4. Yuri Diogenes, Erdal Ozkaya, Dr. Erdal Ozkaya,” Cybersecurity - Attack and Defense Strategies”,2022.
5. Alessandro Parisi,”Hands-On Artificial Intelligence for Cybersecurity”, 2019.

Web References

1. https://www.geeksforgeeks.org/cyber-security-tutorial/
2. https://www.simplilearn.com/tutorials/cyber-security-tutorial/types-of-cyber-attacks
3. https://www.mygreatlearning.com/blog/types-of-cyber-attacks/
4. https://cybersecurityguide.org/resources/coding-for-cybersecurity/
5. https://www.codingninjas.com/studio/library/cyber-attacks-and-their-types

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	-	-	-	-	2	3	2
2	2	2	3	3	2	-	3	3	2
3	2	2	3	3	2	-	2	1	1
4	2	2	3	3	2	-	1	1	2
5	2	2	3	3	2	3	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE103**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Bio-Inspired Computing**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand basic concepts of evolutionary algorithm	**K2**
	CO2 Understand the basic features of neural and immune systems and able to build the neural model.	**K2**
	CO3 Make use of complex and functional high-level phenomena can emerge from low-level interactions.	**K3**
	CO4 Illustrate computational processes derived from neural models.	**K2**
	CO5 Implement simple bio-inspired algorithms like genetic and Particle Swarm Optimization	**K3**

UNIT- I	**Introduction to Evolutionary Algorithm**	**Periods: 9**	
Evolutionary algorithm, components of evolutionary algorithm representation (definition of individuals), Evaluation function (Fitness function), Population, parent selection Mechanism, Variation Operators, Survivor Selection Mechanism (Replacement), Initialization, Termination Condition, evolutionary algorithm case study Cellular systems, cellular automata, modeling with cellular systems, other cellular systems, computation with cellular systems, artificial life: analysis and synthesis of cellular systems.			**CO1**
UNIT- II	**Neural Systems**	**Periods: 9**	
Biological nervous systems, artificial neural networks, neuron models, architecture, signal encoding ,synaptic plasticity, unsupervised learning, supervised learning, reinforcement learning, evolution of neural networks, hybrid neural systems, case study			**CO2**
UNIT- III	**Developmental and Immune Systems**	**Periods: 9**	
Rewriting system, synthesis of developmental system, evolutionary rewriting systems, evolutionary developmental programs, biological immune systems, lessons for artificial immune systems, algorithms and applications, shape space, negative selection algorithm, clonal selection algorithm			**CO3**
UNIT- IV	**Behavioral Systems**	**Periods: 9**	
Behavior in cognitive science, behavior in AI, behavior based robotics, biological inspiration for robots, robots as biological models, robot learning, evolution of behavioral systems, learning in behavioral systems, co-evolution of body and control, towards self-reproduction, simulation and reality			**CO4**
UNIT- V	**Genetic Algorithms**	**Periods: 9**	
Representation of Individuals, Mutation, Recombination, Population Models, Parent Selection, Survivor Selection, Example Application: Solving a Job Shop Scheduling Problem			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. D. Floreano and C. Mattiussi, "Bio-Inspired Artificial Intelligence", MIT Press, 2008.
2. Tao Song, Pan Zheng, Mou Ling Dennis Wong, Xun Wang, “Bio-Inspired Computing Models and Algorithms”, world scientific, 2019
3. F. Neumann and C. Witt, “Bioinspired Computation in combinatorial optimization: Algorithms and their computational complexity”, Springer, 2010.

Reference Books

1. D. E. Goldberg, “Genetic algorithms in search, optimization, and machine learning”, Addison- Wesley, 1989.
2. Simon O. Haykin, “Neural Networks and Learning Machines”, Third Edition, Prentice Hall, 2008.
3. M. Dorigo and T. Stutzle, “Ant Colony Optimization”, A Bradford Book, 2004.
4. R. C. Ebelhart, “Swarm Intelligence”, Morgan Kaufmann, 2001.
5. Xin-She Yang,Zhihua Cui Renbin Xiao Amir HosseinGandomi Mehmet Karamanoglu “Swarm Intelligence and Bio-Inspired Computation”, 1st Edition, Elsevier, 2013.

Web References

1. https://tutorials.one/bio-inspired-computing-approach-in-artificial-intelligence/
2. https://pythonhosted.org/inspyred/
3. https://pdfs.semanticscholar.org ›
4. https://www.frontiersin.org/research-topics/25088/bio-inspired-computation-and-its-applications
5. https://www.sciencegate.app/source/1398722893

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	-	-	-	-	2	3	2
2	2	2	3	3	2	-	3	3	2
3	2	2	3	3	2	-	2	1	1
4	2	2	3	3	2	-	1	1	2
5	2	2	3	3	2	3	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE104**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Block Chain and Crypto Currency**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Cryptography	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the Design principles of Bitcoin and Ethereum.	**K2**
	CO2 Make use of the Simplified Payment Verification protocol.	**K3**
	CO3 Understand about Cryptocurrency	**K3**
	CO4 Illustrate the Cryptocurrency Regulation	**K3**
	CO5 Implement Blockchain Applications	**K3**

UNIT- I	**Introduction**	**Periods: 9**	
Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.			**CO1**
UNIT- II	**Blockchain**	**Periods: 9**	
Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.			**CO2**
UNIT- III	**Cryptocurrency**	**Periods: 9**	
History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.			**CO3**
UNIT- IV	**Cryptocurrency Regulation**	**Periods: 9**	
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 Block chain.			**CO4**
UNIT- V	**Blockchain Applications**	**Periods: 9**	
Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Douglas Robert Stinson and Maura Paterson, “Cryptography: Theory and Practice”, CRC press, 2018.
2. Imran Bashir, “Mastering Blockchain: Deeper insights into decentralization, cryptography”, Packet Publishing Ltd, Kindle Edition, 2017.
3. Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, Kindle Edition, 2016.

Reference Books

1.Imran Bashir, “Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts,DApps, cryptocurrencies, Ethereum, and more”, Packt Publishing Limited, 3rd Edition,2020.
2.Andreas M. Antonopoulos,”Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O'Reilly Media,2nd Edition 2017.
3.Keith M.Martin ,”Everyday Cryptography: Fundamental Principles & Applications”,Oxford University Press, First edition 2016.
4. Dr.Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,” Yellow paper.2014.
5. Dr. T R Padmanabhan C K Shyamala, N Harini , “Cryptography and Security”, Wiley,1st Edition,2011.

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1. http://chimera.labs.oreilly.com/books/1234000001802/ch08.html
2. https://bitcoin.org/bitcoin.pdf
3. https://www.geeksforgeeks.org/introduction-to-crypto-terminologies
4. https://complyadvantage.com/knowledgebase/crypto-regulations/cryptocurrency-regulations-india
5. https://www.proofpoint.com/us/threat-reference/encryption

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	1	1	3	3	3	3	3	3	3
2	2	2	2	2	-	2	2	2	-
3	3	3	3	3	3	3	3	3	3
4	2	2	2	2	-	2	2	2	-
5	2	2	2	2	-	2	2	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE105**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**IOT Applications Engineering**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of IoT		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Identify the IoT networking components with respect to OSI layer.	**K2**
	CO2	Build schematic for IoT solutions	**K3**
	CO3	Make use of Cloud computation and Bigdata Analytics	**K3**
	CO4	Illustrate IoT Security	**K3**
	CO5	Make use of IoT Applications	**K3**

UNIT- I	**Introduction**	**Periods: 9**	
Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open source hardwares, Examples of IoT infrastructure,			**CO1**
UNIT- II	**IOT Protocols and Softwares**	**Periods: 9**	
MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP,XMPP and gateway protocols, IoT Communication Pattern, IoT protocol Architecture, Selection of Wireless technologies -6LoWPAN, Zigbee, WIFI, BT, BLE,SIG,NFC, LORA, LiFi, WiDi			**CO2**
UNIT- III	**Cloud Computation and BigData Analytics**	**Periods: 9**	
Evolution of Cloud Computation, Commercial clouds and their features, open source IoT platforms, cloud dashboards, Introduction to big data analytics and Hadoop.			**CO3**
UNIT- IV	**IOT Security**	**Periods: 9**	
Need for encryption, standard encryption protocol, light weight cryptography, Quadruple Trust Model for IoT-A – Threat Analysis and model for IoT-A, Cloud security			**CO4**
UNIT- V	**IOT Applications**	**Periods: 9**	
Case studies: IoT for smart cities, health care, agriculture, smart meters.M2M, Web of things, Cellular IoT, Industrial IoT, Industry 4.0			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2016.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014
3. LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The Internet of Things: From RFID to the Next-Generation Pervasive Network, Aurbach publications, March,2008.

Reference Books

1. Vijay Madisetti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" Arshdeep Bahga & Vijay Madisetti, 2014.
2. Asoke K Talukder and Roopa R Yavagal, "Mobile Computing," Tata McGraw Hill, 2010.
3. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010
4. RonaldL. Krutz, Russell Dean Vines,Cloud Security: A Comprehensive Guide to Secure Cloud Computing,Wiley-India, 2010
5. Jonathan Follett, "Designing for Emerging - UX for Genomics, Robotics, and the Internet of Things Technologies", O'Reilly, 2014.

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1. https://www.wired.co.uk/article/internet-of-things-what-is-explained-iot
2. https://www.ibm.com/blogs/internet-of-things/what-is-the-iot/
3. https://www.geeksforgeeks.org/edge-computing/
4. https://www.i-scoop.eu/internet-of-things-guide/edge-computing-iot/
5. https://digimat.in/nptel/courses/video/106105166/L02.html

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	1	2	1	2	2	3	3	1	3
2	1	2	1	2	2	3	3	3	2
3	1	2	1	2	2	3	2	1	3
4	2	2	2	3	2	3	1	1	2
5	3	1	2	3	2	3	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSEC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Information Visualization**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

(Common to M.Tech CSE and CSE(BDA))

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Analyze the different data types, visualization types to bring out the insight.	**K3**
	CO2 Make use of Visualization Techniques	**K3**
	CO3 Illustrate different Visual Analytics	**K2**
	CO4 Make use of Data Visualization Tools	**K3**
	CO5 Demonstrate Visualization dashboard creations	**K2**

UNIT- I	**Introduction**	**Periods: 9**
Overview of data visualization - Data Abstraction - Task Abstraction - Dimensions and Measures - Analysis:Four Levels for Validation. Statistical charts (Bar Chart - stacked bar chart – Line Chart - Histogram - Pie chart- Frequency Polygon - Box plot - Scatter plot - Regression curves		**CO1**
UNIT- II	**Visualization Techniques**	**Periods: 9**
Introduction to various data visualization tools - Scalar and point techniques - vector visualization techniques -multidimensional techniques - visualizing cluster analysis – K-means and Hierarchical Cluster techniques.		**CO2**
UNIT- III	**Data Visualization and Visual Analytics**	**Periods: 9**
Time Series data visualization – Text data visualization – Spatial Data Visualization - Networks and Trees - Heat Map – Tree Map - Map Color and Other Channels Manipulate View – Visual Attributes - Multivariate data visualization – Geometric projection techniques - Icon-based techniques - Pixel-oriented techniques - Hierarchical techniques - Scatterplot matrix - Hyper box - Trellis display - Parallel coordinates		**CO3**
UNIT- IV	**Data Visualization Tools**	**Periods: 9**
Tableau functions and logics: Marks and Channels-Arrange Tables- Arrange Spatial Data- Facets into multiple views		**CO4**
UNIT- V	**Visualization Dashboard Creations**	**Periods: 9**
Data Dashboard- Taxonomies- User Interaction- Organizational Functions-Dashboard Design – Worksheets - Workbooks – Workbook Optimization - Protection and common mistakes. Dashboard creation using visualization tool use cases: Finance-marketing-insurance-healthcare		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Tamara Munzer, Visualization Analysis and Design, 1st edition, CRC Press, United States, 2015.
2. Michael Fry, Jeffrey Ohlmann, Jeffrey Camm, James Cochran, Data Visualization: Exploring and Explaining with Data, South-Western College Publishing, 2021
3. Dr. Chun-hauh Chen, W. K. Hardle, A. Unwin, Handbook of Data Visualization, 1st edition, Springer publication, Germany, 2008.

Reference Books

1. Ben Fry, Visualizing Data, 1st edition, O'Reilly Media, United States, 2008.
2. Avril Coghlan, A little book of R for multivariate analysis, 1st edition, Welcome Trust Sanger Institute,United Kingdom, 2013.
3. Colin Ware,Information Visualization Perception for Design,2 nd Edition ,Elsevier Science,2019
4. Riccardo Mazza,Introduction to Information Visualization,1st EditionSpringer London,2009
5. Claus O. Wilke,undamentals of Data Visualization,O'Reilly MediaInc,2019

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1. https://www.tableau.com/
2. https://www.sciencedirect.com/science/article/pii/S2452414X19300573
3. https://study.com/academy/lesson/information-visualization-tools-techniques.html
4. https://www.youtube.com/watch?v=_YfHDbADy4s
5. https://www.nobledesktop.com/learn/data-visualization/video-tutorials

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	1	2	1	2	2	3	3	1	3
2	1	2	1	2	2	3	3	3	2
3	1	2	1	2	2	3	2	1	3
4	2	2	2	3	2	3	1	1	2
5	3	1	2	3	2	3	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE206**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Malware Analysis**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand basics of Malware	**K2**
	CO2 Make use of Basic Analysis	**K3**
	CO3 Illustrate Static and Dynamic Analysis	**K3**
	CO4 Apply Malware functionalities	**K4**
	CO5 Illustrate Anti reverse Engineering	**K3**

UNIT- I	**Malware Basics**	**Periods: 9**	
General Aspect of Computer infection program , Non Self Reproducing Malware, How does Virus Operate?, Virus Nomenclature, Worm Nomenclature, Recent Malware Case Studies			**CO1**
UNIT- II	**Basic Analysis**	**Periods: 9**	
Antivirus Scanning, x86 Disassembly, Hashing, Finding Strings, Packed Malware, PE File Format, Linked Libraries & Functions, PE Header File & Section			**CO2**
UNIT- III	**Advanced Static and Dynamic Analysis**	**Periods: 9**	
IDA Pro, Recognizing C code constructs, Analyzing malicious windows program, Debugging, OllyDbg, Kernel Debugging with WinDbg, Malware Focused Network Signatures			**CO3**
UNIT- IV	**Malware Functionalities**	**Periods: 9**	
Malware Behavior, Covert Malware Launch, Data Encoding, Shellcode Analysis			**CO4**
UNIT- V	**Anti-Reverse Engineering**	**Periods: 9**	
Anti-Disassembly, Anti-Debugging, Anti-virtual machine techniques, Packers and Unpacking			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Michael Sikorski, Andrew Honig, “Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software”, 2012
2. Monnappa K A “Learning Malware Analysis: Explore the Concepts, Tools, and Techniques to Analyze and Investigate Windows Malware” 2018
3. Alexey Kleymenov and Amr Thabet,” Mastering Malware Analysis: The Complete Malware Analyst's Guide to Combating Malicious Software, APT, Cybercrime, and IoT Attacks”,2019

Reference Books

1. Dylan Barker, “Malware Analysis Techniques: Tricks for the triage of adversarial software”, Packt Publishing, Limited, 2021.
2. Abhijit Mohanta and Anoop Saldanha, “Malware Analysis and Detection Engineering: A Comprehensive Approach to Detect and Analyze Modern Malware” Apress, 2020
3. Michael Ligh, Blake Hartstein, Steven Adair, Matthew Richard, “Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code”2010
4. Victor Marak,”Windows Malware Analysis Essentials”, 2015
5. Mihai Christodorescu, Somesh Jha, Douglas Maughan, Dawn Song, Cliff Wang, “Malware Detection”, Springer Science & Business Media, 2007.

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1. http://www.malware-analyzer.com
2. http://resources.infosecinstitute.com/malware-analysis-basic-dynamic-techniques/
3. http://www.remux.org
4. https://www.youtube.com/watch?v=qA0YcYMRWyI
5. https://perception-point.io/guides/malware/malware-detection-7-methods-and-security-solutions-that-use-them/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	1	2	1	2	2	3	3	1	3
2	1	2	1	2	2	3	3	3	2
3	1	2	1	2	2	3	2	1	3
4	2	2	2	3	2	3	1	1	2
5	3	1	2	3	2	3	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II/III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSEC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Soft Computing**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

(Common to M.Tech CSE and CSE(BDA))

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Apply neural networks, bidirectional associative memories and adaptive resonancetheory for solving different engineering problems	**K2**
	CO2 Identify and describe soft computing techniques and build supervised learning and unsupervised learning networks	**K3**
	CO3 Apply fuzzy logic and reasoning to handle uncertainty and solve various engineeringproblems.	**K2**
	CO4 Apply genetic algorithms to combinatorial optimization problems.	**K2**
	CO5 Evaluate and compare solutions by various soft computing approaches for a given problem	**K3**

UNIT- I	**Introduction to Soft Computing**	**Periods: 9**
Soft computing vs. hard computing, evolution of soft computing, features and types of soft computing, applications of soft computing, basics of machine learning.		**CO1**
UNIT- II	**Neural Networks and Back PropagationNetworks**	**Periods: 9**
Basic concepts of Neural Networks, Model of Artificial Neuron, Neural Network Architectures, Characteristics of neural networks, Learning Methods, Early neural network architectures, Application domains. Back propagation network (BPN), Back propagation Learning, Applications of BPN, Parameter selection, Variations of Back propagation Algorithms		**CO2**
UNIT- III	**Associative Memory Networks**	**Periods: 9**
Auto correlators, hetero correlators: Kosko's discrete Bi-direction associative memory (BAM), Exponential BAM, Application of Character Recognition		**CO3**
UNIT- IV	**Unsupervised Learning: Adaptive Resonance Theory**	**Periods: 9**
Adaptive Resonance Theory (ART), Classical ART Networks, Simplifies ART Architecture, Features, algorithms and Illustration of ART1 and ART2 model, Related Applications		**CO4**
UNIT- V	**Fuzzy Sets and Fuzzy Relations**	**Periods: 9**
Fuzzy versus Crisp, Crisp Sets, Fuzzy sets, Membership functions, fuzzy set operations, properties of Fuzzy sets, Crisp Relations, Fuzzy relations – Fuzzy Cartesian product, Operations of Fuzzy Relations		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. S, Rajasekaran& G.A. VijayalakshmiPai, "Neural Networks, Fuzzy systems and evolutionary algorithms: Synthesis and Applications", PHI Publication, 2nd Ed. 2017
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", John Wiley and Sons, 3rd ed, 2011.
3. S.N. Sivanandam& S.N. Deepa, "Principles of Soft Computing", Wiley Publications, 3rd ed,2018.

Reference Books

1. Jang, Jyh-Shing Roger, Chuen-Tsai Sun, and EijiMizutani. "Neuro-fuzzy and soft computing- a computational approach to learning and machine intelligence" Pearson, 1997.
2. Kosko, B., Neural Networks and Fuzzy Systems: A Dynamical Systems Approach toMachine Intelligence, PHI Publication, 1994.
3. George J. Klir,Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 2015
4. Rich E andKnight K, Artificial Intelligence, McGraw Hill Education; 3rd ed, 2017.
5. Haykin, "Neural Networks and Learning Machines", Pearson Education Inc., 3rd Ed 2008.

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1. https://digitalthinkerhelp.com/what-is-soft-computing-and-its-applications-and-techniques/
2. https://www.includehelp.com/soft-computing/
3. https://www.educba.com/soft-computing-techniques/
4. https://nptel.ac.in/courses/106105173
5. https://www.youtube.com/watch?v=a63JT0OFeys

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	1	2	1	2	2	3	3	1	3
2	1	2	1	2	2	3	3	3	2
3	1	2	1	2	2	3	2	1	3
4	2	2	2	3	2	3	1	1	2
5	3	1	2	3	2	3	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23BDEC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Neural Networks**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

(Common to M.Tech CSE(BDA) and M.Tech CSE)

Prerequisite	Basic Physics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the basics of ANN and comparison with Human brain.	**K3**
	CO2 Understand the role of neural networks in engineering, artificia intelligence, and cognitive modelling.	**K2**
	CO3 Understand the concepts and techniques of neural networks throughthe study of the most important neural network models.	**K3**
	CO4 Evaluate whether neural networks are appropriate to a particular application.	**K2**
	CO5 Apply neural networks to particular application, and to know whatsteps to take to improve performance.	**K2**

UNIT- I	**Introduction**	**Periods: 9**
A Neural Network-Human Brain- Models of a Neuron-Neural Networks viewed as Directed Graphs-Network Architectures-Knowledge Representation-Artificial Intelligence and Neural Networks. Learning Process: Error Correction Learning- Memory Based Learning-Hebbian Learning, Competitive- Boltzmann Learning-Credit Assignment Problem- Memory- Adaption- Statistical Natureof the Learning Process.		**CO1**
UNIT- II	**Single Layer Perceptrons**	**Periods: 9**
Adaptive Filtering Problem- Unconstrained Organization Techniques- Linear Least Square Filters- Least Mean Square Algorithm- Learning Curves- Learning Rate Annealing Techniques- Perceptron –Convergence Theorem- Relation Between Perceptron and Bayes Classifier for a Gaussian Environment. Multilayer Perceptron: Back Propagation Algorithm XOR Problem- Heuristics- Output Representation and Decision Rule-Computer Experiment- Feature Detection		**CO2**
UNIT- III	**Back Propagation**	**Periods: 9**
Back Propagation and Differentiation- Hessian Matrix- Generalization- Cross Validation- NetworkPruning Techniques-Virtues and Limitations of Back Propagation Learning- Accelerated Convergence-Supervised Learning.		**CO3**
UNIT- IV	**Self-Organization Maps (SOM)**	**Periods: 9**
Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of FeatureMap, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification.		**CO4**
UNIT- V	**NEURO DYNAMICS**	**Periods: 9**
Dynamical Systems-Stability of Equilibrium States, Attractors-Neuro Dynamical Models - Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models- restricted boltzmen machine.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Neural Networks a Comprehensive Foundations, Simon S Haykin, PHI Ed.
2. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.
3. Neural Networks A Classroom Approach -Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

Reference Books

1. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
2. Neural Networks -James A Freeman David M S Kapura Pearson Ed., 2004.
3. Artificial Neural Networks – B. Vegnanarayana Prentice Hall of India P Ltd 2005
4. Introduction to Artificial Neural Systems - J.M. Zurada, Jaico Publications 1994.
5. Artificial Neural Networks- B. Yegnanarayana, Pill, New Delhi 1998.

Web References

1. https://www.cs.rit.edu/~lr/courses/nn/main.html
2. https://www.inspirenignite.com/up/neural-network
3. https://www.investopedia.com/terms/n/neuralnetwork.asp
4. https://www.mygreatlearning.com/blog/types-of-neural-networks/
5. https://link.springer.com/10.1007/978-3-642-20617-7_6563

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	2	1			-	1	3
2	3	3	2	1			-	1	3
3	3	3	2	1			-	1	3
4	3	3	2	1			-	1	3
5	3	3	2	1			-	1	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**II**	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23CSE207**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Robotic Process Automation**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of sensor and IoT	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Extend the robotic process automation and its essential tools.	**K2**
	CO2 Describe sequencing of flows in RPA.	**K2**
	CO3 Interpret the Exception handing in Automation.	**K4**
	CO4 Illustrate overview of orchestration server and its controls.	**K4**
	CO5 Demonstrate RE framework for software automation.	**K4**

UNIT- I	**Introduction to Automation**	**Periods: 9**	
Robotic process automation: RPA - Benefits of RPA - Components of RPA - RPA platforms – UiPath - Blue Prism - Work Fusion - UiPath: UiPath Robot - UiPath Orchestrator.			**CO1**
UNIT- II	**Sequencing Workflows**	**Periods: 9**	
Sequences, flowcharts Control Flow: Control Flow Activities - The Assign activity - The Delay activity - The While activity - The Do while activity - For each activity - The If activity. Data Manipulation: variables and scope collections – arguments - data tables – file operation – conversion of CSV/Excel to data table and vice versa.			**CO2**
UNIT- III	**Triggers, Debugging and Logging**	**Periods: 9**	
Event Triggers: Hotkey trigger - mouse trigger - system trigger – Debugging: techniques – Error Handling – Logging: Client logging - Server logging – Extensions – Project Organization.			**CO3**
UNIT- IV	**Orchestration Server and other RPA Tools**	**Periods: 9**	
Overview of Orchestration Server: Queues – Assets – Process - Control Bots: Robot statuses - editing the Robot - deleting Robot - Displaying logs of Robot-Deploy Bots- Other RPA tools.			**CO4**
UNIT- V	**Implementing RE Framework**	**Periods: 9**	
Introduction to RE Framework – Purpose of RE framework – using state machine layout – states of the state machine – workflows Involved – Workflows of the Framework – Exception Handling & Logging .			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Tripathi Alok Mani, “Learning Robotic Process Automation”, Packt Publishing, First Edition, 2018.
2. Richard Murdoch, “Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant”, First Edition, 2020.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGrawHill Singapore, 1996.

Reference Books

1. S. Muhkerjee, ”Essentials of Robotics Process Automation”, Khanna Books, Second Edition, 2019.
2. Nandan Mullakara, ”Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere”, Packt Publishing, First edition, 2020.
3. M.P.Groover, M.W, “Learning Robotic Process Automation”, Packt Publishing Limited,
4. “The Simple Implementation Guide to Robotic Process Automation”, iUniverse Publisher,
5. JohnJ.Craig, “Introduction to Robotics Mechanics and Control”, Pearson Education, Third edition, 2009.

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1. https://www.tutorialspoint.com/uipath
2. https://asha24.net/learn/robotic-process-automation
3. https://book.akij.net/learningrobotics automation
4. https://www.javatpoint.com/robotics-tutorial
5. http://www.robotictutorials.com

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	2	3	2	3	2	2	3	2
2	3	3	3	3	2	3	3	3	2
3	2	3	2	3	3	3	3	3	3
4	3	2	3	1	3	2	2	2	2
5	3	2	3	1	3	3	2	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSEC03**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Text, Web and Social Media Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

(Common to M.Tech CSE and CSE(BDA))

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand Text Mining	**K2**
	CO2 Illustrate Web Mining	**K3**
	CO3 Make use of Social Network Analysis	**K2**
	CO4 Exploit Social Media Mining	**K3**
	CO5 Make use of Sentimental Mining	**K3**

UNIT- I	**Introduction to Text Mining**	**Periods: 9**	
Text Representation- tokenization, stemming, stop words, TF-IDF, Feature Vector Representation, NER, N-gram modeling. Text Clustering, Text Classification, Topic Modeling-LDA,HDP			**CO1**
UNIT- II	**Introduction to Web-Mining**	**Periods: 9**	
Inverted indices and Boolean queries. PLSI, Query optimization, page ranking. Web Crawling-Crawler Algorithms, Implementation Issues, Evaluation, Session & visitor Analysis, Visitor Segmentation, Analysis of Sequential & Navigational Patterns, Predictions based on web user transactions.			**CO2**
UNIT- III	**Fundamentals of Social Network Analysis**	**Periods: 9**	
Social Network Perspective, Fundamentals concepts in Network Analysis: Sociogram, Sociometry. Social Network Data: Types of Networks: One-Mode, Two-Mode, Affiliation, Ego-centered and Special Dyadic Networks, Network Data, Measurement and Collection, Notations for Social Network Data: Graphs, Directed, Singed, Valued graphs, Multigraph, Relations and Matrices			**CO3**
UNIT- IV	**Social Media Mining**	**Periods: 9**	
Introduction to Social Media Network Essentials of Social graphs, Social Networks, Models, Information Diffusion in Social Media. Behavioral Analytics, Influence and Homophily, Recommendation in Social Media			**CO4**
UNIT- V	**Sentimental Mining**	**Periods: 9**	
Sentiment classification feature based opinion mining, comparative sentence and relational mining, Opinion spam			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1.Bing Liu, “Web Data Mining-Exploring Hyperlinks, Contents, and Usage Data”, Springer, Second Edition, 2011.
2.Reza Zafarani, Mohammad Ali Abbasi and Huan Liu, “Social Media Mining – An Introduction”, Cambridge University Press, 2014.
3.Bing Liu, “Sentiment Analysis and Opinion Mining”, Morgan & Claypool Publishers, 2012.

Reference Books

1. Nitin Indurkhya, Fred J Damerau, “Handbook of Natural Language Process”, 2nd Edition, CRC Press, 2010.
2. Matthew A.Russell, “Mining the social web”, 2nd edition- O'Reilly Media, 2013.
3. Gabor Szabo, Gungor Polatkan, P. Oscar Boykin, Antonios Chalkiopoulos,”Social Media Data Mining and Analytics”, Willey, 2018
4. Ganis,Kohirkar,” Social Media Analytics”, Pearson Education India, 2016
5. Marshall Sponder,” Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics”, McGraw-Hill Education, 2014

Web References

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2. https://towardsdatascience.com/a-guide-text-analysis-text-analytics-text-mining-f62df7b78747
3. https://www.tutorialspoint.com/web_analytics/index.html
4. https://www.tutorialspoint.com/social_media_marketing/social_media_analysis.htm
5. https://www.simplilearn.com/web-analytics-guide-for-newbies-article

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	-	-	1	-	1	1	1
2	2	2	2	3	2	-	1	2	1
3	1	1	2	2	-	-	1	2	1
4	1	1	-	3	2	-	1	2	1
5	3	2	2	2	2	3	1	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II/III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSEC04**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Data Storage Technologies and Networks**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

(Common to M.Tech CSE and CSE(BDA))

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basic concepts of Storage Technologies. (K2)	**K1**
	CO2 Identify the Storage Items and its Operations. (K2)	**K3**
	CO3 Understand the Networked Storage like DAS, SAN and NAS. (K3)	**K4**
	CO4 Learn the concepts related to Information Availability. (K3)	**K3**
	CO5 Ability to describe Storage Security and Virtualization. (K3)	**K3**

UNIT- I	**INTRODUCTION TO STORAGE TECHNOLOGY**	**Periods: 9**	
Data Proliferation and the varying value of data with time and usage - Sources of data and states of data creation - Data center requirements and Evolution to accommodate storage needs - Overview of basic storage management skills and activities - The Five Pillars of Technology - Overview of Storage Infrastructure Components - Evolution of storage - Information Lifecycle Management concept - Data Categorization within an Enterprise - Storage and Regulations.			**CO1**
UNIT- II	**STORAGE SYSTEMS ARCHITECTURE**	**Periods: 9**	
Intelligent disk subsystems overview - Contrast of integrated vs. modular arrays - Component architecture of intelligent disk subsystems - Disk physical structure components – properties - performance and specifications - Logical partitioning of disks - RAID and parity algorithms - hot sparing - Physical vs. logical disk organization - protection and back end management - Array caching properties and algorithms - Front end connectivity and queuing properties - Front end to host storage provisioning - mapping and operation - Interaction of file systems with storage - Storage system connectivity protocols.			**CO2**
UNIT- III	**NETWORKED STORAGE**	**Periods: 9**	
JBOD – DAS – SAN - NAS and CAS evolution - Direct Attached Storage (DAS) environments: elements - connectivity and management. Storage Area Networks (SAN): Elements and Connectivity - Fiber Channel principles - Standards and Network management principles - SAN management principles. Network Attached Storage (NAS): elements - connectivity options - connectivity protocols (NFS, CIFS, FTP) and management principles - IP SAN elements - Standards (iSCSI, FCIP, iFCP) - connectivity principles - security and management principles. Content Addressable Storage (CAS): elements, connectivity options – Standards and management principles.			**CO3**
UNIT- IV	**INFORMATION AVAILABILITY**	**Periods: 9**	
Business Continuity and Disaster Recovery Basics - Local business continuity techniques - Remote business continuity techniques - Disaster Recovery principles and techniques Managing and Monitoring Management philosophies (holistic vs. system and component) - Industry management standards (SNMP, SMI-S, CIM) - Standard framework applications - Key Management Metrics (thresholds, availability, capacity, security, performance) - Metric Analysis Methodologies and Trend Analysis - Provisioning and Configuration change planning - Problem reporting - prioritization and handling techniques.			**CO4**
UNIT- V	**SECURING STORAGE AND STORAGE VIRTUALIZATION**	**Periods: 9**	
Define storage security - List the critical security attributes for information systems - Describe the elements of a shared storage model and security extensions - Define storage security domains - List and analyze the common threats in each domain - Identify different virtualization technologies - Describe block-level and file level virtualization technologies and processes.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Marc Farley Osborne, “Building Storage Networks”, Tata Mcgraw Hill, 2006.
2. EMC, Hopkinton and Massachusetts, “Information Storage and Management Storing, Managing, and Protecting Digital Information”, Wiley, 2008.
3. Robert Spalding, “Storage Networks: The Complete Reference“, Tata Mcgraw Hill, 2002.

Reference Books

1. Gerald J Kowalski, Mark T Maybury, “Information Storage and Retrieval Systems - Theory and Implementation”, BS Publications, 2006.
2. Thejendra BS, “Disaster Recovery & Business Continuity”, Shroff Publishers & Distributors, 2008.
3. Barb Goldworm, Anne Skamarock, “Blade Servers & Virtualization”, Wiley India.
4. Meeta Gupta, “Storage Area Network Fundamentals”, Pearson Education Limited, 2006.
5. John Chirillo, Scott Blaul, “Storage Security Protecting SANs, NAS and DAS”, Wiley, 2003.

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1. https://www.youtube.com/watch?v=bzEaDPu09vY
2. https://www.snia.org/education/storage_networking_primer/san/what_san
3. http://www.ittoday.info/ITPerformanceImprovement/Articles/2013-01Schulz.html
4. https://www.igi-global.com/dictionary/information-availability/14353
5. https://searchstorage.techtarget.com/definition/storage-virtualization

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	2	3	2	2	3	2	2
2	3	2	2	2	2	2	3	2	2
3	3	3	3	3	3	3	3	3	3
4	3	3	3	3	3	3	3	3	3
5	3	3	3	3	3	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**II**	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23CSE208**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Reinforcement Learning**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Implement in-code common algorithms following code standards and libraries used in RL	**K3**
	CO2 Understand and work with approximate solutions.	**K1**
	CO3 Explore imitation learning tasks and solutions.	**K3**
	CO4 Learn how to define RL tasks and the core principals behind the RL, including policies, value functions.	**K3**
	CO5 Understand and work with tabular methods to solve classical control problems.	**K3**

UNIT- I	**Reinforcement Learning Primitives**	**Periods: 9**	
Introduction and Basics of RL, Defining RL Framework, Probability Basics: Probability Axioms,Random Variables, Probability Mass Function, Probability Density Function, CumulativeDistribution Function and Expectation. Introduction to Agents, Intelligent Agents – ProblemSolving – Searching, Logical Agents.			**CO1**
UNIT- II	**Markov Decision Process and Dynamic Programming**	**Periods: 9**	
Markov Property, Markov Chains, Markov Reward Process (MRP), Bellman Equations for MRP,Dynamic Programming: Polices (Evaluation, Improvement, Iteration, ValueIteration),Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming			**CO2**
UNIT- III	**Monte Carlo Methods and Temporal Difference Learning**	**Periods: 9**	
Monte Carlo: Prediction, Estimation of Action Values, Control and Control without ExploringStarts, Off-Policy Control, Temporal Difference Prediction:TD(0), SARSA: On-Policy Tcontrol, Q-Learning: Off-Policy TD control, Games, Afterstates, and Other Special Cases.			**CO3**
UNIT- IV	**Deep Reinforcement Learning**	**Periods: 9**	
Deep Q-Networks, Double Deep-Q Networks(DQN, DDQN, Dueling DQN, Prioritized Experience Replay). Policy Optimization in RL Introduction to Policy-based Methods, Vanilla Policy Gradient, REINFORCE Algorithm andStochastic Policy Search, Asynchronous Actor-Critic and Asynchronous Advantage Actor-Critic(A2C, A3C), Advanced Policy Gradient (PPO, TRPO, DDPG)			**CO4**
UNIT- V	**Multi Agent in RL**	**Periods: 9**	
Multi-Agent Learning, Meta-learning, Partially Observable Markov Decision Process, Ethics inRL, Applying RL for Real-World Problems.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1.Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An Introduction", Second Edition, MIT Press, 2019.
2.Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach.", Pearson Education Limited, 2016.
3.Michael Wooldridge, “An Introduction to Multi Agent Systems”, John Wiley, 2002.

Reference Books

1. Ian Goodfellow, YoshuaBengio, and Aaron Courville. "Deep learning." MIT press, 2017.
2. Marco Wiering, Martijn van Otterlo(Ed),"Reinforcement Learning, State-of-the-Art, Adaptation, Learning, and Optimization book series, ALO, volume 12, Springer, 2012.
3. Keng, Wah Loon, Graesser, Laura, "Foundations of Deep Reinforcement Learning: Theory and Practice in Python", Addison Wesley Data & Analytics Series, 2020.
4. Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018.
5. RagavVenkatesan, Baoxin Li, “Convolutional Neural Networks in Visual Computing”, CRC Press, 2018

Web References

1. https://www.javatpoint.com/reinforcement-learning
2. https://www.simplilearn.com/tutorials/machine-learning-tutorial/reinforcement-learning
3. https://www.learndatasci.com/tutorials/reinforcement-q-learning-scratch-python-openai-gym/
4. https://www.analyticsvidhya.com/blog/2017/01/introduction-to-reinforcement-learning-implementation/
5. https://www.tensorflow.org/agents/tutorials/0_intro_rl

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	-	-	1	-	1	1	1
2	2	2	2	3	2	-	1	2	1
3	1	1	2	2	-	-	1	2	1
4	1	1	-	3	2	-	1	2	1
5	3	2	2	2	2	3	1	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**II**	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23CSE209**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Mobile Application and Development**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify the requirements for mobile applications development.	**K2**
	CO2 Illustrate the challenges in mobile application interface and development.	**K3**
	CO3 Extend the concept of web components to involve for mobile application development.	**K4**
	CO4 Make use of Android SDK and iOS SDK for platform integration.	**K3**
	CO5 Develop various real time mobile applications.	**K4**

UNIT- I	**Application Foundation and Interfaces**	**Periods: 9**
Introduction to mobile applications – Importance of mobile strategies – Cost of development – Mobile myths – Market and business drivers for mobile applications – Mobile web presence – Mobile applications – Benefits of a mobile app – Introduction to Interfaces – Mobile user interface design – Understanding mobile application users – Understanding mobile information design – Understanding mobile platforms – Using the tools of mobile interface design.		**CO1**
UNIT- II	**Web Components**	**Periods: 9**
Choosing a mobile web option – Adaptive mobile websites – Dedicated mobile websites – Mobile web apps with HTML5 – Design patterns for mobile applications – Advanced web service techniques for mobile devices.		**CO2**
UNIT- III	**Android Software Development**	**Periods: 9**
Android toolkit - Java for android - components of an Android Application. Eclipse Concepts and Terminology - Eclipse Views and Perspective - Eclipse and Android - Effective java for Android Building a View - Fragments and Multiplatform Support – Drawing - Handling and Persisting Data.		**CO3**
UNIT- IV	**Platform Integration**	**Periods: 9**
Development practices – Android fundamentals – Android SDK – Common interactions – Offline storage – iOSSDK – Debugging iOS apps – Objective - C basics – iOS features.		**CO4**
UNIT- V	**Application Development**	**Periods: 9**
Using google maps – GPS – Wi-Fi and WiMAX – Integration with social media applications – Foldable displays – Centralized storage – Mobile commerce.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.
2. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, Dream Tech, 2012.
3. James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012.

Reference Books

1. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.
2. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, “Android Programming: The Big Nerd Ranch Guide”, Big Nerd Ranch LLC, Third edition, 2017.
3. Reto Meier, “Professional android Development”, Wiley-India Edition, 2012.
4. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, Second edition, 2011.
5. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd, 2010.

Web References

1. https://www.keycdn.com/blog/web-development-tools
2. https://www.comentum.com/guide-to-web-application-development.html
3. http://developer.android.com/develop/index.html
4. https://www.stclaircollege.ca/programs/mobile-applications-development
5. https://www.fingent.com/blog/mobile-application-development-your-ultimate-guide/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE210**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Wireless Sensor Networks and IOT**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand basic sensor network concepts	**K1**
	CO2 Know physical layer issues, understand and analyze Medium Access Control Protocols	**K2**
	CO3 Comprehend network and transport layer characteristics and protocols and implement conventional protocols	**K3**
	CO4 Understand the network management and Middleware services	**K1**
	CO5 Analyze Middleware and Security issues	**K3**

UNIT- I	**Fundamentals of Sensor Networks**	**Periods: 9**	
Introduction to computer and wireless sensor networks and Overview of the syllabus- Motivation for a network of Wireless Sensor nodes- Sensing and sensors-challenges and constraints - node architecture-sensing subsystem, processor subsystem-communication interfaces- prototypes, Application of Wireless sensors- Introduction of Tiny OS Programming and TOSSIM Simulator.			**CO1**
UNIT- II	**Communication Characteristics And Deployment Mechanisms**	**Periods: 9**	
Wireless Transmission Technology and systems-Radio Technology Primer-Available Wireless Technologies - Hardware-Telosb, Micaz motes- Time Synchronization- Clock and the Synchronization Problem - Basics of time synchronization-Time synchronization protocols - Localization- Ranging Techniques- Range based Localization-Range Free Localization- Event driven Localization			**CO2**
UNIT- III	**MAC Layer**	**Periods: 9**	
Overview-Wireless Mac Protocols-Characteristics of MAC protocols in Sensor networks – Contention free MAC Protocols-characteristics- Traffic Adaptive Medium Access-Y-MAC, Low energy Adaptive Clustering - Contention based MAC Protocols-Power Aware Multi-Access with signaling, Sensor MAC-Timeout MAC-Data gathering MAC- Case study –Implementation and Analysis of MAC player protocol in TinyOS.			**CO3**
UNIT- IV	**Routing in Wireless Sensor Networks**	**Periods: 9**	
Design Issues in WSN routing- Data Dissemination and Gathering-Routing Challenges in WSN - Flooding-Flat Based Routing – SAR, Directed Diffusion, Hierarchical Routing- LEACH, PEGASIS - Query Based Routing- Negotiation Based Routing-Geographical Based Routing- Transport layer- Transport protocol Design issues- Performance of Transport Control Protocols.Case study- Implementation and analysis of Routing protocol or transport layer protocol in Tiny OS			**CO4**
UNIT- V	**Middleware and Security Issues**	**Periods: 9**	
WSN middleware principles-Middleware architecture-Existing middleware - operating systems for wireless sensor networks-performance and traffic management - Fundamentals of network security-challenges and attacks - Protocols and mechanisms for security. Case study- Handling attacks in Tiny OS			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Waltenegus Dargie, Christian Poellabauer , “Fundamentals of Wireless Sensor Networks, Theory and Practice”, Wiley Series on wireless Communication and Mobile Computing, 2011
2. Kazem Sohraby, Daniel manoli , “Wireless Sensor networks- Technology, Protocols and Applications”, Wiley InterScience Publications 2010.
3. Bhaskar Krishnamachari , “ Networking Wireless Sensors”, Cambridge University Press, 2005

Reference Books

1. C.S Raghavendra, Krishna M.Sivalingam, Taiebznati , “Wireless Sensor Networks”, Springer Science 2004.
2. Jun Zheng, Abbas Jamalipour,” Wireless Sensor Networks: A Networking Perspective”, Wiley-IEEE Press,2009
3. Ibrahiem M. M. El Emary, S. Ramakrishnan,”Wireless Sensor Networks: From Theory to Applications”, 2013
4. Robert Faludi,” Building Wireless Sensor Networks”, O'Reilly Media, Inc. 2010.
5. A Swami,” Wireless Sensor Networks - Signal Processing and Communications Perspectives”,2007.

Web References

1. https://www.geeksforgeeks.org/wireless-sensor-network-wsn/
2. https://www.electronicshub.org/wireless-sensor-networks-wsn/
3. https://www.tutorialspoint.com/what-are-wireless-sensor-networks
4. https://www.save9.com/internet-and-wireless-networks/wireless-sensor-networks/
5. https://www.ilovephd.com/what-is-the-difference-between-wsn-and-iot/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	-	-	1	-	1	1	1
2	2	2	2	3	2	-	1	2	1
3	1	1	2	2	-	-	1	2	1
4	1	1	-	3	2	-	1	2	1
5	3	2	2	2	2	3	1	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **AC**				*End Semester Exam Type: **TE**		
Course Code	**P23ACTX01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**English for Research Paper Writing**	**2**	**-**	**-**	**-**	**100**	**-**	**100**

(Common to all M.Tech Programme)

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand that how to improve your writing skills and level of readability.	**K2**
	CO2 Learn about what to write in each section.	**K1**
	CO3 Understand the skills needed when writing a Title.	**K2**
	CO4 Understand the skills needed when writing the Conclusion.	**K2**
	CO5 Ensure the good quality of paper at very first-time submission.	**K3**

UNIT- I	**Introduction to Research Paper Writing**	**Periods: 6**	
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.			**CO1**
UNIT- II	**Presentation Skills**	**Periods: 6**	
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.			**CO2**
UNIT- III	**Title Writing Skills**	**Periods: 6**	
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.			**CO3**
UNIT- IV	**Result Writing Skills**	**Periods: 6**	
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.			**CO4**
UNIT- V	**Verification Skills**	**Periods: 6**	
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission.			**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Adrian Wallwork, “English for Writing Research Papers”, Springer, New York, Dordrecht Heidelberg London, 2011.
2. Day R, “How to Write and Publish a Scientific Paper”, Cambridge University Press, 2006.
3. Goldbort R, “Writing for Science”, Yale University Press (Available on Google Books), 2006.
4. Highman N, “Handbook of Writing for the Mathematical Sciences”, SIAM. Highman’s book, 1998.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Disaster Management**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Ability to summarize basics of disaster.	**K1**
	CO2	Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	**K2**
	CO3	Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	**K3**
	CO4	Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	**K3**
	CO5	Ability to develop the strengths and weaknesses of disaster management approaches.	**K3**

UNIT- I	**Introduction**	**Periods: 6**	
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.			**CO1**
UNIT- II	**Repercussions of Disasters and Hazards**	**Periods: 6**	
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.			**CO2**
UNIT- III	**Disaster Prone Areas in India**	**Periods: 6**	
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics.			**CO3**
UNIT- IV	**Disaster Preparedness and Management**	**Periods: 6**	
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.			**CO4**
UNIT- V	**Risk Assessment**	**Periods: 6**	
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival			**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Goel S. L., "Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company, 2007.
3. Sahni, Pardeep Et.Al. , "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX03**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Sanskrit for Tecnical Knowledge**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understanding basic Sanskrit language.	**K2**
	CO2 Write sentences	**K2**
	CO3 Know the order and roots of Sanskrit.	**K3**
	CO4 Know about technical information about Sanskrit literature	**K3**
	CO5 Understand the technical concepts of Engineering.	**K2**

UNIT- I	**Alphabets**	**Periods: 6**
Alphabets in Sanskrit.		**CO1**
UNIT- II	**Tenses and Sentences**	**Periods: 6**
Past/Present/Future Tense - Simple Sentences.		**CO2**
UNIT- III	**Order and Roots**	**Periods: 6**
Order - Introduction of roots of Engineering-Electrical, Mechanical, Architecture, Mathematics.		**CO3**
UNIT- IV	**Sanskrit Literature**	**Periods: 6**
Technical information about Sanskrit Literature.		**CO4**
UNIT- V	**Technical Concepts of Engineering**	**Periods: 6**
Technical concepts		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Dr. Vishwas, “Abhyaspustakam”, Samskrita-Bharti Publication, New Delhi.
2. Prathama Deeksha, Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, “Teach Yourself Sanskrit”, New Delhi Publication.
3. Suresh Soni, “India’s Glorious Scientific Tradition”, Ocean books (P) Ltd., New Delhi, 2017

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX04**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Value Education**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Knowledge of self-development.	**K2**
	CO2	Learn the importance of Human values.	**K1**
	CO3	Developing the overall personality.	**K3**
	CO4	Developing Character and Competence	**K3**

UNIT- I	**Values and Self Development**	**Periods: 6**	
Values and self-development–Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgments of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.			**CO1**
UNIT- II	**Cultivation of Values**	**Periods: 6**	
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline			CO2
UNIT- III	**Personality Development**	**Periods: 6**	
Personality and Behavior Development-Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brother hood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.			**CO3**
UNIT- IV	**Character Development**	**Periods: 6**	
Character and Competence–Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role.			**CO4**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX05**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Constitution of India**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	**K3**
	CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	**K3**
	CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections.	**K3**
	CO4	Discuss the passage of the Hindu Code Bill of 1956.	**K3**
	CO5	Discuss the administration and Election commission	**K3**

UNIT- I	**History of Making of The Indian Constitution**	**Periods: 6**	
History, Drafting Committee, (Composition & Working).			**CO1**
UNIT- II	**Philosophy of The Indian Constitution**	**Periods: 6**	
Preamble, Salient Features.			**CO2**
UNIT- III	**Contours of Constitutional Rights and Duties**	**Periods: 6**	
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.			**CO3**
UNIT- IV	**Organs of Governance**	**Periods: 6**	
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.			**CO4**
UNIT- V	**Local Administration and Election Commission**	**Periods: 6**	
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy. Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.			**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. "The Constitution of India, 1950(Bare Act), Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution, 1 st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edition, Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
5. Suresh Soni, "India's Glorious Scientific Tradition" Ocean books (P) Ltd., New Delhi, 2017.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Computer Science and Engineering**		Programme: **M.Tech.**					
Semester	**I/II**		Course Category : **AC**			*End Semester Exam Type: **TE**		
Course Code	**P23ACTX06**		Periods / Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**Pedagogy Studies**		**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)									
Prerequisite	No Prerequisite needed								
Course Outcomes	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)		
	CO1	What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?					**K2**		
	CO2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?					**K2**		
	CO3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?					**K2**		
	CO4	Illustrate Professional development					**K3**		
	CO5	Identify Research gaps and Future Directions					**K3**		

UNIT- I	**Introduction and Methodology**	**Periods: 6**	
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions – Overview of methodology and Searching.			CO1
UNIT- II	**Thematic Overview**	**Periods: 6**	
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.			**CO2**
UNIT- III	**Evidence on The Effectiveness of Pedagogical Practices**	**Periods: 6**	
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies			**CO3**
UNIT- IV	**Professional Development**	**Periods: 6**	
Professional development: alignment with classroom practices and follows up support – Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes			**CO4**
UNIT- V	**Research Gaps and Future Directions**	**Periods: 6**	
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.			**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Ackers J, Hardman,F, "Classroom interaction in Kenyan primary schools, Compare", 31(2): 245- 261, 2001.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies", 36(3):361-379, 2004.
3. Akyeampong K, "Teacher training in Ghana-does it count? Multi-site teacher education research project (MUSTER) country report", London, DFID, 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?", International Journal Educational Development, 33(3): 272–282, 2013.
5. Alexander RJ, "Culture and pedagogy: International comparisons in primary education", Oxford and Boston: Blackwell, 2001.
6. Chavan M, "Read India: Amass scale, rapid, 'learning to read' campaign", 2003.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX07**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Stress Management by Yoga**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Develop healthy mind in a healthy body thus improving social health also	**K2**
	CO2 Improve efficiency.	**K2**
	CO3 Understand Asan and Pranayam	**K2**
	CO4 Apply Asanas	**K4**
	CO5 Apply Pranayam	**K4**

UNIT- I	**Introduction**	**Periods: 6**	
Definitions of Eight parts of yoga. (Ashtanga).			**CO1**
UNIT- II	**Do`s and Don't's in Life**	**Periods: 6**	
Yam and Niyam - Do`s and Don't's in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.			**CO2**
UNIT- III	**Asan and Pranayam**	**Periods: 6**	
Asan and Pranayam - Various yoga poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayam.			**CO3**
UNIT- IV	**Asan Practices**	**Periods: 6**	
Practice on Various yoga poses			**CO4**
UNIT- V	**Pranayam Practices**	**Periods: 6**	
Practice on various pranayam			**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Janardan Swami Yoga bhyasi Mandal, "Yogic Asanas for Group Tarining-Part-I", Nagpur.
2. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama Publication Department, Kolkata

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX08**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Personality Development through Life Enlightenment Skills**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							
Course Outcomes	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)	
	CO1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.					**K3**	
	CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity.					**K1**	
	CO3	Study of Neet is hatakam will help in developing versatile personality of students.					**K3**	
UNIT- I					**Periods: 6**			
Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's) 4-Verses 18, 38,39 Chapter18 – Verses37,38,63.								**CO1**
UNIT- II					**Periods: 12**			
Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3- Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.model – shrimad bhagwad geeta - Chapter2- Verses 17, Chapter 3-Verses 36,37,42 – Chapter.								**CO2**
UNIT- III					**Periods: 12**			
Statements of basic knowledge – Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter12 -Verses 13, 14, 15, 16,17, 18 - Personality of role.								**CO3**
Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**			**Total Periods: 30**			
Reference Books								
1. Gopinath, Rashtriya Sanskrit Sansthanam P, "Bhartrihari's Three Satakam, Niti-sringar- vairagya", New Delhi,2010. 2. Swami Swarupananda, Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata, 2016								

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX09**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Unnat Bharath Abhiyan**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Gain an understanding of rural life, culture and social realities	**K3**
	CO2	Develop a sense of empathy and bonds of mutuality with local community	**K1**
	CO3	Appreciate significant contributions of local communities to Indian society and economy	**K3**
	CO4	Learn to value the local knowledge and wisdom of the community	**K3**
	CO5	Identify opportunities for contributing to community's socio-economic improvements.	**K3**

UNIT- I	**Appreciation of Rural Society**	**Periods: 6**	
Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure.			**CO1**
UNIT- II	**Understanding Rural Economy and Livelihood**	**Periods: 6**	
Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets.			**CO2**
UNIT- III	**Rural Institutions**	**Periods: 6**	
Traditional rural organizations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration.			**CO3**
UNIT- IV	**Rural Development Programmes**	**Periods: 6**	
History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awaas Yojana, Skill India, Gram Panchayat Decentralized Planning, NRLM, MNREGA, etc.			**CO4**
UNIT- V	**Field Based Practical Activities**	**Periods: 6**	
Visit MGNREGS project sites. Swachh Bharat project sites, Conduct Mission Antyodaya surveys, Interactive community exercise with local leaders, Panchayat functionaries, Visit Rural Schools / mid-day meal centres, study Academic and infrastructural resources and gaps, Participate in Gram Sabha meetings, Visit local Anganwadi Centre, Conduct soil health test, drinking water analysis.			**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Singh, Katar, "Rural Development : Principles, Policies and Management", Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, "Sustainable Development Goals", 2015.
4. M.P.Boraian, "Best Practices in Rural Development", Shanlax Publishers, 2016

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23BDEC03**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Analytics of Things**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Common to M.Tech CSE(BDA) and M.Tech CSE

Prerequisite	Basics of IoT	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the specific challenges in applying data analytics techniques over IoT data.	**K2**
	CO2 Will know IoT network architecture and design.	**K2**
	CO3 Analyze Smart objects and connecting smart objects	**K3**
	CO4 Analyze various IoT networking protocols.	**K3**
	CO5 Apply IoT analytics for cloud and data science for IoT analytics.	**K4**

UNIT- I	**IoT Analytics, Challenges and Network Architectures**	**Periods: 9**	
IoT analytics: Defining Analytics, Defining Internet of Things, The concepts of constrained - IoT challenges: the Data volume, Problem with time and space, Data quality, Analytics Challenges -Business value concerns. Drivers behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.			**CO1**
UNIT- II	**The Things in IoT and Connecting Smart Objects**	**Periods: 9**	
Sensors, Actuators, and Smart Objects, Sensor Networks, Communications Criteria, Range, Frequency Bands, Power Consumption, Topology, Constrained Devices, Constrained-Node Networks, IoT Access Technologies, IEEE 802.15.4, IEEE 802.15.4g and 802.15.4e, LoRaWAN.			**CO2**
UNIT- III	**IoT Networking Protocols**	**Periods: 9**	
IoT networking data messaging protocols, Message Queue Telemetry Transport (MQTT), Hyper-Text Transport Protocol (HTTP), Constrained Application Protocol (CoAP), Data Distribution Service (DDS).			**CO3**
UNIT- IV	**Data Science for IoT Analytics**	**Periods: 9**	
Machine learning (ML), Feature engineering with IoT data, Validation methods, Understanding the bias– variance tradeoff, Comparing different models to find the best fit using R, Random forest models using R, Anomaly detection using R.			**CO4**
UNIT- V	**IoT Analytics for the Cloud**	**Periods: 9**	
Building elastic analytics, Elastic analytics concepts, designing for scale, Cloud security and analytics, The AWS overview, Microsoft Azure overview. Contemporary Issues			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Andrew Minteer , Analytics for the Internet of things, Packt publishing 2017.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.
3. Adeel Javed, “Building Arduino Projects for the Internet of Things: Experiments with Real-World Applications”, 1st Edition, Apress, 2016.

Reference Books

1. Pethuru Raj, Anupama C. Raman, The Internet of Things, Enabling Technologies, Platforms, and Use Cases, CRC Press, 2017.
2. Rajkumar Buyya, Amir Vahid Dastjerdi, Internet of Things Principles and Paradigms, Morgan Kaufmann, 1st edition, 2016.
3. Marco Schwartz, Internet of Things with Arduino Cookbook, Packt Publishing,2016.
4. Tausifa Jan Saleem, Mohammad Ahsan Chishti, “Big Data Analytics for Internet of Things”, Wiley, 2021.
5. Data Science Salon, “IoT and Analytics Condition Based Maintenance”, Data Science Salon, 2020.

Web References

1. https://dl.acm.org/doi/10.1145/3204947
2. https://www.researchgate.net/publication/324475172_Analytics_for_the_Internet_of_Things_A_Survey
3. https://link.springer.com/article/10.1007/s43926-021-00016-5
4. https://www.sciencedirect.com/science/article/pii/S2666603020300294
5. https://iot-analytics.com/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE311**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Cloud Security and Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Cloud Computing	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Comprehend the basics of cloud platforms and risk issues in cloud computing.	**K2**
	CO2 Understand cloud security architecture, challenges and requirements.	**K2**
	CO3 Understand the functionalities of security protocols.	**K2**
	CO4 Identifying best practices and strategies for a secure cloud environment.	**K3**
	CO5 Illustrate how to perform security analytics in cloud platform.	**K4**

UNIT- I	**Securing the cloud**	**Periods: 9**	
Cloud platforms and architectures Security issues from the cloud providers perspec- tive,users perspective Understanding security and privacy - Cloud Computing risk issues. Security challenges Security requirements for the architecture - Securing private and public cloudsSecurity patterns Cloud security architecture Infrastructure security.			**CO1**
UNIT- II	**Security Protocols and Standards**	**Periods: 9**	
Host security, Compromise response, Security standards Message Level Security (MLS), Transport Level Security, OAuth, OpenID, eXtensible Access Control Markup Language (XACML), and Security Assertion Markup Language (SAML).			**CO2**
UNIT- III	**Strategies and Security management in the Cloud**	**Periods: 9**	
Strategies and best practices Security controls: limits, best practices, monitoring Security criteria -assessing risk factors in Clouds. Security management in the cloud: SaaS, PaaS, IaaS availability management Security as a service-Trust Management for Security.			**CO3**
UNIT- IV	**Security Analytics I**	**Periods: 9**	
Techniques in Analytics - Challenges in Intrusion Detection System and Incident IdentificationDDoS attacks Analytics - Analysis of Log file - Simulation and Security Process.			**CO4**
UNIT- V	**Security Analytics II**	**Periods: 9**	
Access Analytics - Security Analysis with Text Mining Security Intelligence and Breaches			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Ronald L. Krutz , Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud computing, Wiley 2010
2. Securing the Cloud: Cloud Computer Security Techniques and Tactics, by Vic (J.R) Winkler, Elseiver 2011
3. Ben Halpert , Auditing Cloud Computing: A Security and Privacy Guide: , John Wiley Sons, 2011.

Reference Books

1. Ianlim, E.Coleen Coolidge, Paul Hourani, Securing Cloud and Mobility: A Practitioners Guide, Auerbach Publications, Feb 2013.
2. Pethuru Raj, “Cloud Enterprise Architecture”, CRC Press, 2013.
3. Raj Kumar Buyya , James Broberg, andrzejGoscinski, Cloud Computing:!!, Wiley 2013
4. Dave shackleford, Virtualization Security!, SYBEX a wiley Brand 2013.
5. Mather, Kumaraswamy and Latif, Cloud Security and Privacy!, OREILLY 2011

Web References

1. https://aws.amazon.com/security/
2. https://jisajournal.springeropen.com/articles/10.1186/1869-0238-4-5
3. https://www.mdpi.com/2673-8732/3/3/18
4. https://cloud.google.com/learn/what-is-cloud-network-security
5. https://www.sailpoint.com/identity-library/cloud-security-defined/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23CSE312**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Pattern Recognition**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No pre request needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understanding Pattern recognition	**K2**
	CO2 Classification and different approaches of algorithms	**K3**
	CO3 Identify different Paradigms of Pattern Recognition	**K3**
	CO4 Make use of Feature Extraction	**K2**
	CO5 Illustrate Advances in Pattern Recognition	**K4**

UNIT- I	**Introduction**	**Periods: 9**	
Introduction – Definitions, data sets for Pattern, Application Areas and Examples of pattern recognition, Design principles of pattern recognition system, Classification and clustering, supervised Learning, unsupervised learning and adaptation, Pattern recognition approaches, Decision Boundaries, Decision region , Metric spaces, distances.			**CO1**
UNIT- II	**Classification**	**Periods: 9**	
Classification: introduction, application of classification, types of classification, decision tree, naïve bayes, logistic regression , support vector machine, random forest, K Nearest Neighbour Classifier and variants, Efficient algorithms for nearest neighbour classification, Different Approaches to Prototype Selection, Combination of Classifiers, Training set, test set, standardization and normalization.			**CO2**
UNIT- III	**Pattern Recognition**	**Periods: 9**	
Different Paradigms of Pattern Recognition, Representations of Patterns and Classes, Unsupervised Learning & Clustering: Criterion functions for clustering, Clustering Techniques: Iterative square - error partitional clustering – K means, hierarchical clustering, Cluster validation.			**CO3**
UNIT- IV	**Feature Extraction**	**Periods: 9**	
Introduction of feature extraction and feature selection, types of feature extraction , Problem statement and Uses, Algorithms - Branch and bound algorithm, sequential forward / backward selection algorithms, (l,r) algorithm.			**CO4**
UNIT- V	**Advances in Pattern Recognition**	**Periods: 9**	
Recent advances in Pattern Recognition, Structural PR, SVMs, FCM, Soft computing and Neuro-fuzzy techniques, and real-life examples, Histograms rules, Density Estimation, Nearest Neighbor Rule, Fuzzy classification.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Richard O. Duda, Peter E. Hart and David G. Stork, “Pattern Classification”, 2nd Edition, John Wiley, 2006.
2. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2009.
3. S. Theodoridis and K. Koutroumbas, “Pattern Recognition”, 4th Edition, academic Press, 2009.

Reference Books

1. Robert Schalkoff, “pattern Recognition: statistical, structural and neural approaches”, JohnWiley & sons , Inc, 2007.
2. Shinghal Rajjan, “Pattern Recognition: Techniques and Applications”, OUP India, 2006.
3. Sankar K Pal, Amita Pal, “Pattern Recognition: from classical to Modern approach”, World Scientific, 2001
4. Murty M. Narasimha, “Pattern Recognition;An Algorithmic approach”, Springer London Ltd, 2011
5. Marques de Sa J.P, “Pattern Recognition: Concepts,Methods and Applications”, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG, 2001

Web References

1. https://www.sciencedirect.com/journal/pattern-recognition
2. https://www.cambridge.org/core/books/abs/pattern-recognition-and-neural-networks/references
3. https://www.spiceworks.com/tech/artificial-intelligence/articles/what-is-pattern-recognition/
4. https://www.geeksforgeeks.org/pattern-recognition-introduction/
5. https://viso.ai/deep-learning/pattern-recognition/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSEC05**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Game Design and Augmented Reality**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Common to M.Tech CSE and M.Tech CSE(BDA)

Prerequisite	Basic knowledge about AR	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Learn and understand the AR world and setting up the environment.	**K3**
	CO2 Understand the building of AR App	**K3**
	CO3 Set up the AR Solar System and Flat Tire.	**K3**
	CO4 Set up the Room Decoration with AR and AR instruction manual.	**K4**
	CO5 Develop the Poke the Ball Game.	**K5**

UNIT- I	**Augment your world and setting up your system**	**Periods: 9**	
Augmented Reality Applications - AR Development Tools and Frameworks - User Interaction in AR - AR Content Creation and Design - Social and Ethical Implications of AR.			**CO1**
UNIT- II	**Building our AR App and Augmented Business Cards**	**Periods: 9**	
Conceptualizing the AR Experience - Choosing the Right AR Development Platform - Designing AR User Interfaces - Integrating AR Features with Unity (or other AR Engines) - Testing and Iterating on Your AR App.			**CO2**
UNIT- III	**AR Solar system and how to change a flat tire**	**Periods: 9**	
Solar System Exploration in AR – Educational AR Apps for Astronomy – AR Planetarium Navigation – Augmented Reality Solar System Models – Preparation and Safety Measures – Installing the Spare Tire and Finishing the Process.			**CO3**
UNIT- IV	**Augmenting the instruction manual and room decoration with AR**	**Periods: 9**	
Interactive Step-by-Step Guides - Product Demos and Simulations - AR Troubleshooting and Maintenance - User Feedback and Ratings - Virtual Furniture Placement - Customizable Virtual Decor - AR Art Galleries and Displays - Seasonal and Themed Decorations.			**CO4**
UNIT- V	**Poke the Ball Game**	**Periods: 9**	
Poke Game Mechanics - Scoring System - Levels and Challenges - Visual Design and Theme - Leaderboards and Social Features.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Micheal Lanham, "Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia" , packt Publishing, 2017.
2. Dominic Cushnan, Sean White, "Unity AR & VR by Tutorials", Razeware LLC, 2019.
3. Jonathan Linowes, "Title: ARCore by Example", Packt Publishing, 2018.

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1. Raghav Sood, Mastering Unity 2D Game Development - Second Edition, Packt Publishing, 2018.
2. Greg Kipper, Joseph Rampolla, "Augmented Reality: An Emerging Technologies Guide to AR Publication: Syngress", 2013.
4. Daniel M. Kligler, "Beginning Windows Mixed Reality Programming: For HoloLens and Mixed Reality Headsets", Apress, 2017.
4. Jason Odom, "Mastering Unreal Technology, Volume I: Introduction to Level Design with Unreal Engine 3", Sams Publishing, 2009.
5. Palmer Luckey, Blake J. Harris, "The History of the Future: Oculus, Facebook, and the Revolution That Swept Virtual Reality", HarperCollins, 2019

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2. https://docs.unity3d.com/Packages/com.unity.xr.arfoundation@5.1/manual/index.html
3. https://docs.unity3d.com/Packages/com.unity.xr.arkit@1.0/manual/index.html
4. https://github.com/google-ar/arcore-unity-sdk
5. https://developers.google.com/ar/develop/unity

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23CSE313**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**IoT Security and Trust**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Wireless Sensor Networks and IoT	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understanding **encryption for cyber security**	**K2**
	CO2 Identify IoT security framework	**K3**
	CO3 Illustrate Elementary blocks of IoT Security & Models for Identity Management	**K4**
	CO4 Identity Management and Trust Establishment	**K3**
	CO5 Analyze Security, Digital Identity in Cloud Computing and Cyber Crimes	**K3**

UNIT- I	**Fundamentals of encryption for cyber security.**	**Periods: 9**	
Cryptography – Need and the Mathematical basics- History of cryptography, symmetric ciphers, block ciphers, DES – AES. Public-key cryptography: RSA, Diffie-Hellman Algorithm,Elliptic Curve Cryptosystems, Algebraic structure, Triple Data Encryption Algorithm (TDEA) Block cipher			**CO1**
UNIT- II	**IoT security framework**	**Periods: 9**	
IIOT security frame work, Security in hardware,Bootprocess, OS & Kernel, application,run time environment and containers. Need and methods of Edge Security, Network Security: Internet, Intranet, LAN, Wireless Networks, Wireless cellular networks, Cellular Networks and VOIP.			**CO2**
UNIT- III	**Elementary blocks of IoT Security & Models for Identity Management**	**Periods: 9**	
Vulnerability of IoT and elementary blocks of IoT Security, Threat modeling – Key elements. Identity management Models and Identity management in IoT, Approaches using User-centric, Device-centric and Hybrid.			**CO3**
UNIT- IV	**Identity Management and Trust Establishment**	**Periods: 9**	
Trust management lifecycle, Identity and Trust, Web of trust models. Establishment: Cryptosystems – Mutual establishment phases – Comparison on security analysis. Identity management framework. Capability-based access control schemes, Concepts, identity-based and identity-driven, Light weight cryptography, need and methods.			**CO4**
UNIT- V	**Security, Digital Identity in Cloud Computing and Cyber Crimes**	**Periods: 9**	
Cloud security, Digital identity management in cloud, Classical solutions, alternative solutions, Management of privacy and personal data in Cloud. Cyber Crimes and Laws – Hackers – Dealing with the rise tide of Cyber Crimes – Cyber Forensics and incident Response – Network Forensics.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. John R. Vacca, “Computer and Information Security Handbook”, Elsevier, 2013.
2. Parikshit Narendra Mahalle , Poonam N. Railkar, “Identity Management for Internet of Things”, River Publishers, 2015.
3. William Stallings, “Cryptography and Network security: Principles and Practice”, 5th Edition, Pearson Education, India. 2014.

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1. Maryline Laurent, Samia Bouzefrane, “Digital Identity Management”, Elsevier, 2015.
2. Christof Paar and Jan Pelzl, “Understanding Cryptography – A Textbook for Students and Practitioners”, Springer, 2014.
3 Behrouz A.Forouzan : Cryptography & Network Security – The McGraw Hill Company, 2007.
4. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: “Private Communication in a public World”, PTR Prentice Hall, Second Edition, 2002.
5. Alasdair Gilchrist, “IoT security Issues”, Oreilly publications, 2017

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4. https://ieeexplore.ieee.org/document/9187908
5. https://link.springer.com/article/10.1007/s42452-021-04156-9

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSEC06**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Image and Video Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Common to M.Tech CSE and M.Tech CSE(BDA)

Prerequisite	No Prerequisite	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the requirements of image processing	**K2**
	CO2 Illustrate the principles and techniques of digital image in applications related to digital imaging system	**K4**
	CO3 Demonstrate the image recognition and motion recognition	**K3**
	CO4 Understand the fundamentals of digital video processing	**K2**
	CO5 Design and Analysis of video processing in application	**K4**

UNIT- I	**Image Segmentation, Compression and Colour Image Processing**	**Periods: 9**	
Basic steps of Image processing system – Pixel relationship- Image Transforms-. Image Enhancement- Histogram Processing, Spatial filtering, Frequency Domain filtering - Image Segmentation –Detection of Discontinuities. - Edge Linking and Boundary Detection. - Thresholding. -Region-Based Segmentation. Image Compression – Encoder-Decoder model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, JPEG, JPEG 2000. Colour Image Processing – Colour Models, Color Transformations Color Image Smoothing and Sharpening, Color Noise Reduction, Color-Based Image Segmentation			**CO1**
UNIT- II	**Feature extraction and Texture Analysis**	**Periods: 9**	
Feature Extraction - Binary object feature, Histogram-based (Statistical) Features, Intensity features, Shape feature extraction, PCA - SIFT – SURF. Texture Analysis - Concepts and classification, statistical, structural and spectral analysis.			**CO2**
UNIT- III	**Object recognition and Image Retrieval**	**Periods: 9**	
Object Recognition -Patterns and pattern class, Bayes' Parametric classification, Feature Selection and Boosting, Template-Matching. Content Based Image Retrieval - Feature based image retrieval, Object Based Retrieval			**CO3**
UNIT- IV	**Digital video processing, Segmentation and Tracking**	**Periods: 9**	
Digital Video, Sampling of video signal, Video Enhancement and Noise Reduction- Rate control and buffering, MPEG, H.264, Inter frame Filtering Techniques, Fundamentals of Motion Estimation and Motion Compensation - Change Detection, Background modelling, Motion Segmentation, Simultaneous Motion Estimation and Segmentation, Motion Tracking, Multi-target/Multi-camera tracking			**CO4**
UNIT- V	**Video Analysis Action Recognition**	**Periods: 9**	
Video Analysis Action Recognition, Video based rendering, Context and scene understanding. Case Study: Surveillance - Advanced Driver Assistance System			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Ed., Prentice-Hall, 2008
2. Murat Tekalp, "Digital Video Processing", Second Edition, Prentice Hall, 2015.
3. Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis, and Machine Vision, 4nd edition, Thomson Learning, 2013

Reference Books

1. Oge Marques, "Practical Image and Video Processing Using MATLAB", Wiley-IEEE Press,2011
2. Yu Jin Zhang, "Image Engineering: Processing, Analysis and Understanding", Tsinghua University Press, 2009.
3. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012
4. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010
5. Boguslaw Cyganek,"Object Detection and Recognition in Digital Images: Theory and Practice", Wiley 2013

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2. https://dl.acm.org/doi/10.1145/3576935
3. https://cloudinary.com/documentation/video_analytics
4. https://www.happiestminds.com/services/image-processing-text-audio-video-analytics/
5. https://ieeexplore.ieee.org/document/9362900

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23CSE314**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Web Application Security**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Web application	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify the vulnerabilities in the web applications.	**K2**
	CO2 Identify the various types of threats and mitigation measures of web applications.	**K2**
	CO3 Apply the security principles in developing a reliable web application.	**K4**
	CO4 Use industry standard tools for web application security.	**K2**
	CO5 Apply penetration testing to improve the security of web applications.	**K4**

UNIT- I	**Overview of Web Applications**	**Periods: 9**	
Introduction history of web applications interface ad structure benefits and drawbacks of web applications Web application Vs Cloud application. Web Application Security Fundamentals ,Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb- Classifying and Prioritizing Threads- Browser Security Principles -Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS - HTML Injection			**CO1**
UNIT- II	**Web Application Vulnerabilities**	**Periods: 9**	
Web Application Vulnerabilities -Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application- Session vulnerabilities and testing - Cross-site request forgery			**CO2**
UNIT- III	**Web Application Mitigations**	**Periods: 9**	
Web Application Mitigations -Http request , http response, rendering and events , html image tags, image tag security, issue, java script on error , Java script timing , port scanning , remote scripting , running remote code, frame and iframe , browser sandbox, policy goals, same origin policy, library import, domain relaxation			**CO3**
UNIT- IV	**Secure website design**	**Periods: 9**	
Secure website design : Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management ,Sensitive Data, Session Management, Cryptography, Parameter Manipulation, Exception Management, Auditing and Logging, Design Guidelines, Forms and validity, Technical implementation			**CO4**
UNIT- V	**Web Application Security**	**Periods: 9**	
Cutting Edge Web Application Security -Clickjacking - DNS rebinding - Flash security - Java applet security - Single-sign-on solution and security -IPv6 impact on web security			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Professional, 2011.
2. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011
3. Cross M, "Developer'S Guide To Web Application Security", Elsevier, 2007.

Reference Books

1. Carlos serao, "Web Application Security", Springer-Verlag Berlin and Heidelberg GmbH & Co. KG, 2009.
2. Andrew Hoffman, "Web Application Security: Exploitation and Countermeasures for Modern Web Applications", O'Reilly, 2020
3. Dafydd Stuttard and Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", Wiley, 2011
4. Malcolm McDonald "Grokking Web Application Security", MEAP,2024
5. Dr Sunny Wear, "Burp Suite Cookbook - Second Edition: Web application security made easy with Burp Suite", Packt Publishing, 2023

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2. https://www.cuit.columbia.edu/sites/default/files/content/Web%20Application%20Security%20Standards%20and%20Practices.pdf
3. https://www.w3.org/2019/03/webappsec-2019-charter.html
4. https://ieeexplore.ieee.org/document/8342469/
5. https://owasp.org/www-project-top-ten/

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE315**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Cognitive Science**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No pre request needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand basics of Cognitive Computing	**K2**
	CO2 Plan and use the primary tools associated with cognitive computing	**K2**
	CO3 Plan and execute a project that leverages Cognitive Computing	**K2**
	CO4 Make use of Learning models of Cognition	**K3**
	CO5 Analyze Case Studies of Cognition	**K3**

UNIT- I	**Introduction**	**Periods: 9**
Cognitive science and cognitive Computing with AI, Cognitive Computing - Cognitive Psychology - The Architecture of the Mind - The Nature of Cognitive Psychology – Cognitive architecture – Cognitive processes – The Cognitive Modeling Paradigms - Declarative / Logic based Computational cognitive modeling –connectionist models – Bayesian models. Introduction to Knowledge-Based AI – Human Cognition on AI – Cognitive Architectures		**CO1**
UNIT- II	**Cognitive Computing with Inference and Decision Support Systems**	**Periods: 9**
Intelligent Decision making, Fuzzy Cognitive Maps, Learning algorithms: Non linear HebbianLearning – Data driven NHL - Hybrid learning, Fuzzy Grey cognitive maps, Dynamic Random fuzzy cognitive Maps.		**CO2**
UNIT- III	**Cognitive Computing with Machine Learning**	**Periods: 9**
Machine learning Techniques for cognitive decision making – Hypothesis Generation and Scoring - Natural Language Processing - Representing Knowledge - Taxonomies and Ontologies - Deep Learning.		**CO3**
UNIT- IV	**Learning models of Cognition**	**Periods: 9**
Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models-Learning (Deep) Continuous Functions – Mixture Models.		**CO4**
UNIT- V	**Case Studies**	**Periods: 9**
Cognitive Systems in health care – Cognitive Assistant for visually impaired – AI for cancer detection, Predictive Analytics - Text Analytics - Image Analytics -Speech Analytics – IBM Watson		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1 Hurwitz, Kaufman, and Bowles, “Cognitive Computing and Big Data Analytics”,Wiley, Indianapolis, IN, 2005..
2 Masood, Adnan, Hashmi, Adnan,”Cognitive Computing Recipes-Artificial Intelligence Solutions Using Microsoft Cognitive Services and TensorFlow”, 2015
3.Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, “Cognitive Computing: Theory and Applications: (Handbook of Statistics 35)”, Elsevier publications, 2016.

Reference Books

1.Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
2.Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”,The MIT Press, 1999
3 Peter Fingar, Cognitive Computing: A Brief Guide for Game Changers, PHI Publication, 2015
4 Gerardus Blokdyk ,Cognitive Computing Complete Self-Assessment Guide, 2018
5 Rob High, Tanmay Bakshi, Cognitive Computing with IBM Watson: Build smart applications using Artificial Intelligence as a service, IBM Book Series.

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2.https://groups.inf.ed.ac.uk/teaching/cogsci/course/tutorials
3. http://www.digimat.in/nptel/courses/video/109104123/L01.html
4. https://www.youtube.com/watch?v=LTThtJMTew8
5. https://emeritus.org/blog/healthcare-cognitive-science/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE316**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Cloud Application Development and Management**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics about Cloud	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Demonstrate the ability to access the various cloud platforms used	**K2**
	CO2 Describe the standardization process of cloud platform and various API's	**K2**
	CO3 Describe the methods for managing the data in cloud and demonstrate the concepts of automation, provisioning using puppet tool.	**K2**
	CO4 Develop Applications in the cloud platform	**K4**
	CO5 Analyze and use of an appropriate framework and APIs for the task	**K3**

UNIT- I	**Introduction**	**Periods: 9**
Basic concepts and techniques-Business case for implementing cloud application, Requirements collection for cloud application development, Cloud service models and deployment models, Open challenges in Cloud Computing: Cloud inter-operability and standards, scalability and fault tolerance, security, trust and privacy.		**CO1**
UNIT- II	**Application Development Framework**	**Periods: 9**
Application development framework-Accessing the clouds: Web application vs Cloud Application, Frameworks: Model View Controller (MVC), Struts, Spring. Cloud platforms in Industry – Google AppEngine, Microsoft Azure, Openshift, CloudFoundry		**CO2**
UNIT- III	**Cloud Service Delivery Environment and API**	**Periods: 9**
Cloud service delivery environment and API Storing objects in the Cloud, Session management, Working with third party APIs: Overview of interconnectivity in Cloud ecosystems. Facebook API, Twitter API, Google API		**CO3**
UNIT- IV	**Architecting for the Cloud**	**Periods: 9**
Architecting for the Cloud : Best practices-Best practices in architecture cloud applications in AWS cloud, Amazon Simple Queue Service (SQS), RabbitMQ- Cloud applications Amazon Simple Notification Service (Amazon SNS), multi-player online game hosting on cloud resources, Building content delivery-networks using clouds		**CO4**
UNIT- V	**Managing the data in Cloud**	**Periods: 9**
Managing the data in cloud-Securing data in the cloud, ACL, OAuth, OpenID, XACML, securing-data for transport in the cloud, scalability of applications and cloud services. Automation and provisioning tool-Puppet and Chef – steps for automation: Introduction, files and packages, services and subscriptions, exec and notify, facts, conditional statements and logging.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 2013
2. David E.Y.Sarna, "Implementing and Developing Cloud Computing Applications", Auerbach Publications,2010
3. John Biggs, Vicente García, Jose Salanova, "Building Intelligent Cloud Applications: Develop Scalable Models Using Serverless Architectures with Azure", O'Reilly, 2019.

Reference Books

1. Rajkumar buyya, Christian vecchiola, S Thamarai Selvi , "Mastering cloud computing", Tata McGraw Hill Education Private Limited, 2013 .
2. Anthony T .Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing a Practical Approach", Tata McGraw-HILL, 2010 Edition.
3. Barrie sosinsky, "Cloud computing bible, Wiley publishing
4. James Loope, "Managing Infrastructure with puppet", O'REILLY , June 2011
5. Michael Miller, "Cloud Computing: Web Based Applications That Change The Way You Work And Collaborate Online", Pearson, 2008.

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3. https://aws.amazon.com/documentation
4. https://learn.rumie.org/jR/bytes/learn-the-basics-of-cloud-computing
5. https://www.reply.com/alpha-reply/en/content/cloud-computing-in-web-app-development-what-are-you-waiting-for

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
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3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE317**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Intelligent Internet of Things**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of IoT	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understanding IoT and Intelligent Systems	**K2**
	CO2 Make use of IoT Sensors and Actuators	**K2**
	CO3 Illustrate Data Processing and analytics in IoT	**K3**
	CO4 Apply Artificial Intelligence in IoT	**K4**
	CO5 Illustrate IoT applications and Future Trends	**K3**

UNIT- I	**Introduction to IoT and Intelligent Systems**	**Periods: 9**	
Overview of IoT-Definition, evolution, and key concepts-IoT architecture and components-Intelligent Systems-Introduction to AI in IoT-Machine learning and IoT applications-Interconnectivity and Communication Protocols-IoT communication protocols-Edge computing in IoT			**CO1**
UNIT- II	**IoT Sensors and Actuators**	**Periods: 9**	
Sensor Technologies-Types of sensors used in IoT-Sensor data acquisition and processing-Actuators in IoT-Overview and applications-Controlling devices in IoT systems-Data Fusion and Sensor Networks-Sensor data fusion techniques-Wireless sensor networks			**CO2**
UNIT- III	**Data Processing and Analytics in IoT**	**Periods: 9**	
Data Storage and Management-IoT data storage solutions-Big Data and IoT-Data Analytics in IoT-Descriptive, predictive, and prescriptive analytics-Real-time analytics in IoT- Security and Privacy in IoT - Threats and challenges-Security measures in IoT systems			**CO3**
UNIT- IV	**Artificial Intelligence in IoT**	**Periods: 9**	
Introduction to AI-Basics of artificial intelligence-Machine learning algorithms-AI Applications in IoT Predictive maintenance-Anomaly detection-Smart cities and homes-Edge Computing and AI Deploying AI models at the edge-Edge intelligence in IoT systems			**CO4**
UNIT- V	**IoT Applications and Future Trends**	**Periods: 9**	
Industry-specific IoT Applications-Healthcare, agriculture, manufacturing-Case studies and real-world examples-Ethical considerations in IoT-Social impact and responsibility-Future Trends in IoT			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Maciej Kranz, "Building the Internet of Things", Wiley, 2016
2. Rajkumar Buyya et al.,"Internet of Things: Principles and Paradigms", Morgan Kaufmann Publishers In, 2016.
3. Claire Rowland and Elizabeth Goodman, "Designing Connected Products", O'Reilly Media,2015.

Reference Books

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson, 2010.
2. Bruce Sinclair, "IoT Inc: How Your Company Can Use the Internet of Things to Win in the Outcome Economy", McGraw Hill, 2017.
3. Perry Lea, "IoT and Edge Computing for Architects", Packt Publishing Limited, 2020.
4. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", Shroff/O'Reilly, 2022.
5. Data Science Salon, “IoT and Analytics Condition Based Maintenance”, Data Science Salon, 2020.

Web References

1. https://dl.acm.org/doi/10.1145/3204947
2. https://www.researchgate.net/publication/324475172_Analytics_for_the_Internet_of_Things_A_Survey
3. https://link.springer.com/article/10.1007/s43926-021-00016-5
4. https://www.sciencedirect.com/science/article/pii/S2666603020300294
5. https://iot-analytics.com/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23CSE318**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Big Data Technologies**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Big Data	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Illustrate the usage of data on different Big data ecosystems.	**K4**
	CO2 Demonstrate the Pig architecture and evaluation of pig scripts.	**K3**
	CO3 Describe the Hive architecture and execute SQL queries on sample data sets.	**K3**
	CO4 Understand the concepts of indexing and use these concepts in solr search engine.	**K2**
	CO5 Implement and evaluate the data manipulation procedures using pig, hive, sqoop and solr.	**K3**

UNIT- I	**Introduction**	**Periods: 9**	
Big data- Concepts, Needs and Challenges of big data. Types and source of big data. Components of Hadoop Eco System- Data Access and storage, Data Intelligence, Data Integration, Data Serialization, Monitoring, Indexing.			**CO1**
UNIT- II	**Apache Pig**	**Periods: 9**	
Apache Pig -Introduction, Parallel processing using Pig, Pig Architecture, Grunt, Pig Data Model-scalar and complex types. Pig Latin- Input and output, Relational operators, User defined functions. Working with scripts - Apache Hive Fundamentals - Introduction-Hive modules, Data types and file formats, Hive QL-Data Definition and Data Manipulation.			**CO2**
UNIT- III	**Apache Hive Advanced Concepts**	**Periods: 9**	
Apache Hive Advanced Concepts -Hive QL queries, Hive QL views- reduce query complexity. Hive scripts. Hive QL Indexes- create, show, drop. Aggregate functions. Bucketing vs Partitioning.			**CO3**
UNIT- IV	**Importing and Handling Relational Data in Hadoop**	**Periods: 9**	
Importing and Handling Relational Data in Hadoop using Sqoop-Relational database management in Hadoop: Bi directional data transfer between Hadoop and external database. Import data- Transfer an entire table, import subset data, use different file format. Incremental import import new data, incrementally import data, preserving the value			**CO4**
UNIT- V	**Export transfer data from Hadoop**	**Periods: 9**	
Export transfer data from Hadoop, update the data, update at the same time, export subset of columns. Hadoop ecosystem integration- import data to hive, using partitioned hive tables, replace special delimiters. - Introduction. Information retrieval search engine, categories of data, inverted index. Design- field attributes and types. Indexing- indexing tool. Indexing operations using csv documents. Searching data- parameters, default query- Recent Trends in Big data			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1.AlanGates,"Programming Pig Data flow Scripting with Hadoop",O'ReillyMedia,Inc,2011.
2.Jason Rutherglen, Dean Wampler, Edward Caprialo, "Programming Hive", O'ReillyMedia Inc, 2012
3.KathleenTing,JarekJarcec Cecho, "Apache Sqoop Cook book",O'ReillyMediaInc,2013.

Reference Books

1.Dikshant Shahi, "Apache Solr: A Practical approach to enterprise search", Apress, 2015.
2.Chuck Lam, "Hadoop in Action", Manning Publications,2010.
3.Andrea Gazzarini, "Apache Solr Essentials", PACKT Publications, 2015
4. Viktor Mayer-Schonberger, Kenneth Cukier, "Big Data: A Revolution That Will Transform How We Live, Work, and Think", Houghton Mifflin Harcourt, 2013
5. Bernard Marr, "Big Data in Practice", wiley,2016.

Web References

1. https://link.springer.com/chapter/10.1007/978-3-030-68176-0_6
2. https://link.springer.com/referencework/10.1007/978-3-319-63962-8
3. https://www.interviewbit.com/blog/big-data-technologies/
4. https://www.mdpi.com/2227-7390/11/1/96
5. https://www.sciencedirect.com/science/article/pii/S1319157817300034

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE319**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Digital Forensics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics about Forensics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understanding Digital forensics	**K2**
	CO2 Make use of Windows Systems and artifacts	**K3**
	CO3 Make use of Linux Systems and artifacts	**K3**
	CO4 Illustrate current computer forensics tools	**K4**
	CO5 Analyze Identification of data	**K3**

UNIT- I	**Digital forensic**	**Periods: 9**	
Computer forensics and investigations as a profession, understanding computer forensics, computer forensics versus other related disciplines, History of computer Forensics, understanding case laws, developing computer forensics resources, preparing for computer investigations, understanding law enforcement agency investigations, Following the legal process, understanding corporate investigations, establishing company policies, Displaying warning Banners.			**CO1**
UNIT- II	**Windows Systems and artifacts**	**Periods: 9**	
Windows Systems and Artifacts: Introduction, Windows File Systems, File Allocation Table,New Technology File System, File System Summary, Registry, Event Logs, Prefetch Files,Shortcut Files, Windows Executable.			**CO2**
UNIT- III	**Linux Systems and artifacts**	**Periods: 9**	
Linux Systems and Artifacts: Introduction, Linux File Systems, File System Layer, File Name Layer , Metadata Layer, Data Unit Layer, Journal Tools, Deleted Data, Linux Logical Volume Manager, Linux Boot Process and Services, System V , BSD, Linux System Organization and Artifacts, Partitioning, File system Hierarchy, Ownership and Permissions, File Attributes, Hidden Files, User Accounts , Home Directories, Shell History GNOME Windows Manager Artifacts, Logs, User Activity Logs, Syslog, Command Line Log Processing, Scheduling Tasks			**CO3**
UNIT- IV	**Current Computer Forensics Tools**	**Periods: 9**	
Evaluating Computer Forensics Tool Needs, Types of Computer Forensics Tools, Tasks Performed by Computer Forensics Tools, Tool Comparisons, Other Considerations for Tools, Computer Forensics Software Tools, Command-Line Forensics Tools, UNIX/Linux Forensics Tools, Other GUI Forensics Tools, Computer Forensics Hardware Tools, Forensic Workstations, Using a Write-Blocker.			**CO4**
UNIT- V	**Identification of data**	**Periods: 9**	
Identification of Data: Timekeeping, Forensic Identification and Analysis of Technical Surveillance Devices, Reconstructing Past Events: How to Become a Digital Detective, Useable File Formats, Unusable File Formats, Converting Files, Investigating Network Intrusions and Cyber Crime, Network Forensics and Investigating logs, Investigating network Traffic, Investigating Web attacks , Router Forensics. Cyber forensics tools and case studies.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, Syngress imprint of Elsevier.
2. Bill Nelson, Amelia Phillips, Christopher Steuart, “Guide to Computer Forensics and Investigations”, Fourth Edition, Course Technology.
3. Angus M.Marshall, “Digital forensics: Digital evidence in criminal investigation”, John Wiley and Sons, 2008

Reference Books

1. Greg Gogolin, “Digital Forensics Explained”, Taylor & Francis Ltd, 2021
2. Nilakshi Jain, Dhananjay R. Kalbande, “Digital Forensic: The Fascinating World of Digital Evidences”, Wiley,2016
3. Kavrestad J, “Fundamentals of Digital Forensics”, Springer, 2018
4. Bhardwaj, K Kaushik, “Practical Digital Forensics”, BPB, 2023
5. Lin X, “Introductory Computer Forensics A Hands On Practical Approach”, Springer, 2018

Web References

1. https://www.forensicsciencesimplified.org/digital/resources.html
2. https://www.bluevoyant.com/knowledge-center/understanding-digital-forensics-process-techniques-and-tools
3. https://www.sciencedirect.com/topics/computer-science/digital-forensic-tool
4. https://www.techtarget.com/searchsecurity/definition/computer-forensics
5. https://onlinecourses.nptel.ac.in/noc23_cs127/preview

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE320**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Knowledge Engineering and Expert Systems**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Pre request needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Develop production systems, description logic-based systems and Bayesian networks	**K3**
	CO2 Use logic in knowledge representation, reasoning and planning	**K2**
	CO3 Design knowledge representation models for expert systems	**K4**
	CO4 Design knowledgebase for expert systems	**K4**
	CO5 Analyzing Expert System	**K3**

UNIT- I	**Basics of Knowledge Processes**	**Periods: 9**
Introduction to Knowledge – Knowledge units, facts, concepts, relations, Types of Knowledge –Tacit, Explicit, Implicit, Hybrid, Knowledge Processes – acquisition, representation, reasoning, storing, sharing, reuse. Knowledge Cycle – Acquire, Represent, Store, Share, Hybridization		**CO1**
UNIT- II	**Knowledge Acquisition and Expression**	**Periods: 9**
Knowledge sources– structured, semi-structured, unstructured. Introduction to knowledge representation and reasoning, role of logic, the language of First orders logic, forward chaining & backward chaining approaches and Expressing Knowledge.		**CO2**
UNIT- III	**Knowledge Representation**	**Periods: 9**
The propositional case, handling variables and quantifiers, dealing with computational intractability. Clauses, Concepts, Relations, Knowledge Units, Representation.		**CO3**
UNIT- IV	**Procedural Control of Reasoning and Rules**	**Periods: 9**
Horn Clauses, SLD resolution, Computing SLD derivations. Facts and rules, Rule formation and search strategy, algorithm design, specifying goal order, committing to proof methods, controlling backtracking, negation as failure, Dynamic databases		**CO4**
UNIT- V	**Expert System**	**Periods: 9**
Production systems, working memory, production rules, conflict resolution, making production systems more efficient. Objects and frames, a basic frame formalism, Probability Theory, the subjective Bayesian method, the certainty factor model, Dempster-Shafer Theory, Network Models		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Simon Kendal, Malcolm Creen, “An Introduction to Knowledge Engineering”, Springer, 2007
2. Rafael Valencia-Garcia, Giner Alor-Hernández, Current Trends on Knowledge-Based Systems, Springer International Publishing AG, 2018
3. Grega Jakus, Veljko Milutinovic, Sanida Omerovic, Saso Tomazic, “Concepts, Ontologies and Knowledge Representation”, Springer, 2013

Reference Books

1. Ronald J. Brachman and Hector J.Levesque, “Knowledge representation and reasoning”, 2nd edition, Elsevier publications, 2004
2. Ela Kumar, “Knowledge Engineering”, Dreamtech Press, 2019.
3. Donald A. Waterman , “A Guide To Expert Systems”, Pearson, 1986
4. P. Megaladevi, “Knowledge engineering for industrial expert systems”, De Gruyter 2022.
5. Spyros Tzafestas “Expert Systems in Engineering Applications”,Springer Verlog, 1993.

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2. https://dl.acm.org/journal/esjoke
3. https://link.springer.com/chapter/10.1007/978-1-4471-0631-9_1
4. https://www.sciencedirect.com/science/article/abs/pii/0005109891900090
5. https://ieeexplore.ieee.org/document/4307009

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II/III**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23BDTD01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**No SQL Databases**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Common to M.Tech CSE(BDA) and M.Tech CSE

Prerequisite	Basics of SQL and Databases	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Illustrate the detailed architecture, Database properties and storage requirements.	**K2**
	CO2 Differentiate and identify right database models for real time applications.	**K3**
	CO3 Outline Key value architecture, characteristics, and Design Schema and implement CRUD operations, distributed data operations.	**K2**
	CO4 Compare data ware housing schemas and implement various column store internals.	**K3**
	CO5 Choose and implement advanced columnar data model functions for the realtime Applications.	**K4**

UNIT- I	**Introduction to NoSQL**	**Periods: 9**
Data base revolutions: First generation, second generation, third generation, Managing Transactions and Data Integrity, ACID and BASE for reliable database transactions, speeding Performance by strategic use of RAM, SSD, and disk, achieving horizontal scalability with Data base sharing, Brewers CAP theorem.		**CO1**
UNIT- II	**NoSQL Data Architecture Patterns**	**Periods: 9**
NoSQL Data model: Aggregate Models- Document Data Model- Key-Value Data Model Columnar Data Model, Graph Based Data Model Graph Data Model, NoSQL system ways to handle big data problems, Moving Queries to data, not data to the query, hash rings to distribute the data on clusters, replication to scale reads, Database distributed queries to Data nodes.		**CO2**
UNIT- III	**Key Value Data Stores and Document Oriented Database**	**Periods: 9**
Essential features of key value Databases, Properties of keys, Characteristics of Values, Key-Value Database Data Modeling Terms, Key-Value Database. Document, Collection, Naming, CRUD operation, querying, indexing, Replication, Sharing.		**CO3**
UNIT- IV	**Columnar Data Model – I and II**	**Periods: 9**
Data warehousing schemas: Comparison of columnar and row-oriented storage, Column-store Architectures: C-Store and Vector-Wise, Column-store internals and, Inserts/updates/deletes. Advanced techniques: Vectorized Processing Compression, Write penalty, Operating Directly on Compressed Data Late Materialization Joins , Group-by, Aggregation and Arithmetic Operations.		**CO4**
UNIT- V	**Data Modeling with Graph**	**Periods: 9**
Comparison of Relational and Graph Modeling, Property Graph Model Graph Analytics: Link analysis algorithm- Web as a graph, Page Rank- Markov chain, page rank computation, Topic specific page rank (Page Ranking Computation techniques: iterative processing, Random walk distribution Querying Graphs: Introduction to Cypher, case study: Building a Graph Database Application- community detection		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Dan Sullivan Sullivan, “NoSQL for Mere Mortals”, Addison-Wesley, 2015.
2. Christopher D.manning, Prabhakar Raghavan, Hinrich Schutze, “An introduction to Information Retrieval”, Cambridge University Press,2008.
3. Daniel Abadi, Peter Boncz and Stavros Harizopoulas, “The Design and Implementation of Modern Column-Oriented Database Systems”, Now Publishers,2013.

Reference Books

1. Elmasri and Navathe , “Fundamentals of Database Systems”, Pearson Education 2013.
2. Sadalage P & Fowler, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, Wiley Publications,1st Edition, 2019.
3. Perkins, Eric Redmond, Jim Wilson, Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQLMovement, 2nd Edition, Pragmatic Bookshelf, 2018.
4. Andreas Meier, Michael Kaufmann, “SQL & Nosql Databases”,Repro Books, 2019
5. Guy Harrison, “Next Generation Database: NoSQL and big data”, Apress, 2015.

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1. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
2. https://www.geeksforgeeks.org/introduction-to-nosql/
3. https://www.javatpoint.com/nosql-databa
4. https://intellipaat.com/nosql-cassandra-hbase-training/
5. https://www.udemy.com/nosql/online-course

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**III**	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23CSE321**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Industrial IoT**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of IoT	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Knowledge of theory and practice related to Industrial IoT Systems	**K2**
	CO2 Ability to identify, formulate and solve engineering problems by using Industrial IoT	**K2**
	CO3 Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability	**K3**
	CO4 Analyze Visualization and Data Types	**K3**
	CO5 Illustrate Applications of IIOT	**K4**

UNIT- I	**Introduction to Industrial IoT (IIoT) Systems**	**Periods: 9**	
The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT			**CO1**
UNIT- II	**IIoT Components**	**Periods: 9**	
Fundamentals of Control System, introductions, components, closed loop & open loop system. Introduction to Sensors - Description - Working principle- Types of sensors, working principle of basic Sensors -Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11).Digital switch, Electro Mechanical switches.			**CO2**
UNIT- III	**Communication Technologies**	**Periods: 9**	
Communication Protocols: IEEE 802.15.4, ZigBee, Z Wave, Bluetooth, BLE, NFC, RFID Industry standards communication technology (LoRAWAN, OPC UA, MQTT), connecting into existing Modbus and Profibus technology, wireless network communication			**CO3**
UNIT- IV	**Visualization and Data Types**	**Periods: 9**	
Front-end EDGE devices, Enterprise data for IIoT, Emerging descriptive data standards for IIoT, Cloud data base, Could computing, Fog or Edge computing. Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.			**CO4**
UNIT- V	**Applications of IIOT**	**Periods: 9**	
Applications: Health monitoring, Iot smart city, Smart irrigation, Robot surveillance			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”, Apress, 2016
2. Bartodziej, Christoph Jan Springer, “The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics”, Economic science. 2017.
3. Mahmood, Zaigham (Ed.), “The Internet of Things in the Industrial Sector”, Springer, 2019

Reference Books

1. Ismail Butun, “Industrial IoT Challenges, Design Principles, Applications, and Security”, Springer, 2020.
2. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat “Industrial Internet of Things: Cyber manufacturing System”, Springer,
3. Rajkamal, “Embedded System: Architecture, Programming and Design”, TMH3. 2017
4. Dr. OvidiuVermesan, Dr. Peter Friess, “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers,2013.

Web References

1. https://onlinecourses.nptel.ac.in/noc20_cs69/preview
2. https://aws.amazon.com/iot/solutions/industrial-iot/
3. https://www.i-scoop.eu/internet-of-things-iot/industrial-internet-things-iiot-saving-costs-innovation/
4. https://www.geeksforgeeks.org/benefits-of-internet-of-thingsiot-in-manufacturing-industry/
5. https://www.techtarget.com/iotagenda/definition/Industrial-Internet-of-Things-IIoT

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	1	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PA**			*End Semester Exam Type: **LE**			
Course Code	**P23CSW301**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Project Phase - I**	**-**	**-**	**12**	**6**	**50**	**50**	**100**

Aim & Objective:

The project work aims to develop the work practice and to apply theoretical and practical tools/techniques for solving real life problems related to industry and current research. The objective of the project work is to improve the professional competency and research attitude by touching the areas which are not covered in theory or laboratory classes.

- The project work shall be a design project/experimental project and/or computer simulation project on any of the topic in manufacturing engineering or related field.
- The project work shall be allotted individually on different topics.
- The students shall be encouraged to do their project work in the parent institute itself. In exceptional cases the students shall be permitted to undertake continue their project outside the parent institute with appropriate permission from Head of the institution through the Project Coordinator.
- Department shall constitute an Evaluation Committee to review the project work.
- The Evaluation committee shall consist of at least three faculty members namely internal guide, project coordinator and another expert in the specified area of the project.

The student is required to undertake the project phase I during the third semester and the same shall be continued in the 4 th semester (Phase II). Phase I consist of preliminary thesis work, three reviews of the work and the submission of preliminary report. First review shall highlight the topic, objectives and origin of problem, second review shall highlight, Literature survey, methodology and expected results. Third review shall evaluate the progress of the work, preliminary report and scope of the work which shall be completed in the 4 th semester. Also the evaluation of project phase - I shall be done externally.

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **PA**			*End Semester Exam Type: -			
Course Code	**P23CSW302**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Internship**	**-**	**-**	**-**	**2**	**100**	**-**	**100**

Students should undergo training or internship during summer / winter vacation at Industry/ Research organization / University (after due approval from the Programme Academic Coordinator and Department Consultative Committee (DCC). In such cases, the internship/training should be undergone continuously (without break) in one organization. Normally no extension of time is allowed. However, DCC may provide relaxation based on the exceptional case. The students are allowed to undergo three to four weeks internship in established industry / Esteemed institution during vacation period. The student should give presentation and submit report to DCC. The Internship is assessed internally for 100 marks.

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**III**	Course Category : **AEC**			*End Semester Exam Type: -			
Course Code	**P23CSC301**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**NPTEL/SWAYAM/MOOC**	**-**	**-**	**-**	**-**	**100**	**-**	**100**

Student should register online courses like MOOC / SWAYAM / NPTEL etc. approved by the Department committee comprising of HoD, Programme Academic Coordinator and Subject Experts. Students have to complete relevant online courses successfully. The list of online courses is to be approved by Academic Council on the recommendation of HoD at the beginning of the semester if necessary, subject to ratification in the next Academic council meeting. The Committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the marks secured in online examinations. The marks attained for this course is not considered for CGPA calculation.

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**IV**	Course Category : **PA**			*End Semester Exam Type: **LE**			
Course Code	**P23CSW403**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Project Phase - II**	**-**	**-**	**24**	**12**	**50**	**50**	**100**

Aim & Objective:

The project work aims to develop the work practice and to apply theoretical and practical tools/techniques for solving real life problems related to industry and current research. The objective of the project work is to improve the professional competency and research attitude by touching the areas which are not covered in theory or laboratory classes.

- The project work shall be a design project/experimental project and/or computer simulation project on any of the topic in manufacturing engineering or related field.
- The project work shall be allotted individually on different topics.
- The students shall be encouraged to do their project work in the parent institute itself. In exceptional cases the students shall be permitted to undertake continue their project outside the parent institute with appropriate permission from Head of the institution through the Project Coordinator.
- Department shall constitute an Evaluation Committee to review the project work.
- The Evaluation committee shall consist of at least three faculty members namely internal guide, project coordinator and another expert in the specified area of the project.

Project phase II is a continuation of project phase I which started in the third semester. There shall be three reviews in the fourth semester, first in the beginning of the semester, second in the middle of the semester and the Third at the end of the semester. First review is to evaluate the progress of the work and planned activity; second review shall be presentation and discussion. Third review shall be a presubmission presentation before the evaluation committee to assess the quality and quantity of the work done. This would be a pre qualifying exercise for the students for getting approval for the submission of the thesis. At least one technical paper shall be prepared for possible publication in journals or conferences. The technical paper shall be submitted along with the thesis. The final evaluation of the project shall be done externally.