AL-AMEEN ENGINEERING COLLEGE

(AUTONOMOUS)

Accredited by NAAC with "A" Grade :: An ISO Certified Institution
(Affiliated to Anna University, Chennai & Approved by AICTE, New Delhi)
Karundevanpalayam, NanjaiUthukkuli Post, Erode – 638 104, Tamilnadu, INDIA.

CURRICULUM & SYLLABI

SEMESTERS – I to IV

(Regulations 2023)

CHOICE BASED CREDIT SYSTEM

M.E. Computer Science and Engineering

Applicable to the Students admitted to M.E. Programmes from the AY 2023-24

KNOWLEDGE LEVELS (BLOOM'S TAXONOMY)

Notation	Knowledge Levels
K1	Remembering
K2	Understanding
K3	Applying
K4	Analysing
K5	Evaluating
K6	Creating

INSTITUTION VISION
To be a multi-disciplinary institute of academic excellence in Engineering, Technology and allied fields for uplifting the under-privileged and rural; inculcating brotherhood and positivism among its students.

INSTITUTION MISSION
To groom confident, wholesome students with social consciousness and values, by endeavoring experiences for the ever-changing world of work.

DEPARTMENT VISION
To be a renowned program for satisfying the rapidly changing information and communication technology needs of the rural and underprivileged with humane values.

DEPARTMENT MISSION	
M1	To grow comprehensive ICT experiences in students for uplifting rural and the under-privileged community.
M2	To impart Computer Science education towards inclusiveness of trans-disciplinary areas in the ever-changing ICT environment.
M3	To develop students focused on careers and entrepreneurship with awareness of social, economic and ethical impacts.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	Graduates will be prepared with an ethical work culture for taking ICT to the rural and the under-privileged.
PEO 2	Graduates will be employed in the computing profession, and will understand, research, apply new ideas and technologies of ICT as the field evolves.
PEO 3	Graduates will be equipped with communication skills and leadership qualities, with an interest in, and aptitude for starting-up and growing their own new firms.
PEO 4	Graduates will demonstrate their ability to work effectively as a team member in an ever-changing professional environment.

PROGRAM OUTCOMES (POs)	
PO 1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSOs)	
PSO 1	Organize heterogeneous data for accurate large-scale data processing using appropriate algorithms and tools.
PSO 2	Understand modern networking technologies and apply programming skills to create scalable real-time applications.

CURRICULUM

SEMESTER I

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	23MC1T1	Research Methodology and IPR	BS	40	60	3	0	0	3
2	23MC1T2	Engineering Mathematics and application	HS	40	60	3	0	0	3
3	23MC1T3	Application of Data Structures	PC	40	60	3	0	0	3
4		Program Elective I	PE	40	60	3	0	0	3
5		Program Elective II	PE	40	60	3	0	0	3
LABORATORY COURSES									
6	23MC1L1	Application of Data Structure Laboratory	PC	60	40	0	0	4	2
7	23MC1L2	Data Analytics Laboratory	PC	60	40	0	0	4	2
Total						**15**	**0**	**8**	**19**

SEMESTER II

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	23MC2T1	Database Engineering	PC	40	60	3	0	0	3
2	23MC2T2	Machine Learning Techniques	PC	40	60	3	0	0	3
3		Program Elective III	PE	40	60	3	0	0	3
4		Program Elective IV	PE	40	60	3	0	0	3
5		Audit course	AC	40	60	3	0	0	3
LABORATORY COURSES									
6	23MC2L1	Database Engineering Laboratory	PC	60	40	0	0	4	2
7	23MC2L2	Machine Learning Laboratory	PC	60	40	0	0	4	2
Total						**15**	**0**	**8**	**19**

SEMESTER III

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1		Program Elective V	PE	40	60	3	0	0	3
2		Program Elective VI	PE	40	60	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSE									
3	23MC3L1	Dissertation phase I	EEC	40	60	0	0	20	10
Total						**6**	**0**	**20**	**16**

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
EMPLOYABILITY ENHANCEMENT COURSE									
1	23MC4L1	Dissertation Phase II	EEC	40	60	0	0	28	14
Total						**0**	**0**	**28**	**14**

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (HS)

S. No.	Course Code	Course Title	L	T	P	C
1	23MC1T2	Engineering Mathematics and application	3	0	0	3

BASIC SCIENCES (BS)

Sl.No.	Course Code	Course Title	L	T	P	C
1	23MC1T1	Research Methodology and IPR	3	0	0	3

PROFESSIONAL CORE (PC)

Sl.No.	Course Code	Course Title	L	T	P	C
1	23MC1T3	Application of Data Structures	3	0	0	3
2	23MC1L1	Application of Data Structure Laboratory	0	0	4	2
3	23MC1L2	Data Analytics Laboratory	0	0	4	2
4	23MC2T1	Database Engineering	3	0	0	3
5	23MC2T2	Machine Learning Techniques	3	0	0	3
6	23MC2L1	Database Engineering Laboratory	0	0	4	2
7	23MC2L2	Machine Learning Laboratory	0	0	4	2

PROFESSIONAL ELECTIVES (PE)

Program Elective I							
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	23MC1E1	Artificial Intelligence and Machine Learning	PE	3	0	0	3
2	23MC1E2	Agent Based Intelligent System	PE	3	0	0	3
3	23MC1E3	Deep Learning Techniques	PE	3	0	0	3

.

Program Elective II							
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	23MC1E4	Information Retrieval Techniques	PE	3	0	0	3
2	23MC1E5	Data Science and Analytics	PE	3	0	0	3
3	23MC1E6	Optimization Techniques	PE	3	0	0	3

Program Elective III							
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	23MC2E1	Big Data Analytics	PE	3	0	0	3
2	23MC2E2	Cloud Computing Technologies	PE	3	0	0	3
3	23MC2E3	5G Networks	PE	3	0	0	3

.

Program Elective IV							
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	23MC2E4	High Speed Networks	PE	3	0	0	3
2	23MC2E5	Block chain Techniques	PE	3	0	0	3
3	23MC2E6	Automata Theory	PE	3	0	0	3

Program Elective V							
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	23MC3E1	Programming Paradigm	PE	3	0	0	3
2	23MC3E2	Digital Image Processing and Application	PE	3	0	0	3
3	23MC3E3	Agile Methodology	PE	3	0	0	3

Program Elective VI							
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	23MC3E4	Mobile and Pervasive Computing	PE	3	0	0	3
2	23MC3E5	Bio Informatics	PE	3	0	0	3
3	23MC3E6	Data Visualization Techniques	PE	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No.	Course Code	Course Title	L	T	P	C
1	23MC3L1	Dissertation phase I	0	0	20	10
2	23MC4L1	Dissertation Phase II	0	0	28	14

AUDIT COURSE (AC)

Audit course							
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	23MC2A1	English for Research Paper Writing	AC	3	0	0	3
2	23MC2A2	Disaster Management	AC	3	0	0	3
3	23MC2A3	Value Education	AC	3	0	0	3
4	23MC2A4	Pedagogy Studies	AC	3	0	0	3
5	23MC2A5	Stress Management by Yoga	AC	3	0	0	3

CREDIT SUMMARY

Sl. No.	Subject Area	Credits per Semester				Total Credits
		I	II	III	IV	
1	**HS**	3				**3**
2	**BS**	3				**3**
3	**PC**	7	10			**17**
4	**PE**	6	6	6		**18**
5	**EEC**			10	14	**24**
6	**AC**		3			**3**
TOTAL		**19**	**19**	**16**	**14**	**68**

Total Credit: 68

HS – Humanities and Social Sciences including Management
BS– Basic Sciences
PC– Professional Core
PE– Professional Electives
EEC– Employability Enhancement Courses
AC– Audit Courses

SYLLABUS

SEMESTER I

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	23MC1T1	Research Methodology and IPR	BS	40	60	3	0	0	3
2	23MC1T2	Engineering Mathematics and application	HS	40	60	3	0	0	3
3	23MC1T3	Application of Data Structures	PC	40	60	3	0	0	3
4		Program Elective I	PE	40	60	3	0	0	3
5		Program Elective II	PE	40	60	3	0	0	3
LABORATORY COURSES									
6	23MC1L1	Application of Data Structure Laboratory	PC	60	40	0	0	4	2
7	23MC1L2	Data Analytics Laboratory	PC	60	40	0	0	4	2
Total						**14**	**0**	**8**	**19**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E.CSE	23MC1T1	RESEARCH METHODOLOGY AND IPR	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the research problems and identify the approaches to solve the problems.	K3	1
CO2	Analyze literature surveys and prepare reports based on research ethics.	K4	2
CO3	Develop research proposals and apply assessment procedures to review.	K3	3
CO4	Develop patents using the IPR & PCT guidelines.	K3	4
CO5	Assume the licensing process for patents and analyse the developments of IPR.	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1			3		3		2	
CO2		3				2	2	
CO3	2		2		2			2
CO4	2		2		2			2
CO5					2		2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO RESEARCH PROBLEM**	**9**
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 investigations of solutions for research problem-Data collection-Analysis-Interpretation-Necessary instrumentations.		
Topic - 2	**LITERATURERE VIEW**	**9**
Effective Literature studies approaches-analysis-Plagiarism-Research ethics Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical frame work, Developing a conceptual frame work, Writing about the literature reviewed.		
Topic - 3	**TECHNICAL WRITING/PRESENTATION**	**9**
Effective technical writing-how to write report-paper-Developing a research proposal-Format of Research proposal-a presentation and assessment by a review committee		
Topic - 4	**INTRODUCTIONTOINTELLECTUALPROPERTYRIGHTS(IPR)**	**9**
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 grant Patents, Patenting under Patent Cooperation Treaty (PCT).		
Topic - 5	**INTELLECTUALPROPERTYRIGHT(IPR)**	**9**
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-Traditional knowledge -case studies.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Donald S. Chisum and Tyler T. Ochoa "Understanding Intellectual Property Law" (Fifth Edition, 2020).
2	Alexander M. Novikov "Research Methodology: From Philosophy of Science to Research Design" (First Edition, 2021).
3	Tanya Aplin, Jennifer Davis, and Simon Peabody "Intellectual Property Law: Text, Cases, and Materials" (Third Edition, 2017).
4	John Adams "Research Methodology: A Step-by-Step Guide for Business Students" (Seventh Edition, 2017).
5	James A. Poupard and Kristin Burkholder "Research Methodology: A Step-by-Step Guide for Scientists" (Second Edition, 2017).
6	C.R.Kothari, Gaurav Garg, Research Methodology, Methods and Techniques, 4th Edition, New Age International Publishers 2018.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=NGHdnT24FGg
2	https://www.youtube.com/watch?v=AYz407uRL0w
3	https://www.slideshare.net/DrKapilGupta2/research-methodology-ipri
4	https://www.youtube.com/watch?v=zkCdOFaAucc
5	https://www.youtube.com/watch?v=Og3oV7qH2BU

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	23MC1T2	ENGINEERING MATHEMATICS AND APPLICATION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the concepts of probability distributions in an appropriate place of science and engineering.	K3	1
CO2	Analyze the data with the help of correlation and curve fitting in an appropriate place of science and engineering.	K4	2
CO3	Identify the hypothesis to analyze the nature of data.	K3	3
CO4	Organize a calculation for identifying the suitability of an experiment.	K3	4
CO5	Demonstrate the properties and applications of vector spaces in computer science and Engineering.	K2	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	3	3	3				
CO2	3	3	3	3				
CO3	3	3	3	3				
CO4	3	3	3	3				
CO5	3	3	3	3				

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**MATRIX THEORY**	**9**
Cholesky decomposition method- QR factorization method-Least Square Method-Singular value decompositions method- Pseudo-inverse method.		
Topic - 2	**ESTIMATION THEORY**	**9**
Unbiased estimators – Method of moments – Maximum likelihood estimation - Curve fitting by principle of least squares – Regression lines..		
Topic - 3	**PROBABILITY**	**9**
Probability – Axioms of probability – Conditional probability – Baye‟s theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform.		
Topic - 4	**TWO DIMENSIONAL RANDOM VARIABLES**	**9**
Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.		
Topic - 5	**TESTING OF HYPOTHESIS**	**9**
Sampling distributions – Estimation of parameters - Statistical hypothesis - Tests based on Normal, t, Chi Square and F distributions for mean, variance and proportion.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Matrix Analysis and Applied Linear Algebra" by Carl D. Meyer since the 2nd edition published in 2022.
2	Veerarajan T, “Probability and Random Processes (with Queuing Theory andQueuing Networks)”, Fourth Edition ,McGraw Hill Education(India) Pvt Ltd., New Delhi, 2016
3	Gross, D., Shortle J. F., Thompson, J.M., and Harris, C. M., "Fundamentals of Queueing Theory", 4th Edition, John Wiley, 2014
4	Probability and Statistics for Engineers and Scientists" by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, and Keying E. Ye. The latest edition of this book is the 9th edition, published in 2017.
5	"Practical Statistics for Data Scientists" by Andrew Bruce and Peter Bruce. The latest edition of this book is the 2nd edition, published in 2020.
6	"Hypothesis Testing: An Intuitive Guide for Making Data Driven Decisions" by Ph.D. Pamela Harris. This book was published in 2020.

OTHER REFERENCES	
1	https://www.cuemath.com/learn/mathematics/probability-in-real-life/
2	https://sciencing.com/examples-of-real-life-probability-12746354.html
3	http://www.iraj.in/journal/journal_file/journal_pdf/14-358-149822091462-64.pdf
4	https://www.youtube.com/watch?v=VK-rnA3-41c
5	https://www.youtube.com/watch?v=k4SNOqExA0s

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	23MC1T3	APPLICATIONS OF DATA STRUCTURES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze algorithm complexity using asymptotic notations.	K4	1
CO2	Develop algorithms to perform operations using hierarchical data structures.	K3	2
CO3	Develop solutions using graph algorithms.	K3	3
CO4	Apply algorithm design techniques to solve computational problems.	K3	4
CO5	Analyze the complexity classes for NP problems.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2							2
CO2	2		3		3		3	
CO3	3		3		3			3
CO4			2					2
CO5		2					2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**ANALYSIS OF ALGORITHM EFFICIENCY**	**9**
Role of Algorithms in Computing – Asymptotic Notations – Solving Recurrences: Recursion-Tree Method – Masters Theorem – Amortized Analysis : Aggregate Analysis – Accounting Method – Potential Method.		
Topic - 2	**HIERARCHICAL DATA STRUCTURES**	**9**
Binary Heap – D – Heaps – Leftist Heaps-Skew Heaps- Binomial Queues-Splay Trees – Red - Black Trees – Multi - Way Trees 2-3-4 Trees-Priority Queues-Tries.		
Topic - 3	**GRAPH ALGORITHMS**	**9**
Graph Traversals – All – To – All Shortest Path Problem – Union – Find Problem – Maximum Flows – Eulerian Graphs – Hamiltonian Graphs – Hamiltonian Cycle Problem – Graph Coloring – Vertex – Cover Problem.		
Topic - 4	**ALGORITHM DESIGN TECHNIQUES**	**9**
Dynamic Programming : Matrix – Chain Multiplication – Greedy Algorithms : Activity Selection Problem – Huffman Codes – Divide and Conquer : Maximum Sub – Array Problem - Strassen‟s Algorithm		
Topic - 5	**COMPLEXITY CLASSES**	**9**
Polynomial / Exponential Time – Decision Problem – Types of Complexity Classes – Relationship Between P, NP, NP Hard and NP Complete – Clique Decision Problem.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Data Structures and Algorithms: Annotated Reference with Examples" by Granville Barnett and Luca Del Tongo (2017).
2	Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser "Data Structures and Algorithms in Python"(Second Edition, 2018).
3	Mark A. Weiss "Data Structures and Algorithm Analysis in Java" (Third Edition, 2017).
4	Clifford A. Shaffer "Data Structures and Algorithm Analysis in Java" (Fourth Edition, 2018).
5	Robert Lafore "Data Structures and Algorithms in Java" (Second Edition, 2020).
6	Adam Drozdek, Data Structures and Algorithms in C++, Fourth Edition, Cengage Learning, 2013.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=03w8o2cLcVU
2	https://www.youtube.com/watch?v=zACWv81lTy4
3	https://www.youtube.com/watch?v=Ou29NNWTSaw
4	https://www.geeksforgeeks.org/real-time-application-of-data-structures/
5	https://www.javatpoint.com/application-of-data-structure

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	23MC1E1	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Build the Architecture of Intelligent agents	K3	1
CO2	Develop algorithms to perform Issues in The Design of Search Programs.	K3	2
CO3	Develop solutions using Optimization algorithm.	K3	3
CO4	Apply the Applications of Machine Learning and Data Mining.	K3	4
CO5	Analyze the forecasting and learning theory.	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2		3					2
CO2	3		3		3		3	
CO3	3		3		3		3	
CO4	2		2					2
CO5	2		2					2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Artificial Intelligence, Application of AI, AI Problems, Problem Formulation, Intelligent Agents, Types of Agents, Agent Environments, PEAS representation for an Agent, Architecture of Intelligent agents. Reasoning and Logic, Prepositional logic, First order logic, Using First-order logic, Inference in First-order logic, forward and Backward Chaining		
Topic - 2	**SEARCH STRATEGIES**	**9**
Solving problems by searching, Search- Issues in The Design of Search Programs, Un-Informed Search- BFS, DFS; Heuristic Search Techniques: Generate-And Test, Hill Climbing, Best-First Search, A* Algorithm, Alpha beta search algorithm, Problem Reduction, AO*Algorithm, Constraint Satisfaction, Means-Ends Analysis		
Topic - 3	**ARTIFICIAL NEURAL NETWORKS**	**9**
Introduction, Activation Function, Optimization algorithm- Gradient decent, Networks Perceptrons, Adaline, Multilayer Perceptrons , Backpropogation Algorithms Training Procedures, Tuning the Network Size		
Topic - 4	**INTRODUCTION TO MACHINE LEARNING**	**9**
Machine Learning basics, Applications of ML,Data Mining Vs Machine Learning vs Big Data Analytics. Supervised Learning- Naïve Base Classifier, , Classifying with k-Nearest Neighbour classifier, Decision Tree classifier, Naive Bayes classifier. Unsupervised Learning - Grouping unlabeled items using k-means clustering, Association analysis with the Apriori algorithm Introduction to reinforcement learning		
Topic - 5	**FORECASTING AND LEARNING THEORY**	**9**
Non-linear regression, Logistic regression, Random forest, Baysian Belief networks, Bias/variance tradeoff, Tuning Model Complexity, Model Selection Dilemma Clustering : Expectation-Maximization Algorithm, Hierarchical Clustering, Supervised Learning after Clustering, Choosing the number of clusters, Learning using ANN		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig,2020
2	Elaine Rich, Kevin Knight and Shiva shankar B Nair, Artificial Intelligence, Tata McGraw Hill, 2019.
3	Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar "Foundations of Machine Learning" (First Edition, 2018).
4	Palash Goyal, Sumit Pandey, and Karan Jain "Deep Learning for Natural Language Processing" (First Edition, 2018).
5	O theobald, Machine learning for absolute beginners,2nd edition,2017.
6	Willi Richert and Luis Pedro Coelho "Hands-On Machine Learning with Python" (Second Edition, 2019).

OTHER REFERENCES	
1	https://www.geeksforgeeks.org/dimensionality-reduction/
2	https://www.javatpoint.com/dimensionality-reduction-technique
3	https://www.geeksforgeeks.org/ml-linear-discriminant-analysis/
4	https://www.youtube.com/watch?v=wnqkfpCpK1g
5	https://www.javatpoint.com/difference-between-artificial-intelligence-and-machine-learning

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	23MC1E2	AGENT BASED INTELLIGENT SYSTEM	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the searching techniques, heuristic algorithms and game playing to solve real time problems.	K3	1
CO2	Analyze the logical inference in first order logic and the logical language to express knowledge about complex worlds.	K4	2
CO3	Examine basic ideas of planning types and monitoring for the successful completion of the plan.	K4	3
CO4	Apply utility theory and probability theory for handling uncertain worlds.	K3	4
CO5	Analyze the learning methods and Natural Language Processing Toolkits in intelligent system development.	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2	2			3		3	
CO2	3		2					
CO3	2		2					2
CO4	3		2				3	
CO5	2		2					2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Definitions – Intelligent agents : Nature of environment – Structure of agents – problem solving –Searching : uninformed search strategies - Searching with partial information – Heuristics : Local search algorithms – Constraint satisfaction problems : Back tracking search- Game playing : Optimal decisions - Alpha, Betapruning.		
Topic - 2	**KNOWLEDGE REPRESENTATION AND REASONING**	**9**
Logical Agents : Propositional logic - Reasoning patterns in propositional logic - Agent based propositional logic – First order logic : Syntax and semantics – First order inference : Unification – Chaining – Resolution strategies – Knowledge representation : Objects – Actions – Events - Techniques.		
Topic - 3	**PLANNING AGENTS**	**9**
Planning problem : STRIPS – State space search – Partial order planning – Graphs – Hierarchical network planning – Non deterministic domains - Conditional planning - Execution monitoring and replanning – Continuous planning-Multi agent planning.		
Topic - 4	**AGENTS AND UNCERTAINTY**	**9**
Acting under uncertainty - Probability notation - Baye‟s rule and use - Probabilistic reasoning: Bayesian networks – Other approaches – Time and uncertainty : Temporal models – Simple decisions : Utility theory –Decision network - Complex decisions : Value iteration-Policy iteration.		
Topic - 5	**HIGHER LEVEL AGENTS**	**9**
Knowledge in learning : Explanation based learning - Relevance information - Statistical learning methods : Instance based learning - Neural network - Reinforcement learning : Passive and active communication : Formal grammar - Augmented grammars - Natural Language Processing: Introduction - Understanding - Perception - Natural Language Toolkit (NLTK).		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Agent-Based Modeling and Simulation with Swarm" edited by Hitoshi Iba and Claus C. Aranha (First Edition, 2019).
2	Elaine Rich, Kevin Knight and Shiva shankar B Nair, Artificial Intelligence, Tata McGraw Hill, 2019.
3	"Agent-Based Modeling and Simulation with Swarm" edited by Hitoshi Iba and Claus C. Aranha (First
4	David L.Poole, AlanK.Mackworth, Artificial Intelligence : Foundations of Computational Agents, Cambridge University Press, second Edition, 2017.
5	Sohom Ghosh, Dwight Gunning, Natural Language Processing Fundamentals, Packet Publisher,2019
6	"Agent-Based and Individual-Based Modeling: A Practical Introduction" by Steven F. Railsback and Volker Grimm. The latest edition of this book is the 2nd edition, published in 2019.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=cckckL3uOW8
2	https://www.youtube.com/watch?v=xs6eRgN8dPM
3	https://www.youtube.com/channel/UCYUxfIHkzq-b12-J7JR7ZSQ
4	https://www.javatpoint.com/agents-in-ai
5	https://en.wikipedia.org/wiki/Intelligent_agent

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	23MC1E3	DEEP LEARNING TECHNIQUES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the Basic fundamentals of Machine Learning Algorithms to solve real world problems.	K3	1
CO2	Apply the Deep Learning Architectures to classify the unstructured data.	K3	2
CO3	Analyze the Convolutional Neural Networks and transfer learning models to obtain an optimal solution.	K4	3
CO4	Build a Recurrent Neural Networks, Recursive Nets models and classify the given inputs with reduced cost and time.	K3	4
CO5	Develop a model using Auto encoders and Generative models for image generation.	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3		2					2
CO2	3						2	
CO3	2							
CO4	3		3		3		3	
CO5	3		3		3			3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**MACHINE LEARNING BASICS**	**9**
Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Basic Machine Learning Algorithms, Neural Networks, Multilayer Perceptron, Back-propagation algorithm and its variants stochastic gradient decent, Curse of Dimensionality.		
Topic - 2	**DEEP LEARNING ARCHITECTURES**	**9**
Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders.		
Topic - 3	**CONVOLUTIONAL NEURAL NETWORKS AND TRANSFER LEARNING**	**9**
Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures : ResNet, AlexNet, Applications, Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet		
Topic – 4	**SEQUENCE MODELLING, RECURRENT AND RECURSIVENETS**	**9**
Recurrent Neural Networks, Bidirectional RNNs, Encoder – decoder sequence to sequence architectures – BPTT for training RNN, Long Short – Term Memory Networks.		
Topic – 5	**AUTO ENCODERS AND DEEP GENERATIVE MODELS**	**9**
Under complete Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders, Contractive Encoders - Deep Belief networks, Boltzmann Machines, Deep Boltzmann Machine, Generative Adversial Networks.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Ian Good fellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press,2017.
2	Josh Patterson, Adam Gibson, Deep Learning : A Practitioner's Approach, O'Reilly Media, 2017
3	Umberto Michelucci, Applied Deep Learning. A Case – based Approach to Understanding Deep Neural Networks, A press, 2018
4	"Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani (2018).
5	Giancarlo Zaccone, Md.Rezaul Karim, Ahmed Menshawy, Deep Learning with Tensor Flow.
6	Exploreneural networks with Python, Pack t Publisher, 2017.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=i_LwzRVP7bg
2	https://www.youtube.com/watch?v=WJ-Es3gtR-M
3	https://www.youtube.com/playlist?list=PLkDaE6sCZn6Gl29AoE31iwdVwSG-KnDzF
4	https://www.simplilearn.com/tutorials/deep-learning-tutorial/deep-learning-algorithm
5	https://www.mathworks.com/discovery/deep-learning.html

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	23MC1E4	INFORMATION RETRIEVAL TECHNIQUES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify the information retrieval system and web search.	K2	1
CO2	Analyse the classic information retrieval models and evaluate the performance of an information retrieval system.	K4	2
CO3	Apply the concepts of index construction and compression for information retrieval and query processing in information retrieval.	K3	3
CO4	Develop an efficient search engine and analyse the web content structure in web crawler.	K3	4
CO5	Analyse recommendation system approaches in real world problems.	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3							
CO2	3		2		2			2
CO3	3				2		2	
CO4	3		3		3			3
CO5	3		2					

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Motivation – Information versus Data Retrieval - Basic Concepts - Past, Present, Future – Retrieval Process – Information Retrieval Systems – Architecture – Characterization of IR Model – Documents and Update – Performance Evaluation – Indexing – Web Searching – IR Versus Web Search – Components of a Search Engine.		
Topic - 2	**RETRIEVAL MODELING AND RETRIEVAL EVALUATION**	**9**
Taxonomy and Characterization of IR Models – Classic Information Retrieval Model – Alternative Set Theoretic, Algebraic, Probabilistic Model - Structured Text Retrieval Model - Models for Browsing – Retrieval Evaluation – Retrieval Metrics - Retrieval Performance Evaluation - Reference Collection.		
Topic - 3	**INDEXING AND QUERY PROCESSING**	**9**
Static and Dynamic Inverted Indices - Index Construction and Index Compression. Searching-Sequential Searching and Pattern Matching. Query Operations - Query Languages-Structural Query-Query Protocols – Query Processing - Automatic Local and Global Analysis		
Topic - 4	**WEB RETRIEVAL AND WEB CRAWLING**	**9**
The Web - Search Engine Architectures – Crawling the web – Crawling Documents and Email – Document Parsing - Link Analysis – Ranking - Simple Ranking Functions - Learning to Rank - Browsing - Applications of a Web Crawler – Evaluating Search Engines – Social Search		
Topic - 5	**RECOMMENDER SYSTEM**	**9**
Recommender Systems Functions - Data and Knowledge Sources - Recommendation Techniques - Basics of Content - based Recommender Systems - High Level Architecture - Advantages and Drawbacks of Content – based Filtering – Collaborative Filtering – Matrix factorization Models – Neighborhood Models.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Ricardo Baeza Yates, Berthier RibeiroNeto, Modern Information Retrieval : The Concepts and Technology behind Search, (ACM Press Books), Second Edition, Reprint 2016.
2	"Modern Information Retrieval: The Concepts and Technology behind Search" by Ricardo Baeza-Yates and Berthier Ribeiro-Neto (2016).
3	Stefan Buttcher, Charles L.A.Clarke, Gordon V.Cormack, Information Retrieval Implementing and Evaluating Search Engines, The MIT Press, Cambridge, Massachusetts London, England,2016.
4	"Information Retrieval: Implementing and Evaluating Search Engines" by Stefan Büttcher, Charles L. A. Clarke, and Gordon V. Cormack (2016).
5	"Information Retrieval: Implementing and Evaluating Search Engines" by Stefan Büttcher, Charles L. A. Clarke, and Gordon V. Cormack (2016).
6	"Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze,2nd Edition,2021.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=pUlXRD_sY4g
2	https://www.youtube.com/watch?v=BC_cMSbd-2c
3	https://www.youtube.com/watch?v=DvWmdCctYN8
4	https://en.wikipedia.org/wiki/Information_retrieval
5	https://www.britannica.com/technology/information-retrieval

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	23MC1E5	DATA SCIENCE AND ANALYTICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the different pre-processing techniques to understand the data and visualize the results.	K3	1
CO2	Apply the classification, clustering and neural networks techniques to solve a problem in the real world and optimize the results.	K3	2
CO3	Analyze the time series data and trends using models and predict the future.	K4	3
CO4	Develop web analytics techniques to measure the website traffic.	K3	4
CO5	Apply the analytic techniques to collect the visitors information from Google.	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2							
CO2	2							
CO3	3		3		3			3
CO4	3		3		3		3	
CO5	2							

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO DATA SCIENCE**	**9**
Understanding Data Types - Data manipulation - Exploratory data analysis - Data visualization – Missing value analysis - The correction matrix - Outlier detection analysis - Linear Algebra - Statistics - correlation –Simpsons Paradox-Statistical Hypothesis Testing-Gradient Descent –Feature Extraction and Selection.		
Topic - 2	**PREDICTIVE ANALYTICS AND NEURAL NETWORKS**	**9**
Descriptive statistics - Dimensionality Reduction - Semi supervised Learning - Sentiment analysis – Image recognition- Regression - Dealing with categorical data. Convolutional neural network - Artificial Neural network-Back propagation approach-algorithms-Recurrent Neural Network		
Topic - 3	**TIME SERIES ANALYTICS**	**9**
Classification of variation – Analyzing a Series Containing a Trend – Analyzing a Series Containing Seasonality - Removing Trends from a Time Series - Transformation -Stationary Time Series – Mixed ARMA Models – Integrated ARMA Model – The Fourier Transform.		
Topic - 4	**WEB ANALYTICS**	**9**
Understanding web analytics - The foundations of Web analytics :Techniques and Technologies – Data Collection : Importance and Options - Web server log files: Click stream data - User submitted information -Web analytics strategy - Content organization tools - Process measurement tools- Visitor segmentation tools - Campaign analysis tools-Commerce measurement tools.		
Topic - 5	**GOOGLE ANALYTICS**	**9**
Google analytics - Omniture - Web trends - Web analytics - Key features and capabilities - Quantitative and qualitative data - Working of Google analytics - Privacy - Tracking visitor clicks, Outbound links and Non – HTML files.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Field Cady "The Data Science Handbook" (2017).
2	Sayan Mukhopadhyay, Data Analytics Using Python, A press, 2018
3	Peter Bruce and Andrew Bruce "Practical Statistics for Data Scientists: 50 Essential Concepts" (2017).
4	Wes McKinney "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" (2017).
5	Hadley Wickham and Garrett Grolemund "R for Data Science: Import, Tidy, Transform, Visualize, and Model Data" (2017).
6	Joel Grus "Data Science from Scratch: First Principles with Python" (2017).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=N6BghzuFLIg
2	https://m.youtube.com/watch?v=2A9KOkC2La0
3	https://www.youtube.com/watch?v=njri8_gJTs0
4	https://www.geeksforgeeks.org/data-science-vs-data-analytics/
5	https://www.youtube.com/watch?v=T08eJt9DlgU

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	23MC1E6	OPTIMIZATION TECHNIQUES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the engineering application of optimization techniques.	K4	1
CO2	Inference the basic optimization algorithms for solving constrained and unconstrained optimization problems.	K4	2
CO3	Apply the modern methods of optimization techniques to solve engineering problems using Matlab.	K3	3
CO4	Analyze the established and proposed variants of particle swarm optimization techniques.	K4	4
CO5	Examine the performance of particle swarm optimization techniques.	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3		2		2		2	
CO2	2							
CO3	2	2						
CO4	3		2		2			3
CO5	2		2		2		2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO OPTIMIZATION**	**9**
Engineering application of optimization – Statement of an optimization problem – Optimal problem formulation - Classification of optimization problem. Optimum design concepts: Definition of global and local optima – Optimality criteria – Review of basic calculus concepts – Global optimality		
Topic - 2	**OPTIMIZATION ALGORITHMS**	**9**
Optimization algorithms for solving unconstrained optimization problems – Gradient based method : Cauchy‟s steepest descent method, Newtons method, Conjugate gradient method. Optimization algorithms for solving constrained optimization problems : Direct methods- Penalty function methods – Steepest descent method		
Topic - 3	**MODERN METHODS OF OPTIMIZATION**	**9**
Modern methods of Optimization: Genetic Algorithms - Simulated Annealing - Ant colony optimization - Tabusearch-Neural-NetworkbasedOptimization-Fuzzyoptimizationtechniques-ParticleSwarmOptimization-Applications. Use ofMatlabtosolve optimization problems.		
Topic - 4	**ESTABLISHED AND PROPOSED VARIANTS OF PSO**	**9**
Unified Particle Swarm Optimization - Memetic Particle Swarm Optimization - Vector Evaluated Particle Swarm Optimization - Composite Particle Swarm Optimization A Meta-Strategy Approach – Guaranteed Convergence Particle Swarm Optimization - Cooperative Particle Swarm Optimization - Niching Particle Swarm Optimization –Tribes – Quantum Particle Swarm Optimization.		
Topic - 5	**PERFORMANCE ENHANCING TECHNIQUES**	**9**
Introduction – The stretching technique for Alleviating Local Minimisers. The Deflection Technique for Detecting Several Minimisers – The Repulsion Technique – Rounding technique for Integer Optimization – Applications of Particle Swarm Optimization.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Optimization Theory and Practice" by J.S. Arora (2017).
2	Yang. X, Optimization Techniques and Applications with Examples, United States: Wiley,2018
3	Nayak. S, Fundamentals of Optimization Techniques with Algorithms, United Kingdom: Elsevier Science, 2020
4	"Linear and Nonlinear Programming" by David G. Luenberger and Yinyu Ye (Fourth Edition, 2016).
5	"Optimization Theory and Practice" by J.S. Arora (2017).
6	"Introduction to Mathematical Optimization: From Linear Programming to Metaheuristics" by Benoît Vandenbergh, Gautier Stauffer, and Jean-Charles Delvenne (2021).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=lBXdFu6Rwn4
2	https://www.youtube.com/watch?v=_IbFESykZGc
3	https://www.youtube.com/watch?v=9tO8AX7Ah2I
4	https://www.britannica.com/science/optimization
5	https://www.youtube.com/watch?v=84HOL_EiJ4M

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E CSE	23MC1L1	APPLICATIONS OF DATA STRUCTURES LABORATORY	0	0	4	2

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Apply mathematical foundations, algorithmic principles, and computer science theory in the modelling and design of computer-based systems of varying complexity.	K3
CO2	Identify, formulate, critically analyse, and solve problems in the field of Computer Science and Engineering, considering recent and future trends.	K3
CO3	Develop a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, health and safety, and sustainability in the field of Computer Science and Engineering.	K3
CO4	Analyze current techniques, skills, and tools necessary for computing practice and demonstrate advanced knowledge of a selected area within the Computer Science discipline.	K4
CO5	Develop applications using advanced data structures and enhance the knowledge on algorithmic analysis.	K3

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2		2				2	
CO2		2						2
CO3			3		3		3	
CO4	2							
CO5			2		3			3

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
Experiment 1	Write a program that use both recursive and non recursive functions for implementing the following searching methods: i) Linear search ii) Binary search
Experiment 2	Implement the following data structures: a) Left is the aps b) Skew heaps
Experiment 3	Create two binomial queue structures and perform merging of two binomial queues
Experiment 4	Write a program to perform the following: a) Traverse the binary tree using pre-order, in-order and post-order traversals
Experiment 5	Write a program to perform the insertion and deletion operations in AVL Tree using a) Single Rotation b) Double Rotation
Experiment 6	a) Implement insertion, deletion and search operations in Red-Black Tree b) Write a program to implement B-Tree operations.
Experiment 7	a) Implement Dijkstra‟s algorithm and Floyd Warshall‟s algorithm for solving single source shortest path problems. b) Write a program to detect Hamiltonian cycles in a Hamiltonian graph.
Experiment 8	a) Write a program to implement graph coloring algorithms. b) Write a program to find chromatic index of cyclic graphs.
Experiment 9	Implement the Huffman coding algorithm to decode the given text.
Experiment 10	Simulate Tic-Tac-Toegame using back tracking strategy

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Applications Of Data Structures Laboratory Manual, Al - Ameen Publications 2023
2	AlfredV.Aho,JohnE.Hopcroft,JeffreyD.Ullman,DataStructures andAlgorithms,ThirdEdition,Pearson,2015
3	"Data Structures and Algorithm Analysis in Java" by Clifford A. Shaffer (Fourth Edition, 2018).
4	"Data Structures and Algorithms in Python" by Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser (Second Edition, 2018).
5	"Data Structures and Algorithm Analysis in C++" by Mark Allen Weiss (Fourth Edition, 2014).
6	"Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein (Third Edition)

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=Ef3pRDYFhVo
2	https://www.youtube.com/playlist?list=PLgOvAyZGFRoSKBxqG9lbhtz9cVeLDsZnp
3	https://www.youtube.com/watch?v=PoxdkCSsD3A
4	https://www.youtube.com/watch?v=21_bJLB7gyU
5	https://www.youtube.com/watch?v=trKjYdBASyQ

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E CSE	23MC1L2	DATA ANALYTICS LABORATORY	0	0	4	2

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Demonstrate the data pre-processing concepts and show the visualization results using real time data	K2
CO2	Apply different statistical analysis, time series analysis and text analysis to real data set	K3
CO3	Experiment with Hadoop and map reduce concepts using sample dataset.	K3
CO4	Develop text analytics techniques for building solutions for text mining problem.	K3
CO5	Interpret and communicate the outcomes of estimation and hypothesis tests in the context of a problem.	K2

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3		2				2	
CO2	3		2		2			3
CO3	3		2		3		3	
CO4	2		2		3			2
CO5	2		2					3

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
Experiment 1	Demonstrate the missing data handling approaches for the given data set.
Experiment 2	Perform exploratory data analysis with simple visualizations using real time data
Experiment 3	Demonstrate data wrangling concepts using sample dataset.
Experiment 4	Perform dimensionality reduction for the given data.
Experiment 5	Computing summary statistics using real time data.
Experiment 6	Demonstrate testing of hypothesis for Small and Large sample tests for real-time problems
Experiment 7	Apply simple linear and multiple linear regression models to real dataset.
Experiment 8	Apply Time series model AR , ARMA and ARIMA and testing Forecasting accuracy tests.
Experiment 9	Apply Text Analysis concepts with the sample dataset.
Experiment 10	Perform Topic modeling using real time data.
Experiment 11	Demonstrate the sentiment analysis process with the sample dataset.
Experiment 12	Demonstrate the Hadoop and map reduce concept using sample dataset.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**45**		**TOTAL**	**45**

BOOK REFERENCES	
1	Data Analytics Laboratory Manual, Al - Ameen Publications 2023
2	Wes McKinney, “Python for Data Analysis”, 2nd Edition, O'Reilly Media Publication, 2017.
3	"Practical Statistics for Data Scientists: 50 Essential Concepts" by Peter Bruce and Andrew Bruce (2017).
4	"Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney (2017).
5	"Data Science from Scratch: First Principles with Python" by Joel Grus (2015).
6	"Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney (2017).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=Lx5Byh8smaE
2	https://m.youtube.com/@dataanalysislab2511/videos
3	https://www.youtube.com/watch?v=EtwtkAlECww
4	https://www.youtube.com/watch?v=Y2khrpVo6qI
5	https://www.youtube.com/watch?v=w4W1_0kvJS8

SEMESTER II

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	23MC2T1	Database Engineering	PC	40	60	3	0	0	3
2	23MC2T2	Machine Learning Techniques	PC	40	60	3	0	0	3
3		Program Elective III	PE	40	60	3	0	0	3
4		Program Elective IV	PE	40	60	3	0	0	3
5		Audit course	AC	40	60	3	0	0	3
LABORATORY COURSES									
6	23MC2L1	Database Engineering Laboratory	PC	60	40	0	0	4	2
7	23MC2L2	Machine Learning Laboratory	PC	60	40	0	0	4	2
Total						**17**	**0**	**8**	**19**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E CSE	23MC2T1	DATABASE ENGINEERING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Construct an ER model for a database system and apply the normalization in relational databases for removing anomalies.	K3	1
CO2	Analyze the transaction processing, concurrency control in parallel and distributed databases.	K4	2
CO3	Apply the real time data in object and object relational databases.	K3	3
CO4	Apply the concepts of mobile database and implement multimedia databases.	K3	4
CO5	Analyze the emerging database technologies in NoSQL.	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3		3		3			3
CO2	2		2					
CO3	2		3					
CO4	2		3					
CO5	2		2		3		2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DATABASE SYSTEM CONCEPTS**	**9**
Purpose of Database systems - Data Storage and Querying - Database architecture - Data models: Relational model- Entity relationship model : Constraints- Removing redundant attributes in entity sets - Entity-relationship diagrams - Reduction to relational schemas - Entity relationship design issue - Extended E-R features - Normalization and database design		
Topic - 2	**PARALLEL AND DISTRIBUTED DATABASES**	**9**
Parallel databases: I/O parallelism - Inter and intra query parallelism - Inter and intra operation parallelism - Distributed databases: Homogeneous and Heterogeneous databases - Distributed data storage – Distributed transactions – Commit protocols – Concurrency control- Distributed query processing		
Topic - 3	**OBJECT AND OBJECT RELATIONAL DATABASES**	**9**
Concepts for Object Databases: Object Identity - Object structure - Type Constructors - Encapsulation of Operations - Methods - Persistence - Type and Class Hierarchies - Inheritance - ODMG Model - ODL-OQL-Object Database Conceptual Design.		
Topic - 4	**MOBILE AND MULTIMEDIA DATABASES**	**9**
Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management – Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control – Transaction Commit Protocols – Multimedia Databases – Image Databases – Audio Databases – Video Databases		
Topic - 5	**EMERGING DATABASE TECHNOLOGIES**	**9**
No SQL- CAP Theorem – Sharding – Document based- Mongo DB Operation : Insert, Update, Delete, Query, Indexing, Deployment - Using Mongo DB with PHP / JAVA - Cassandra: Data Model, Key Space, Table Operations, CRUD Operations, CQL Types - HIVE: Data types, Database Operations, Partitioning –Hive QL-Orient DB Graph database-Orient DB Features.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	R.Elmasri and S.B. Navathe, Fundamentals of Database Systems. NewDelhi : Pearson Education / Addison Wesley, Seventh Edition, 2016.
2	HenryF.Korth, Abraham Silberschatz and S.Sudharshan, Database System Concepts. NewDelhi : McGrawHill, Seventh Edition, 2019.
3	"Principles of Database Management: The Practical Guide to Storing, Managing and Analyzing Big and Small Data" by Wilfried Lemahieu, Bart Baesens, and Seppe vanden Broucke (Second Edition, 2018).
4	"Database System Concepts" by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan (Seventh Edition, 2019).
5	"SQL Performance Explained" by Markus Winand (Second Edition, 2018).
6	"Database Systems: Design, Implementation, and Management" by Carlos Coronel and Steven Morris (Twelfth Edition, 2018).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=bg2BIVJHOQA
2	https://www.youtube.com/watch?v=T-EVqDVPhLc
3	https://www.youtube.com/watch?v=aFKOPiPbJF4
4	https://www.youtube.com/watch?v=iwRneX7GIGI
5	https://www.udemy.com/course/database-engines-crash-course/

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	23MC2T2	MACHINE LEARNING TECHNIQUES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Compare and Contrast the linear, binary logistic, multinomial logistic, count, and nonlinear regression methods.	K2	1
CO2	Classify the concepts of supervised learning algorithms with patterns to predict label values on additional unlabeled data.	K2	2
CO3	Interpret associated rules and independent component analysis in unsupervised learning algorithms.	K2	3
CO4	Apply deep learning, Neural Network model algorithms to handle uncertainty and solve engineering problems.	K3	4
CO5	Analyze Reinforcement learning algorithms based on behavioral approach and training models.	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2							
CO2	2							
CO3	2		2					
CO4	3		3		2			3
CO5	3		3		2		2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO STATISTICAL THEORY AND REGRESSION**	**9**
Regression for classification: Gauss-Markov theorem - Multiple Regression - Subset selection – Ridge regression - Principal components regression - Partial least squares - Linear Discriminant analysis – Logistic regression- multi-class classification Overfittingandregularizationinlinearregressionandlogisticregression.		
Topic - 2	**SUPERVISED LEARNING**	**9**
Decision Tree Learning - Bayesian Learning- Bayes Theorem Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier - Gibbs Algorithm – Naïve Baye‟s Classifier- Bayesian Belief Network - EM Algorithm		
Topic - 3	**UNSUPERVISED LEARNING**	**9**
Association rules - Cluster analysis-Self organizing maps-Principal components, curves and surfaces-Non-negative matrix factorization-Independent component analysis: maximum likelihood, contrast functions –Multi dimensional scaling-Ensemble learning.		
Topic - 4	**DEEP LEARNING**	**9**
Neural Network Representation - Problems- Perceptron - Multilayer Networks and Back Propagation Algorithms - Convolutional neural networks - Stochastic Gradient Descent - Recurrent neural networks – Create and deploy neural networks using Tensor Flow and Keras		
Topic - 5	**REINFORCEMENT LEARNING**	**9**
Introduction - Single State Case - Elements of Reinforcement Learning - Model Based Learning – Temporal Difference Learning - TD prediction, Optimality of TD(0) - SARSA - R Learning Algorithm - Q Learning Algorithm-Generalization –Partially Observable States		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Building Machine Learning Powered Applications: Going from Idea to Product" by Emmanuel Ameisen (2018).
2	"Hands-On Reinforcement Learning with Python: Master Reinforcement and Deep Reinforcement Learning using OpenAI Gym and TensorFlow" by Sudharsan Ravichandiran (2018).
3	"Hands-On Unsupervised Learning Using Python: How to Build Applied Machine Learning Solutions from Unlabeled Data" by Ankur A. Patel (2019).
4	"Deep Reinforcement Learning Hands-On" by Maxim Lapan (2018).
5	"Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto (2018).
6	"Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville. The latest edition of this book is the 1st edition, published in 2016.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=rqJ8SrnmWu0
2	https://www.youtube.com/watch?v=teWYOMn9Lso
3	https://www.youtube.com/watch?v=lhufOy2W3Ps
4	https://www.javatpoint.com/machine-learning-techniques
5	https://www.tableau.com/learn/articles/top-machine-learning-methods

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E.CSE	23MC2E1	BIG DATA ANALYTICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Build competitive advantage with Big Data analytics by optimizing business decisions and Analyze the Big Data file structure and Approaches.	K3	1
CO2	Discover the building blocks of Data Analytics Lifecycle to manage and execute the analytical projects.	K4	2
CO3	Analyze the data on Hadoop to build and maintain reliable, scalable distributed File System.	K4	3
CO4	Analyze the fundamental enabling technique of Map Reduce and its qualities in big data analytics.	K4	4
CO5	Develop the applications using the programming tools Pig, Hive and Zookeeper in the Hadoop ecosystem.	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2		3		3		3	
CO2	2		3		3			3
CO3	3							
CO4	3							
CO5	3		3		3		3	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT

Topic - 1	INTRODUCTION TO BIG DATA ANALYTICS	9
Big Data Overview, Data Structures, Analyst Perspective on Data Repositories, State of the Practice in Analytics, BI Versus Data Science, Current Analytical Architecture, Drivers of Big Data, Emerging Big Data Ecosystem and a New Approach to Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics.		
Topic - 2	**DATA ANALYTICS LIFE CYCLE**	**9**
Data Analytics Lifecycle Overview, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize, Case Study: Global Innovation Network and Analysis (GINA)		
Topic - 3	**INTRODUCTION TO HADOOP**	**9**
Data format - analyzing data with Hadoop-scaling out-Hadoop streaming- Hadoop pipes, The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Sqoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures, HDFS Administering-Monitoring & Maintenance.		
Topic - 4	**MAPREDUCE APPLICATIONS**	**9**
Map Reduce work flows – unit tests with MR Unit – test data and local tests – anatomy of Map Reduce jobrun - classic Map-reduce - YARN- failures in classic Map-reduce and YARN- job scheduling -shuffle and sort – task execution-Map Reduce types-input formats-output formats.		
Topic - 5	**HADOOP ECOSYSTEM**	**9**
I Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data –Sorting and Aggregating, Map Reduce Scripts, Joins & Subqueries, H Base concepts Advanced Usage, Schema Design, Advance Indexing - Mahout - PIG, Zookeeper - how it helps in monitoring a cluster, H Base uses Zookeeper and how to Build Applications with Zookeeper.		

THEORY	45		TUTORIAL	00		PRACTICAL	00		TOTAL	45

BOOK REFERENCES	
1	"Big Data Analytics for Cyber-Physical Systems: Machine Learning for the Internet of Things" by Dr. Jesse Featherstone (2019).
2	Rajkumar Buyya, Rodrigo N.Calheiros, Amir Vahid Dastjerdi, Big Data Principles and Paradigms, Morgan Kaufmann, 2016.
3	"Big Data Analytics for Sensor-Network Collected Intelligence" edited by Hui-Huang Hsu and Cheng-Hung Chen (2019).
4	"Big Data Analytics for Satellite Image Processing and Remote Sensing" edited by Nilanjan Dey, Amira S. Ashour, and Simon James Fong (2019).
5	"Big Data Analytics in Genomics" edited by Ka-Chun Wong, Huiru Zheng, and Hua Wang (2019).
6	"Big Data Analytics for Smart and Connected Cities" edited by Houbing Song, Ruichen Deng, and Kan Zheng (2019).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=bY6ZzQmtOzk
2	https://www.youtube.com/watch?v=iANBytZ26MI
3	https://www.youtube.com/watch?v=b-IvmXoO0bU
4	https://www.techtarget.com/searchbusinessanalytics/definition/big-data-analytics
5	https://www.coursera.org/in/articles/big-data-analytics

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E.CSE	23MC2E2	CLOUD COMPUTING TECHNOLOGIES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Inspect the components of cloud computing to understand how business agility in an organization can be created.	K4	1
CO2	Indentify the consistency of virtualization technologies in cloud environments.	K3	2
CO3	Examine the deployment of web services from cloud architecture with scheduling schemes and resource management.	K4	3
CO4	Analyze cloud programming models to solve issues on cloud.	K4	4
CO5	Develop a secure cloud to deploy an application based on different security concerns.	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2		3					
CO2	3							
CO3	3		3		3			3
CO4	2							
CO5	3		3		3		2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION – CLOUD INFRA STRUCTURE**	**9**
Cloud computing - Cloud computing delivery models and services - Ethical issues - Cloud vulnerabilities - Cloud computing at Amazon - Cloud computing the Google perspective - Microsoft Windows Azure and online services - Open-source software platforms for private clouds.		
Topic - 2	**CLOUD VIRTUALIZATION TECHNOLOGIES**	**9**
Introduction – Virtualization Defined – Virtualization Benefits – Server Virtualization – Virtual Machine - Virtualization technologies - Hardware Virtualization - OS Virtualization for x86 Architecture –Paravirtualization – Virtual Infra structure Requirements – Server Virtualization Sustainability Assessment.		
Topic - 3	**CLOUD RESOURCE MANAGEMENT AND SCHEDULING**	**9**
Policies and Mechanisms for Resource Management – Stability of a Two – Level Resource Allocation Architecture - A Utility - Based Model for Cloud - Based Web Services - Resource Bundling : Combinatorial Auctions for Cloud Resources - Scheduling Algorithms for Computing Clouds - Fair Queuing - Start –Time Fair Queuing – Borrowed Virtual Time		
Topic - 4	**CLOUD PROGRAMMING MODEL**	**9**
Introduction to Hadoop Framework – Map reduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job -Developing Map Reduce Applications - Design of Hadoop file system-Setting up Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus.		
Topic - 5	**CLOUD SECURITY**	**9**
Cloud Infrastructure security: network, host and application level-aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud – Key privacy issues in the cloud -Cloud Security and Trust Management.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Cloud Computing: Implementation, Management, and Security" by John Rittinghouse and James F. Ransome (2017).
2	"Cloud Computing: Concepts, Methodologies, Tools, and Applications" edited by Information Resources Management Association (2017).
3	"Cloud Computing: Business Trends and Technologies" by Igor Faynberg, Hui-Lan Lu, and Dor Skuler (2016).
4	"Cloud Computing: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti (2016).
5	"Cloud Computing: Concepts, Methodologies and Applications" edited by Information Resources Management Association (2017).
6	"Cloud Computing: An Introduction" by R. Buyya, J. Broberg, and A. Goscinski (2019).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=RWgW-CgdIk0
2	https://www.youtube.com/watch?v=Sb5SO3WRSws
3	https://www.youtube.com/watch?v=Rm7NXLAS8_M
4	https://www.javatpoint.com/cloud-computing-technologies
5	https://www.tutorialspoint.com/cloud_computing/cloud_computing_technologies.htm

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E.CSE	23MC2E3	5G NETWORKS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Summarize the evolution of 5G networks.	K2	1
CO2	Analyze the concept of small cells and its challenges in 5G.	K4	2
CO3	Apply the concept of cognitive radio technologies for 5G mobile clouds	K3	3
CO4	Analyze the applications of wireless spectrum in the Unified 5G Broadcast-Broadband architecture.	K3	4
CO5	Analyze the Security challenges and the concepts of SON in 5G networks.	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2		2					
CO2	2		3					2
CO3	3		3		3		3	
CO4	2		2					
CO5	2		2					

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT											
Topic - 1	**INTRODUCTION**										**9**
Introduction - Historical Trend of Wireless Communications - Evolution of LTE Technology to Beyond 4G-5G Roadmap - 10 Pillars of 5G - 5G in Europe, North America & Asia - 5G Architecture - The 5G Internet –Internet of Things and Context – Awareness – Networking Reconfiguration and Virtualisation Support – Mobility – Quality of Service Control – Emerging Approach for Resource Over-Provisioning.											
Topic - 2	**SMALL CELLS**										**9**
Introduction - Small Cells - Capacity Limits and Achievable Gains with Densification- Mobile Data Demand - Demand vs Capacity - Small - Cell Challenges - Cooperative Diversity and Relaying Strategies –PHY Layer Impacton MAC Protocol Analysis											
Topic - 3	**MOBILE CLOUDS**										**9**
Introduction - The Mobile Cloud - Mobile Cloud Enablers - Network Coding - Cognitive Radio for 5G Wireless Networks - Spectrum Optimisation using Cognitive Radio - Spectrum Optimisation – Cognitive Radio and Carrier Aggregation - Energy - Efficient Cognitive Radio Technology - Key Requirements and Challenges.											
Topic - 4	**WIRELESS SPECTRUM**										**9**
Background - TV White Space Technology - White Space Spectrum Opportunities and Challenges – TV White Space Applications - International Efforts - Role of WS in 5G - Unified 5G Broadcast – Broadband Architecture – Challenges – Candidate Network Architectures – Convergent Solution											
Topic - 5	**SECURITY**										**9**
Overview of a Potential 5G Communications – Security Issues and Challenges in 5G Communications - SON in UMTS and LTE -The Need for SON in 5G –Evolution towards Small – Cell Dominant Het Nets											
THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**		**45**

BOOK REFERENCES	
1	"5G NR: The Next Generation Wireless Access Technology" by Erik Dahlman, Stefan Parkvall, and Johan Skold (2018).
2	Anwer Al-Dulaimi, 5G Networks Fundamental Requirements, Enabling Technologies and Operations Management, Wiley Publication, First Edition , 2018
3	"5G Core Networks: Powering Digitalization" by Stefan Rommer, Peter Hedman, Magnus Olsson, and Lars Frid (2019).
4	Devaki Chandramouli, Juho Pirskanen, Rainer Liebhart, 5G for the Connected World, Wiley Publication, First Edition, 2019
5	"5G NR: Architecture, Technology, Implementation, and Operation of 3GPP New Radio Standards" by Sassan Ahmadi (2019).
6	"5G Core Networks: Powering Digitalization" by Stefan Rommer, Peter Hedman, Magnus Olsson, and Lars Frid (2019).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=p_h-AOaBrh4
2	https://www.youtube.com/watch?v=CDAZL-pgXXA
3	https://www.youtube.com/watch?v=JD_Hil_rjKk
4	https://www.qualcomm.com/5g/what-is-5g
5	https://www.verizon.com/about/our-company/5g/what-5g

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	23MC2E4	HIGH SPEED NETWORKS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Summarize the basic functionalities of OSI model and routing algorithms.	K2	1
CO2	Classify the operations performed on Asynchronous Transfer Mode (ATM) switching.	K2	2
CO3	Compare the various methods for providing connection-oriented services over an advanced network with the reference to MPLS, VPN.	K4	3
CO4	Distinguish the mechanisms involved in the 4G and Long Term Evolution (LTE) networks.	K4	4
CO5	Analyze the importance of internetworking on WLANs and 3GWANs.	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2		2		2			3
CO2	2							
CO3	2		2		2		3	
CO4	2							
CO5	2		3		3			3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
The OSI Reference Model - The TCP / IP Reference Model – Ethernet - Routing Algorithms : The Optimality Principle - Shortest Path – Routing – Flooding - Unicast Routing - Multicast Routing, Routing for Mobile Hosts – Uses : Network Applications – Network Types		
Topic - 2	**SWITCHING NETWORKS**	**9**
Switching – Packet switching – Ethernet – Token Ring – FDDI – DQDB – Frame Relay - SMDS-Circuit Switched – SONET – DWDM – DSL – Intelligent Networks – CATV – ATM – Features – Addressing Signaling & Routing – Header Structure – ATM Adaptation layer - Management control – BISDN – Internet working with ATM		
Topic - 3	**VIRTUAL PRIVATE NETWORK**	**9**
VPN - Remote Access VPN – Site – to – Site VPN - Tunneling to PPP - Security in VPN – MPLS – Operation – Routing - Tunneling and use of Forward Error Correction - Traffic Engineering - MPLS based VPN - Overlay Networks P2P connections - IPv4 vs IPv6		
Topic - 4	**4 GAND LTE**	**9**
Overview of 3G - Migration paths to UMTS - UMTS architecture - 3GPP Network - 4G - Features and challenges - 4G technologies - Software defined radio - Cognitive Radio - IMS architecture – MVNO - LTE: System overview – Evolution from UMTS to LTE		
Topic - 5	**INTERNET WORKING BETWEEN WLANS AND 3G WANS**	**9**
Internet working – Objectives and Requirements, Schemes to Connect WLANs and 3G networks – Session Mobility – Internet working Architecture for WLAN and GPRS – LMDS - MMDS		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Peter Dordal,"An Introduction to Computer Networks", Release 1.9.16, 2018
2	J.F.Kurose, K.W.Ross,"Computer Networking – A Top Down Approach Featuring the Internet", Pearson 7th Edition, 2017
3	"Optical Networks: A Practical Perspective" by Rajiv Ramaswami and Kumar N. Sivarajan
4	"Computer Networking Problems and Solutions: An innovative approach to building resilient, modern networks" by Russ White and Ethan Banks
5	"TCP/IP Illustrated, Volume 1: The Protocols" by W. Richard Stevens
6	"Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=rtTHTtigRqQ
2	https://www.youtube.com/watch?v=-HlJ4psu5aU
3	https://www.youtube.com/watch?v=R-JUOpCgTZc
4	https://mec.edu.in/mvlc/lecture_handouts/l_cse/lh_hsn.pdf
5	https://www.techtarget.com/whatis/glossary/High-Speed-Networks

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	23MC2E5	BLOCKCHAIN TECHNIQUES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Summarize the emerging abstract models for Blockchain tecniques	K2	1
CO2	Apply the concept of Bitcoin and cryptocurrency in Blockchain techniques	K3	2
CO3	Analyze the algorithms involved in distributed consensus.	K4	3
CO4	Develop the Block chain application using hyperledger Fabric and Etherum platform.	K3	4
CO5	Apply the Blockchain technologies in real world problems.	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2							
CO2	3		3		3			3
CO3	3		3					
CO4	3		3		3		3	
CO5	3		3		3			3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT										
Topic - 1	**INTRODUCTION**									**9**
Block chain - Public Ledgers, Block chain as Public Ledgers - Bitcoin, Block chain 2.0, Smart Contracts, Block in a Block chain, Transactions-Distributed Consensus, The Chain and the Longest Chain – Crypto currency to Block chain 2.0 - Permissioned Model of Block chain, Cryptographic - Hash Function, Properties of a hash function – Hash pointer and Merkletree										
Topic - 2	**BITCOIN AND CRYPTOCURRENCY**									**9**
A basic crypto currency, Creation of coins, Payments and double spending, FORTH : the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments - Consensusin a Bitcoin network										
Topic - 3	**DISTRIBUTED CONSENSUS**									**9**
RAFT Consensus - Byzantine general problem, Byzantine fault tolerant (BFT) system - Agreement Protocol, Lamport – Shostak – Pease BFT Algorithm –BFT over Asynchronous systems, Practical Byzantine Fault Tolerance.										
Topic - 4	**HYPER LEDGER FABRIC**									**9**
Architecture of Hyper ledger fabric v1.1 - Introduction to hyper ledger fabric v1.1, chain code - Ethereum : Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, Truffle Design and issue Crypto currency.										
Topic - 5	**BLOCK CHAIN APPLICATIONS**									**9**
Internet of Things – Medical Record Management System – Block chain in Government and Block chain Security – Block chain Use Cases-Finance.										
THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	S.Shukla, M.Dhawan, S.Sharma, S.Venkatesan, Block chain Technology : Crypto currency and Applications, Oxford University Press, 2019
2	Imran Bashir, Mastering Block chain : Distributed Ledger technology, decentralization and smart contracts, Second edition, Packt publishing, 2018
3	Josh Thompson, Block chain : The Block chain for Beginnings, Guild to Block chain Technology and Block chain Programming, Create Space Independent Publishing Platform, 2017
4	Arvind Narayanan, JosephBonneau, EdwardFelten, Andrew Miller and Steven Goldfeder, Bitcoin and crypto currency technologies : acomprehensive introduction, Princeton University Press,2016
5	"Blockchain: The Next Everything" by Stephen P. Williams (2019).
6	"Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions" by Joseph J. Bambara and Paul R. Allen (2018).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=RT7x0lQvSLk
2	https://www.youtube.com/channel/UCNcSSleedtfyDuhBvOQzFzQ
3	https://www.youtube.com/watch?v=jZ4ZK7SkjCs
4	https://www.simplilearn.com/tutorials/blockchain-tutorial/blockchain-technology#:~:text=Blockchain%20is%20a%20method%20of,computers%20participating%20in%20the%20blockchain.
5	https://www.coindesk.com/learn/what-is-blockchain-technology/

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	23MC2E6	AUTOMATA THEORY	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Construct automata for any given pattern and find its equivalent regular expressions.	K3	1
CO2	Build Context free grammar for languages and analyze its properties.	K3	2
CO3	Develop Pushdown automata and Turing Machine to recognize languages and computation.	K3	3
CO4	Construct linear bounded automata and prove equivalence between different language representations within the Chomsky hierarchy.	K3	4
CO5	Analyze the undecidability of languages.	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2		2					
CO2	3		3		3			3
CO3	3		3		3		3	
CO4	3		3					
CO5	2		2					

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**REGULAR LANGUAGES**	**9**
Finite Automata (FA) - Deterministic Finite Automata (DFA) – Non - deterministic Finite Automata (NFA) Equivalence between NFA and DFA. Regular Expression – FA and Regular Expressions – Pumping Lemma for Regular Languages - Closure Properties of Regular Languages		
Topic - 2	**CONTEXT FREE LANGUAGES**	**9**
Context - Free Grammar (CFG) - Derivation Trees - Ambiguity in Grammars and Languages - Equivalence of Parse Trees and Derivation – Simplification of Context – free Grammar – Chomsky Normal Form –Greibach Normal Form - Pumping Lemma for CFL – Closure Properties.		
Topic - 3	**PUSHDOWN AUTOMATA**	**9**
Definition of the Pushdown Automata – Languages of Pushdown Automata - Equivalence of Pushdown Automata and CFG – Deterministic Pushdown Automata - Turing Machines – Language of a Turing Machine Programming Techniques for TM -Storage in Finite Control- Multiple Tracks - Checking off symbols - Subroutines.		
Topic - 4	**CHOMSKY HIERARCHY**	**9**
Regular Grammars – Equivalence of Regular Grammar and Finite Automata – Unrestricted Grammars – Equivalence of Type 0 Grammar and Turing Machines - Context Sensitive Grammars (CSG) and Languages Linear Bounded Automata (LBA) – Equivalence of LBA and CSG		
Topic - 5	**UNDECIDABILITY**	**9**
Properties of Recursively Enumerable (RE) and Recursive Languages – Undecidable Problems about Turing Machine – Rice Theorem - Post's Correspondence Problem (PCP) – Modified Post Correspondence Problem.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Automata Theory and its Applications" by Ajay K. Sharma and Laxmi Narayan Deora (2019).
2	"Automata Theory, Computability and Formal Languages" by Rajendra K. Garg (2018).
3	"Automata Theory, Languages and Computation" by Sanjay Madria and Alok Aggarwal (2018).
4	"Automata Theory and Formal Languages" by Urmila Shrawankar (2019).
5	"Introduction to Automata Theory, Languages and Computation" by Richa Aggarwal and Kamal Kanth (2019).
6	"Introduction to Automata Theory and Formal Languages" by A. K. Sharma (2019).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=bK8LVFWA0L8
2	https://www.youtube.com/watch?v=h1OSmLSacNA
3	https://www.youtube.com/watch?v=Br44Zxv84-Q
4	https://www.javatpoint.com/theory-of-automata
5	https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	23MC2A1	ENGLISH FOR RESEARCH PAPER WRITING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Illustrate the research ideas and writing journal papers	K3	1
CO2	Develop research paper writing	K3	2
CO3	Illustrate that how to improve your writing skills and level of readability	K3	3
CO4	Plan the skills needed when writing a Title.	K3	4
CO5	Examine the good quality of paper at very first-time submission.	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1								
CO2	2		3		3		2	
CO3	2							
CO4								
CO5			3		3			2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PLANNING AND PREPARATION**	**9**
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.		
Topic - 2	**ABSTRACT AND INTRODUCTION**	**9**
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.		
Topic - 3	**REVIEW LITERATURE**	**9**
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.		
Topic - 4	**KEY SKILLS**	**9**
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.		
Topic - 5	**RESULT AND CONCLUSION**	**9**
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. Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission..		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books).
2	Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.
3	Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highmans book.
4	Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
5	"English for Research: Usage, Style, and Grammar" by Adrian Wallwork. The latest edition of this book is the 2nd edition, published in 2016.
6	"Writing Your Journal Article in Twelve Weeks: A Guide to Academic Publishing Success" by Wendy Laura Belcher. This book provides a structured approach to writing academic articles, including research papers, and offers practical advice and exercises. The latest edition is the 2nd edition, published in 2019.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=VK51E3gHENc
2	https://www.youtube.com/watch?v=AfcVdLqvIM0
3	https://www.youtube.com/watch?v=uZBV-jPmhMA
4	https://www.youtube.com/watch?v=C1Gcm4lPO80
5	https://www.youtube.com/watch?v=_bYQ6fkDC6Q

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	23MC2A2	DISASTER MANAGEMENT	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Illustrate the key concepts in disaster risk reduction and humanitarian response	K3	1
CO2	Interpret the strengths and weaknesses of disaster management approaches, planning and programming	K2	2
CO3	Demonstrate a critical understanding of post-disaster diseases and epidemics	K2	3
CO4	Develop an understanding of disaster preparedness and management	K3	4
CO5	Organize the disaster risk assessment and disaster risk reduction	K4	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2							
CO2	2							
CO3	2							
CO4	3		3		3		2	
CO5	2		2		2			2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.		
Topic - 2	**REPERCUSSIONS OF DISASTERS AND HAZARDS**	**9**
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms and Cyclones, Tsunamis and Floods, Droughts and Famines, Landslides and Avalanches Man-made disaster Nuclear Reactor Meltdown, Industrial Accidents and Oil Slicks and Spills Outbreaks of Disease and Epidemics War and Conflicts.		
Topic - 3	**DISASTER PRONE AREAS IN INDIA**	**9**
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		
Topic - 4	**DISASTER PREPAREDNESS AND MANAGEMENT**	**9**
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.		
Topic - 5	**RISK ASSESSMENT**	**9**
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.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies " , New Royal book Company
2	Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi
3	Goel S. L. "Disaster Administration And Management Text and Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi.
4	Introduction to Emergency Management" by George D. Haddow, Jane A. Bullock, and Damon P. Coppola. The latest edition of this book is the 6th edition, published in 2021.
5	"Disaster Risk Reduction Approaches in Pakistan" by Asif Khan, Munir Ahmad, and Muhammad Babar Shahbaz (2018).
6	"The Business Continuity Institute Good Practice Guidelines 2018" by The Business Continuity Institute (2018).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=uyoPMjjSqhs
2	https://www.youtube.com/watch?v=lJ1vKRR8gXE
3	https://www.youtube.com/watch?v=9e-cg0ZFGH0
4	https://www.youtube.com/watch?v=PNgsqO7w9Nk
5	https://www.youtube.com/watch?v=USLHmwvpjX8

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	23MC2A3	VALUE EDUCATION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Interpret the Knowledge of self-development	K2	1
CO2	Demonstrate the importance of Human values	K2	2
CO3	Develop the overall personality	K3	3
CO4	Identify the Dignity of labour	K2	4
CO5	Interview the Character and competence	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1								
CO2								
CO3	2		3		3			2
CO4	2		3		3		2	
CO5	2		2		2			2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**VALUES AND SELF-DEVELOPMENT**	**9**
Values and self-development- Social values and individual attitudes-Work ethics- Indian vision of humanism- Moral and non- moral valuation-Standards and principles-Value judgements.		
Topic - 2	**IMPORTANCE OF CULTIVATION OF VALUES**	**9**
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.		
Topic - 3	**PERSONALITY AND BEHAVIOR DEVELOPMENT**	**9**
Personality and Behavior Development - Soul and Scientific attitude- Positive Thinking- Integrity and discipline-Punctuality- Love and Kindness- Avoid fault Thinking- Free from anger.		
Topic - 4	**DIGNITY OF LABOUR**	**9**
Dignity of labour- Universal brotherhood and religious tolerance-True friendship-Happiness Vs suffering- love for truth-Aware of self-destructive habits-Association and Cooperation-Doing best for saving nature.		
Topic - 5	**CHARACTER AND COMPETENCE**	**9**
Character and Competence -Holy books vs Blind faith, Self-management and Good health. Science of reincarnation, Equality, Nonviolence ,Humility, Role of Women. All religions and same message, Mind your Mind, Self-control. Honesty, Studying effectively.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi
2	Values and Ethics for Organizations (Theory and Practice) (by S.K. Chakraborty) ... Oxford University Press, New Delhi
3	"Teaching for Wisdom, Intelligence, Creativity, and Success" by Robert J. Sternberg. The latest edition is the 2nd edition, published in 2016.
4	"Theories of Personality" by Jess Feist, Gregory J. Feist, and Tomi-Ann Roberts. Latest edition: 9th edition, published in 2021.
5	"Personality: Theory and Research" by Lawrence A. Pervin and Daniel Cervone. Latest edition: 14th edition, published in 2018.
6	"Personality: Classic Theories and Modern Research" by Howard S. Friedman and Miriam W. Schustack. Latest edition: 6th edition, published in 2019.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=DllxzREpYy0
2	https://www.youtube.com/watch?v=efOAycWBdds
3	https://www.youtube.com/playlist?list=PL6sIjV1NQzDaMUlCdvXHzSpAM7CAfJzLM
4	https://www.youtube.com/watch?v=90VQPZURN5c
5	https://www.youtube.com/watch?v=XqQCI_ZhtxA

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	23MC2A4	PEDAGOGY STUDIES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?	K1	1
CO2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?	K1	2
CO3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy overall personality?	K1	3
CO4	Relate existing evidence on the review topic to inform programmer design and policy making undertaken by the DfID, other agencies and researchers	K2	4
CO5	Identify critical evidence gaps to guide and professional development	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1			2		2			3
CO2								
CO3								
CO4			2		2		2	
CO5			2		2			2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION AND METHODOLOGY**	**9**
Aims and rationale- Policy background- Conceptual framework and terminology-Theories of learning-Curriculum- Teacher education-Conceptual framework- Research questions-Overview of methodology and Searching		
Topic - 2	**THEMATIC OVERVIEW**	**9**
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.		
Topic - 3	**EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGY**	**9**
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.		
Topic - 4	**PEDAGOGICAL PRACTICES**	**9**
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		
Topic - 5	**PROFESSIONAL DEVELOPMENT**	**9**
Alignment with classroom practices and follow up, Support Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Educational Psychology: Developing Learners" by Jeanne Ellis Ormrod. Latest edition: 9th edition, published in 2018.
2	"Teaching with Love & Logic: Taking Control of the Classroom" by Jim Fay and David Funk. Latest edition: Updated and Expanded Edition, published in 2019.
3	"How to Differentiate Instruction in Academically Diverse Classrooms" by Carol Ann Tomlinson. Latest edition: 3rd edition, published in 2017.
4	"How Learning Works: Seven Research-Based Principles for Smart Teaching" by Susan A. Ambrose, et al. Latest edition: 2nd edition, published in 2021.
5	"Pedagogy of the Oppressed" by Paulo Freire. Latest edition: 50th Anniversary Edition, published in 2018.
6	"Teaching for Critical Thinking: Tools and Techniques to Help Students Question Their Assumptions" by Stephen D. Brookfield. Latest edition: 2nd edition, published in 2019.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=97aIKc_EOkk
2	https://www.youtube.com/watch?v=N_5JgiG3s0Y
3	https://www.youtube.com/watch?v=QcpwEoW1uY8
4	https://www.masterstudies.com/masters-degree/pedagogy
5	https://m.facebook.com/MahanirbanCalcuttaResearchGroup/videos/pedagogy-of-migration-studies-a-roundtable/4735988893143641/

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	23MC2A5	STRESS MANAGEMENT BY YOGA	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Develop healthy mind in a healthy body thus improving social health also	K3	1
CO2	Inference Efficiency of the body by practicing breathing exercises and yoga	K4	2
CO3	Inspect overall health of body and mind benefits	K4	3
CO4	Motive stress by practicing yoga in stress management	K4	4
CO5	Interview the various yog poses and its effects	K3	5

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1			3		3			3
CO2								
CO3								
CO4			2					
CO5			2		2			2

PRE-REQUISITE	Nil

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION OF YOG**	**9**
Definitions of Eight parts of yog. (Ashtanga)		
Topic - 2	**YAM**	**9**
Yam. Do`s and Dont"s in life. - Ahinsa, satya, astheya, bramhacharya and aparigraha		
Topic - 3	**NIYAM**	**9**
Niyam. Do`s and Dont"s in life. -Shaucha, santosh, tapa, swadhyay, ishwarpranidhan		
Topic - 4	**ASAN**	**9**
Asan - Various yog poses and their benefits for mind & body		
Topic - 5	**PRANAYAM**	**9**
Pranayam - Regularization of breathing techniques and its effects-Types of pranayam		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Yogic Asanas for Group Training-Part-I Janardan Swami Yogabhyasi Mandal, Nagpur. Model Curriculum of Engineering & Technology PG Courses [Volume-I][47].
2	Rajayoga or conquering the Internal Nature by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata.
3	Yoga for Emotional Balance: Simple Practices to Help Relieve Anxiety and Depression" by Bo Forbes
4	The Heart of Yoga: Developing a Personal Practice" by T.K.V. Desikachar
5	"The Science of Yoga: The Risks and the Rewards" by William J. Broad
6	"The Relaxation Response" by Herbert Benson

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=DM7EPiBQ1uk
2	https://www.youtube.com/watch?v=EAnBVRWo9oY
3	https://www.youtube.com/watch?v=udLuhi5cktY
4	https://www.youtube.com/watch?v=Yn8M4PdfY-Q
5	https://www.rishikeshyogpeeth.com/yoga-for-stress-management.html

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	23MC2L1	DATABASE ENGINEERING LABORATORY	0	0	4	2

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Build the basic SQL commands in ORACLE.	K3
CO2	Construct a parallel and distributed database using ORACLE.	K3
CO3	Develop an object oriented database using Case tools.	K3
CO4	Analyze the real world applications using NoSQL.	K4
CO5	Categorize distributed databases and parallel databases.	K4

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3		2					
CO2	3		3		3		3	
CO3	3		3		3			3
CO4	3							
CO5	3							

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
Experiment 1	Working basic SQL commands, Single Row and Group functions
Experiment 2	Implement Parallel Database of University Counselling for Engineering colleges
Experiment 3	Implement Distributed Database for a real time application
Experiment 4	Implement Parallel Database for a real time application
Experiment 5	Object Oriented Database –Extended Entity Relationship using case tool
Experiment 6	MySQL Database Creation, Table Creation, Query
Experiment 7	Mobile Database Query Processing using open source DB (Mongo DB / MySQL etc)
Experiment 8	Mongo DB-CRUD operations and Indexing
Experiment 9	Cassandra-Table Operations, CQL Types
Experiment 10	HIVE : Database Operations, Partitioning – Hive QL Orient DB Graph database – Orient DB Features

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**45**		**TOTAL**	**60**

BOOK REFERENCES	
1	Database Engineering Laboratory Manual, Al-Ameen Publication 2023.
2	Brad Dayley, Teach Yourself NoSQL with Mongo DB in 24Hours, Sams Publishing, Second Edition, 2015.
3	"Database System Concepts" by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan (Seventh Edition, 2019).
4	"Database Systems: Design, Implementation, and Management" by Carlos Coronel, Steven Morris, and Peter Rob (13th Edition, 2018).
5	"Database Processing: Fundamentals, Design, and Implementation" by David M. Kroenke and David J. Auer (14th Edition, 2018).
6	"Database System Concepts" by Silberschatz, Korth, Sudarshan (Seventh Edition, 2019).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=Om3jDgsFvgc
2	https://www.youtube.com/playlist?list=PLf0swTFhTI8o5Lb5yw1aDtvVJ8Wo4Lpm-
3	https://www.youtube.com/watch?v=CdMxR_zubfA
4	https://www.youtube.com/watch?v=F8w3w9_9Cog
5	https://www.youtube.com/watch?v=zyUYbT7WItI

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	23MC2L2	MACHINE LEARNING LABORATORY	0	0	4	2

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Apply the various supervised algorithms and evaluate the performance	K3
CO2	Build the unsupervised algorithms and evaluate the performance	K3
CO3	Analyze and compare the performance of different algorithms	K4
CO4	Compare the linear regression and decision tree algorithms	K4
CO5	Examine machine learning algorithm with balanced and unbalanced.	K4

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3		3					
CO2	3		3		3		3	
CO3	3		3		3			3
CO4	3							
CO5	3							

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
Experiment 1	Implementation of preprocessing techniques
Experiment 2	Implementation of linear regression
Experiment 3	Implementation of PCA for dimensionality reduction
Experiment 4	Implementation of Decision tree
Experiment 5	Implementation of k-means clustering
Experiment 6	Implementation of k-NN
Experiment 7	Implementation of Multilayer perceptron for classification
Experiment 8	Implementation of Backpropagation algorithm
Experiment 9	Implementation of Gaussian Mixture Model Using the Expectation Maximization
Experiment 10	Comparison of linear regression and decision tree algorithm for the given dataset
Experiment 11	Comparison of kernel functions of Support Vector Machine for the given dataset
Experiment 12	Evaluating machine learning algorithm with balanced and unbalanced datasets

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**45**		**TOTAL**	**60**

BOOK REFERENCES	
1	Machine Learning Laboratory Manual, Al-Ameen Publication 2023.
2	"Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili (Third Edition, 2019).
3	"Machine Learning Yearning" by Andrew Ng (2018).
4	"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron (Second Edition, 2019).
5	"Deep Reinforcement Learning Hands-On" by Maxim Lapan (2018).
6	"Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville (2016).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=Om3jDgsFvgc
2	https://www.youtube.com/playlist?list=PLf0swTFhTI8o5Lb5yw1aDtvVJ8Wo4Lpm-
3	https://www.youtube.com/watch?v=CdMxR_zubfA
4	https://www.youtube.com/watch?v=rTEtEy5o3X0
5	https://www.youtube.com/watch?v=wTF6vzS9fy4

SEMESTER III

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1		Program Elective V	PE	40	60	3	0	0	3
2		Program Elective VI	PE	40	60	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSE									
3	23MC3L1	Dissertation phase I	EEC	40	60	0	0	20	10
Total						**6**	**0**	**20**	**16**

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E.CSE	23MC3E1	PROGRAMMING PARADIGM	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyse the syntax and semantics of programming languages.	K4	1
CO2	Develop and implement the subprogram constructs.	K3	2
CO3	Apply object-oriented, concurrency, and event handling programming constructs.	K3	3
CO4	Analyse the functions in Lambda, LISP with its scheme.	K4	4
CO5	Apply and adopt logic programming along with multi-paradigm languages.	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2		2					
CO2	3		3		3			3
CO3	2		3					
CO4	2		2					
CO5	2		3				2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**SYNTAX AND SEMANTICS AND BASIC STATEMENTS**	**9**
Evolution of programming languages – describing syntax and semantics – lexical analysis – parsing – recursive - decent - bottom up parsing - primitive data types - strings - array types - associative arrays – record types - union types - pointers and references - Arithmetic expressions - relational and Boolean expressions - assignment statements - mixed mode assignments - control structures - selection - iterations - branching -guarded statements.		
Topic - 2	**SUBPROGRAMS AND IMPLEMENTATIONS**	**9**
Subprograms – design issues – local referencing – parameter passing - overloaded methods – generic methods design issues for functions - semantics of call and return - implementing simple subprograms – stack and dynamic local variables – nested subprograms – blocks - dynamic scoping		
Topic - 3	**OBJECT-ORIENTATION, CONCURRENCY AND EVENTHANDLING**	**9**
Object - orientation - design issues for OOP languages - implementation of object - oriented constructs - concurrency - semaphores - monitors - message passing - threads - statement level concurrency – exception handling - even handling.		
Topic - 4	**FUNCTIONAL PROGRAMMING**	**9**
Introduction to lambda calculus - fundamentals of functional programming languages - Programming with Scheme – Introduction to LISP – Lists – Storage allocation for lists – Some useful functions – Error handling.		
Topic - 5	**LOGIC PROGRAMMING**	**9**
Introduction to logic and logic programming – Computing with relations – Programming with Prolog – Data structures in Prolog – Programming techniques – Control in Prolog - Cuts.- multi – paradigm languages.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Robert W.Sebesta, Concepts of Programming Languages, 12th Edition, Pearson Education, 2019
2	Michael L. Scott, Programming Language Pragmatics, 4th Edition, Morgan Kaufmann, 2016
3	"Programming Language Concepts" by Peter Sestoft (2017).
4	"Programming in Haskell" by Graham Hutton (Second Edition, 2016).
5	W.F.Clocksin and C.S.Mellish, Programming in Prolog : Using the ISO Standard, 5th Edition, Springer
6	"Programming Paradigms" by Peter Van Roy (2019).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=FGufrjzbiZw
2	https://www.youtube.com/watch?v=dAPL7MQGjyM
3	https://www.youtube.com/watch?v=vIW81u6VmPU
4	https://www.youtube.com/watch?v=H5uA6p_pK-Y
5	https://www.youtube.com/watch?v=FGufrjzbiZw

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E.CSE	23MC3E2	DIGITAL IMAGE PROCESSING AND APPLICATIONS	3	0	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify the fourier transforms, histogram processing and spatial filtering.	K2	1
CO2	Apply the techniques for image restoration in spatial filtering and multi-resolutions in wavelets.	K3	2
CO3	Apply the mathematical modeling of morphological operation in image segmentation and patterns in object recognition.	K3	3
CO4	Analyze the image compression standards and image representation techniques.	K4	4
CO5	Apply image processing concepts in remote sensing & monitoring, Medical imaging and video processing.	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2		2					
CO2	3		3		3			3
CO3	3		3		3		3	
CO4	3		3					
CO5	3		3					2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DIGITAL MIAGE FUNDAMENTALS**	**9**
Fundamentals steps in digital image processing - Introduction to fourier transform and discrete fourier transform - Intensity transformation : Basics - Histogram processing: Histogram equalization, Histogram specification, Spatial filtering: Mechanics, correlation and convolution- Smoothing and sharpening spatial filters.		
Topic - 2	**IMAGE RESTORATION AND WAVELETS**	**9**
Model of image degradation / restoration process - Noise models - Restoration in the presence of noise only spatial filtering – Estimating the degradation function – Inverse filtering – Minimum mean square error filtering - Constrained least squares filtering - Geometric mean filter - Wavelets - Sub band coding – Multi resolution expansions.		
Topic - 3	**IMAGE SEGMENTATION AND RECOGNITION**	**9**
Edge detection – Thresholding – Region based segmentation – Morpho logical processing erosion and dilation, Segmentation by morphological watersheds - Use of Motion in Segmentation - Object Recognition : Patterns and Pattern classes – Recognition Based on Decision – Theoretic Methods – Structural methods.		
Topic - 4	**IMAGE COMPRESSION**	**9**
Fundamentals, image compression models, error – free compression, image Compression Standards - Compression methods - Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Representation and Description.		
Topic - 5	**IMAGE PROCESSING APPLICATIONS**	**9**
Remote sensing & monitoring applications - Medical image applications – Video processing applications		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Rafael C Gonzalez, Richard EWoods, Digital Image Processing, 4th Edition, Pearson Education 2018
2	Digital Image Processing, S.Jayaraman, S.Esakkirajan, T.Veerakumar, McGraw Hill Education, 2009. Pvt Ltd, NewDelhi
3	S Sridhar, Digital Image Processing, 2n ded.,Oxford University Press,2016
4	"Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods (Fourth Edition, 2018).
5	"Digital Image Processing: A Signal Processing and Algorithmic Approach" by D. Sundararajan (2019).
6	"Digital Image Processing and Analysis: Applications with MATLAB and CVIPtools" by Scott E. Umbaugh (2018).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=xUCsfKA8bi0
2	https://www.youtube.com/watch?v=Kv1Hiv3ox8I
3	https://www.youtube.com/watch?v=VSeSH8nmdsQ
4	https://www.youtube.com/watch?v=1IOQG_cJG6c
5	https://www.youtube.com/watch?v=s9_G7hCB7JY

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E.CSE	23MC3E3	AGILE METHODOLOGY	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Compare the software project with traditional and agile model based on customer requirements.	K4	1
CO2	Develop the software product using Agile-based methodology.	K3	2
CO3	Plan and execute the iterative software development process based on knowledge management.	K3	3
CO4	Choose the better process between requirement gathering and requirement elicitation techniques.	K3	4
CO5	Develop techniques and tools for improving team collaboration and software quality.	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2							
CO2	3		3		3			3
CO3	3		3		2		2	
CO4	2							
CO5	3		3		3			3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**AGILE METHODOLOGY**	**9**
Theories for Agile Management - Agile Software Development - Traditional Model vs. Agile Model - Classification of Agile Methods - Agile Manifesto and Principles - Agile Project Management - Agile Team Interactions - Ethics in Agile Teams - Agility in Design, Testing - Agile Documentations - Agile Drivers, Capabilities and Values		
Topic - 2	**AGILE PROCESS**	**9**
Lean Production - SCRUM, Crystal, Feature Driven Development – Adaptive Software Development – Extreme Programming : Method Overview - Lifecycle – Work Products, Roles and Practices		
Topic - 3	**AGILITY AND KNOWLEDGE MANAGEMENT**	**9**
Agile Information Systems – Agile Decision Making – EarlS School sof KM – Institutional Knowledge Evolution Cycle - Development, Acquisition, Refinement, Distribution, Deployment , Leveraging - KM in Software Engineering - Managing Software Knowledge - Challenges of Migrating to Agile Methodologies –Agile Knowledge Sharing - Role of Story – Cards – Story – Card Maturity Model (SMM).		
Topic - 4	**AGILITY AND REQUIREMENTS ENGINEERING**	**9**
Impact of Agile Processes in RE- Current Agile Practices - Variance - Overview of RE - Using Agile - Managing - Unstable Requirements - Requirements Elicitation - Agile Requirements Abstraction Model - Requirements Management in Agile Environment, Agile Requirements Prioritization - Agile Requirements Modeling and Generation - Concurrencyin Agile Requirements Generation		
Topic - 5	**AGILITY AND QUALITY ASSURANCE**	**9**
Agile Product Development - Agile Metrics - Feature Driven Development (FDD) - Financial and Production Metrics in FDD - Agile Approach to Quality Assurance - Test Driven Development - Agile Approach in Global Software Development		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Paul VII, Agile : The Complete Overview of Agile Principles and Practices (Agile Product Management),1st Edition, 2016
2	"Agile Metrics in Action: Measuring and Enhancing the Performance of Agile Teams" by Christopher W. H. Davis (2015).
3	"Agile Data Warehousing for the Enterprise: A Guide for Solution Architects and Project Leaders" by Ralph Hughes (2015).
4	"Kanban: Successful Evolutionary Change for Your Technology Business" by David J. Anderson (2020).
5	"Agile Retrospectives: Making Good Teams Great" by Esther Derby and Diana Larsen (2021).
6	"Agile Adoption Patterns: A Roadmap to Organizational Success" by Amr Elssamadisy (2018)

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=KNBHQ0pyaG8
2	https://www.youtube.com/watch?v=8eVXTyIZ1Hs
3	https://www.youtube.com/watch?v=MC3qCcU2vq4
4	https://www.youtube.com/watch?v=8eVXTyIZ1Hs
5	https://www.youtube.com/watch?v=ZZ_vnqvW4DQ

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E.CSE	23MC3E4	MOBILE AND PERVASIVE COMPUTING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Categorize the various mobile computing ideas and best practices to solve practical problems.	K4	1
CO2	Examine the Global System for Mobile Communications and to solve problems for Authentication and Security	K4	2
CO3	Develop the Data Services and Applications for GPRS	K3	3
CO4	Apply pervasive computing techniques in various domains of importance.	K3	4
CO5	Develop the Programming for Pervasive devices.	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3	2	2					
CO2	3	2	2					
CO3	3		3		3			3
CO4	3		3		3		2	
CO5	3		3		3			3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**MOBILE COMPUTING**	**9**
Mobile Computing – Networks – Middleware and Gateways – Developing Mobile Computing Applications – Mobile Computing Architecture: Architecture for Mobile Computing – Three-Tier Architecture – Design Considerations for Mobile Computing		
Topic - 2	**GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS**	**9**
Global System for Mobile Communications – GSM Architecture – GSM Entities - Call Routing in GSM – GSM Addresses and Identifiers – Network Aspects in GSM – GSM Frequency Allocation – Authentication and Security -Mobile Computing through Internet –Mobile Computing through Telephone – Emerging Technologies: - Bluetooth – RFID -Wireless Broadband (WiMax) - Mobile IP		
Topic - 3	**SHORT MESSAGE SERVICE**	**9**
Short Message Service (SMS)- Value Added Services through SMS – GPRS- GPRS and Packet Data Network – GPRS Network Architecture – GPRS Network Operations –Data Services in GPRS- Applications for GPRS – Limitations of GPRS – CDMA and 3G- Spread Spectrum Technology- CDMA Versus GSM – Wireless Data – Third Generation Networks – Applications on 3G		
Topic - 4	**PERVASIVE COMPUTING**	**9**
Pervasive Computing: Past, Present and Future Pervasive Computing - Pervasive Computing Market – m-Business – Application Examples: Retail, Airline check-in and booking – Sales force automation – Health care – Tracking – Car information system – E-mail access via WAP		
Topic - 5	**DEVICE TECHNOLOGY**	**9**
Device Technology: Hardware – Human Machine Interfaces – Biometrics – Mobile OS – Programming for Pervasive devices.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Ashok K.Talukder and Roopa R.Yuvagal, “Mobile Computing”, 2nd Edition, Tata McGraw Hill, 2010.
2	"Mobile and Ubiquitous Systems: Computing, Networking, and Services" by Jadwiga Indulska and Andreas Zimmermann (2016).
3	"Mobile and Pervasive Computing in Construction Management" by Chimay J. Anumba, Heng Li, and Chunlu Liu (2014).
4	"Mobile Computing" by Raj Kamal (2016).
5	"Wireless Communications & Mobile Computing" by Waleed Ejaz and Yousaf Bin Zikria (2019).
6	"Mobile Communications Handbook" by Jerry D. Gibson (2019).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=7wBVejLUjyg
2	https://www.youtube.com/watch?v=IfefQ0Itbik
3	https://www.youtube.com/watch?v=8mou2GDpmwQ&pp=ygUeaW50ZWdyYXRlZCBkZXZpY2UgbWFudWZhY3R1cmVy
4	https://www.youtube.com/watch?v=vOFxdeYK7qI
5	https://www.youtube.com/watch?v=dfRQRbEabz0

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E.CSE	23MC3E5	BIO INFORMATICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Inference the Internet basics and Connecting to internet requirements.	K4	1
CO2	Develop the Biological databases methodology.	K3	2
CO3	Plan and execute the Pairwise Alignment Technique	K3	3
CO4	Choose the better process for Protein identity based on composition	K3	4
CO5	Develop techniques Using PERL to facilitate biological analysis	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	2							
CO2	3		3		3			3
CO3	3		3		2		2	
CO4	2							
CO5	3		3		3			3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION AND NCBI**	**9**
Internet basics; Connecting to internet; Email; FTP; www; The NCBI data model: Introduction, BIOSEQ‟s, BIOSEQsets, SEQ- ANNOT, SEQ- DESCR.		
Topic - 2	**BIOLOGICAL DATABASES**	**9**
Biological databases-primary sequence databases- Composite sequence databases- Secondary databases-composite protein pattern databases-structure classification databases. Genome Information Resources: DNA sequence databases specialized genomic resources, GRAIL, GENSCAN		
Topic - 3	**ALIGNMENT TECHNIQUES**	**9**
Pairwise Alignment Technique: Database searching-algorithms and programs-comparing two sequences- identity and similarity-global and local alignment- pairwise database searching. Multiple sequence Alignment: Goal of multiple sequence alignment-Computational Complexity-Manual methods-Simultaneous methods-Progressive methods Databases of multiple alignment-Secondary database searching-Analysis packages.		
Topic - 4	**PROTEIN ANALYSIS**	**9**
Protein identity based on composition, Motifs and patterns, secondary structure prediction, specialized secondary structures, tertiary structure		
Topic - 5	**INTRODUCTION TO PERL**	**9**
Using PERL to facilitate biological analysis-Strings, numbers, variables-Basic input & output- File handles Conditional Blocks & loops- Pattern matching- Arrays-Hashes.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Understanding Bioinformatics" by Marketa Zvelebil and Jeremy O. Baum (Third Edition, 2018).
2	Andreas D Baxevanis& B F Francis, "Bioinformatics- A practical guide to analysis of Genes &Proteins", John Wiley,
3	"Biological Sequence Analysis Using the SeqAn C++ Library" by Andreas Gogol-Döring (2016).
4	"Bioinformatics: Sequence Alignment and Markov Models" by Kal Renganathan Sharma (2019).
5	S. Ignacimuthu, S. J., “Basic Bioinformatics‟, Narosa Publishing house.
6	"Bioinformatics: From Genomes to Therapies" by Thomas Lengauer (2017).

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=lhU3CzslFqw
2	https://www.youtube.com/watch?v=JmKD5SnQtFE
3	https://www.youtube.com/watch?v=kNjqVZOXYE4
4	https://www.youtube.com/watch?v=W-Ov2cUaYQY
5	https://www.youtube.com/watch?v=p01s2mmsk3o

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E.CSE	23MC3E6	DATA VISUALIZATION TECHNIQUES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyse the different Visualization Technique	K4	1
CO2	Apply the Interaction techniques in information visualization fields	K3	2
CO3	Build the various abstraction mechanisms in multidimensional Visualization	K3	3
CO4	Develop textual method for interactive visual interfaces	K3	4
CO5	Apply the interactive systems in visualization	K3	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)								
Cos	Programme Learning Outcomes (POs)						PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	3							
CO2	3		2				2	
CO3	3		2		2			3
CO4	3		3		3		3	
CO5	3		3		3			2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Other Assessments (Assignment, Quiz, etc.)
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**FOUNDATIONS FOR DATA VISUALIZATION**	**9**
Introduction to Visualization – Visualization stages – Experimental Semiotics based on Perception – Gibson,,s Affordance theory – A Model of Perceptual Processing – Costs and Benefits of Visualization – Types of Data.		
Topic - 2	**COMPUTER VISUALIZATION**	**9**
Non-Computer Visualization – Computer Visualization: Exploring Complex Information Spaces –Fisheye Views – Applications – Comprehensible Fisheye views – Fisheye views for 3D data – Non Linear Magnification – Comparing Visualization of Information Spaces – Abstraction in computer Graphics – Abstraction in user interfaces.		
Topic - 3	**MULTIDIMENSIONAL VISUALIZATION**	**9**
1D, 2D, 3D – Multiple Dimensions – Trees – Web Works – Data Mapping: Document Visualization – Workspaces.		
Topic - 4	**TEXTUAL METHODS OF ABSTRACTION**	**9**
From Graphics to Pure Text – Figure Captions in Visual Interfaces – Interactive 3D illustrations with images and text – Related work –Consistency of rendered – images and their textual labels – Architecture – Zoom techniques for illustration purpose – Interactive handling of images and text.		
Topic - 5	**ABSTRACTION IN TIME AND INTERACTIVE SYSTEMS**	**9**
Animating non Photo realistic Computer Graphics – Interaction Facilities and High Level Support for Animation Design – Zoom Navigation in User Interfaces – Interactive Medical Illustrations – Rendering Gestural Expressions – Animating design for Simulation – Tactile Maps for Blind People – Synthetic holography – Abstraction Versus Realism– Integrating Spatial and Non Spatial Data.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	. "Interactive Data Visualization for the Web: An Introduction to Designing with D3" by Scott Murray (2017).
2	"Data Visualization: A Practical Introduction" by Kieran Healy (2018).
3	"Data Visualization Made Simple: Insights into Becoming Visual" by Kristen Sosulski (2018).
4	"The Truthful Art: Data, Charts, and Maps for Communication" by Alberto Cairo (2016).
5	"Effective Data Visualization: The Right Chart for the Right Data" by Stephanie D. H. Evergreen (2016).
6	"The Visual Display of Quantitative Information" by Edward R. Tufte

OTHER REFERENCES	
1	http://www.ornl.gov/info/ornlreview/v30n3-4/visual.htm
2	http://www.silvalifesystem.com/articles/visualization-techniques/
3	http://www.ulb.tu-darmstadt.de/tocs/5943970X.pdf
4	https://www.youtube.com/watch?v=NOIfMY0KajE
5	https://www.youtube.com/watch?v=f79bJTZSAqc

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E.CSE	23MC3L1	DISSERTATION PHASE I	0	0	20	10

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Examine a real world problem, identify the requirement and develop the design solutions.	K4
CO2	Identify the technical ideas, strategies and methodologies.	K3
CO3	Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.	K3
CO4	Test and validate through conformance of the developed prototype and analysis the cost effectiveness.	K4
CO5	Plan report and present oral demonstrations.	K3

COURSE CONTENT

Continuous Assessment :

Review I

Identification of topic and Justification

Literature Survey

Review II

Work plan & Approach

Progress, Results and Discussion

Review III

Conclusion

Implementation & Applications

End Semester Examination

Presentation

Report

Viva Voce

TOTAL 300 Hours

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
EMPLOYABILITY ENHANCEMENT COURSE									
1	23MC4L1	Dissertation Phase II	EEC	40	60	0	0	28	14
Total						**0**	**0**	**28**	**14**

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	M.E.CSE	23MC4L1	DISSERTATION PHASE II	0	0	28	14

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Examine a real world problem, identify the requirement and develop the design solutions.	K4
CO2	Identify the technical ideas, strategies and methodologies.	K3
CO3	Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.	K3
CO4	Test and validate through conformance of the developed prototype and analysis the cost effectiveness.	K4
CO5	Plan report and present oral demonstrations.	K3

COURSE CONTENT
Continuous Assessment : **Review I** Work plan & Approach **Review II** Progress Results and Discussion **Review III** Conclusion Implementation & Applications **End Semester Examination** Presentation Report Viva Voce
TOTAL 420 Hours

CREDIT SUMMARY

Sl. No.	Subject Area	Credits per Semester				Total Credits
		I	II	III	IV	
1	**HS**	3				**3**
2	**BS**	3				**3**
3	**PC**	7	10			**17**
4	**PE**	6	6	6		**18**
5	**EEC**			10	14	**24**
6	**AC**		3			**3**
TOTAL		**19**	**19**	**16**	**14**	**68**

Total Credit: 68

HS – Humanities and Social Sciences including Management
BS– Basic Sciences
PC– Professional Core
PE– Professional Electives
EEC– Employability Enhancement Courses
AC– Audit Courses