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 2020)

CHOICE BASED CREDIT SYSTEM

M.E. Computer Science and Engineering

Applicable to the Students admitted in the AY 2020-21 only

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									
1	20MC1T1	Mathematical Foundations For Computer Science	FC	50	50	3	1	0	4
2	20MC1T2	Advanced Data Structures and Algorithms	PC	50	50	3	0	0	3
3	20MC1T3	Research Methodology and IPR	PC	50	50	3	1	0	4
4	20MC1E1 TO 20MC1E3	Professional Elective – I	PE	50	50	3	0	0	3
5	20MC1E4 TO 20MC1E6	Professional Elective – II	PE	50	50	3	0	0	3
LABORATORY									
6	20MC1L1	Data Structures and Algorithms Laboratory	PC	50	50	0	0	3	1.5
7	20MC1L2	Networks Laboratory	PC	50	50	0	0	3	1.5
8	20MC1L3	Research Paper Writing	MC	100	--	2	0	0	0
Total						**17**	**2**	**6**	**20**

SEMESTER II

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY									
1	20MC2T1	Data Management and Analytics	PC	50	50	3	1	0	4
2	20MC2T2	Object Oriented Software Engineering	PC	50	50	3	0	0	3
3	20MC2T3	Modern Operating Systems	PC	50	50	3	0	0	3
4	20MC2E1 TO 20MC2E3	Professional Elective – III	PE	50	50	3	0	0	3
5	20MC2E4 TO 20MC2E6	Professional Elective – IV	PE	50	50	3	0	0	3
LABORATORY									
6	20MC2L1	Data Management and Analytics Laboratory	PC	50	50	0	0	3	1.5
7	20MC2L2	Mini Project with Seminar	EEC	50	50	0	0	3	1.5
8	20MC2L3	Teaching and Learning in Engineering	MC	100	--	2	0	0	0
Total						**17**	**1**	**6**	**19**

SEMESTER III

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY									
1	20MC3E1 TO 20MC3E3	Professional Elective - V	PE	50	50	3	0	0	3
2	20MC3E4 TO 20MC3E6	Professional Elective - VI	PE	50	50	3	0	0	3
LABORATORY									
3	20MC3L1	Project Work Phase I / Industry Project	EEC	50	50	0	0	20	10
Total						**6**	**0**	**20**	**16**

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
LABORATORY									
1	20MC4L1	Project Work Phase II / Industry Project	EEC	50	50	0	0	30	15
Total						**0**	**0**	**30**	**15**

FUNDAMENTAL COURSE (FC)

Sl.No.	Course Code	Course Title	L	T	P	C
1.	20MA1T2	Mathematical Foundations For Computer Science	3	1	0	4

PROFESSIONAL CORE (PC)

Sl.No.	Course Code	Course Title	L	T	P	C
1.	20MC1T2	Advanced Data Structures and Algorithms	3	0	0	3
2.	20MCIT3	Research Methodology and IPR	3	1	0	4
3.	20MC1L1	Data Structures and Algorithms Laboratory	0	0	3	1.5
4.	20MC1L2	Networks Laboratory	0	0	3	1.5
5.	20MC2T1	Data Management and Analytics	3	1	0	4
6.	20MC2T2	Object Oriented Software Engineering	3	0	0	3
7.	20MC2T3	Modern Operating Systems	3	0	0	3
8.	20MC2L1	Data Management and Analytics Laboratory	0	0	3	1.5

PROFESSIONAL ELECTIVES (PE)

Semester I (Elective I)						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20MC1E1	Human Computer Interaction	3	0	0	3
2	20MC1E2	Advanced Compiler Design	3	0	0	3
3	20MC1E3	Artificial Intelligence and Machine Learning	3	0	0	3

Semester I (Elective II)						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20MC1E4	Network Design and Management	3	0	0	3
2	20MC1E5	Soft Computing Techniques	3	0	0	3
3	20MC1E6	Data Science	3	0	0	3

Semester II (Elective III)						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20MC2E1	Cloud Computing and IOT	3	0	0	3
2	20MC2E2	Parallel Computing	3	0	0	3
3	20MC2E3	Software Quality Assurance	3	0	0	3

Semester II (Elective IV)						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20MC2E4	Security in computing	3	0	0	3
2	20MC2E5	Software Project Management	3	0	0	3
3	20MC2E6	Software Defined Networks	3	0	0	3

Semester III (Elective V)						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20MC3E1	Information Retrieval	3	0	0	3
2	20MC3E2	Machine Learning Techniques	3	0	0	3
3	20MC3E3	Cyber Security	3	0	0	3

Semester III (Elective VI)						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20MC3E4	Big Data Analytics Tools	3	0	0	3
2	20MC3E5	Internet of Things	3	0	0	3
3	20MC3E6	Digital Forensics	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	20MC2L2	Mini Project with Seminar	0	0	3	1.5
2.	20MC3L1	Project Work Phase I / Industry Project	0	0	20	10
3.	20MC4L1	Project Work Phase II / Industry Project	0	0	30	15

MANDATORY COURSES

Sl. No.	Course Code	Course Title	L	T	P	C
1.	20MC1T3	Research Paper Writing	2	0	0	0
2.	20MC2L3	Teaching and Learning in Engineering	2	0	0	0

CURRICULUM BREAKDOWN STRUCTURE

Subject	Total number of credits	% of Credits
Fundamental Course (FC)	**4**	**5.71**
Professional Core (PC)	**21.5**	**30.72**
Professional Electives (PE)	**18**	**25.71**
Employability Enhancement Courses (EEC)– Practical Courses and Project Work	**26.5**	**37.86**
Total	**70**	**100**

CREDIT SUMMARY

Sl. No.	Subject Area	Credits per Semester				Total Credits
		I	II	III	IV	
1	**HS**					
2	**FC**	4				4
3	**PC**	10	11.5			21.5
4	**PE**	6	6	6		18
5	**EEC**		1.5	10	15	26.5
6	**MC**	-	-			
TOTAL		**20**	**19**	**16**	**15**	**70**

CURRICULUM

SEMESTER I

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY									
1	20MC1T1	Mathematical Foundations For Computer Science	FC	50	50	3	1	0	4
2	20MC1T2	Advanced Data Structures and Algorithms	PC	50	50	3	0	0	3
3	20MC1T3	Research Methodology and IPR	PC	50	50	3	1	0	4
4	20MC1E1 TO 20MC1E3	Professional Elective – I	PE	50	50	3	0	0	3
5	20MC1E4 TO 20MC1E6	Professional Elective – II	PE	50	50	3	0	0	3
PRACTICAL									
6	20MC1L1	Data Structures and Algorithms Laboratory	PC	50	50	0	0	3	1.5
7	20MC1L2	Networks Laboratory	PC	50	50	0	0	3	1.5
8	20MC1L3	Research Paper Writing	MC	100	--	2	0	0	0
Total						**17**	**2**	**6**	**20**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	20MC1T1	MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Interpret the concept of random variables, queuing models, testing of hypothesis and correlation and regression for applying the interpretations in selection and use of appropriate mathematical techniques	K2	1,2,3,4,5
CO2	Analyse the basic characteristic features of a queuing system and acquire skills in analyzing queuing models	K4	2,3
CO3	Relate and apply the concept of probability and random variables and predict probabilities of events in models following normal distribution.	K3	1
CO4	Compute correlation between variables, and predict unknown values using regression.	K3	5
CO5	Justify the concept of testing of hypothesis for small and large samples and interpret the results.	K5	4
CO6	Analyse the situation and select an appropriate queuing model techniques for solving problems based on Little's formula.	K4	2,3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 Weak, 2 Medium, 3 Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	2	2	3	3										2
CO3	2		3	3										2
CO4			3	3										2
CO5														2
CO6														

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**RANDOM VARIABLES**	**9+3**
Random variables - Binomial, Geometric, Poisson, Uniform, Exponential, Erlang and Normal distributions - Functions of a Random variable - Moments and Moment generating function		
Topic - 2	**MARKOVIAN QUEUEING MODELS**	**9+3**
Markovian models - Birth and Death Queuing models - steady state results: Single and multiple server queuing models - queue with finite waiting rooms - Finite source - Finite source models - Little's formula		
Topic - 3	**NON MORKOVIAN QUEUES AND QUEUES NETWORKS**	**9+3**
Markovian models - Birth and Death Queuing models - steady state results: Single and multiple server queuing models - queue with finite waiting rooms - Finite source - Finite source models - Little's formula.		
Topic - 4	**TESTING OF HYPOTHESIS**	**9+3**
Sampling distributions – Estimation of parameters- Statistical hypothesis - Tests based on Normal, t, Chi Square and F distributions for mean, variance and proportion		
Topic - 5	**CORRELATION AND REGRESSION ANALYSIS**	**9+3**
Coefficient of correlation – rank correlation – regression lines – Multiple and Partial Correlation– Partial regression - regression planes (Problems only).		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Veerarajan T, ―Probability and Random Processes (with Queuing Theory and Queuing Networks)‖, Fourth Edition ,McGraw Hill Education(India) PvtLtd., New Delhi, 2016.
2	Medhi J, ―Introduction to Queuing Systems and applications‖, 1st edition, New Age International (P) Ltd, New Delhi, 2015.
3	Gross D and Harris C. M, ―Fundamentals of Queuing theory‖, John Wiley and Sons,New York, 1998
4	Gupta S.C and Kapoor V.K, ―Fundamentals of Mathematical Statistics‖, Chand & Sons, New Delhi, 2015
5	Kandasamy P, Thilagavathy K and Gunavathy K, ―Probability and Queuing Theory‖,S. Chand & Co, Ramnagar, New Delhi, Reprint 2013

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**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	20MC1T2	ADVANCED DATA STRUCTURES AND ALGORITHMS	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 various basic of data structures.	K2	3,4,5
CO2	Justify various sorting, searching and basic operations on Tree & Graph.	K5	2
CO3	Classify variety of advanced Abstract Data Type (ADT) & Hashing technique.	K4	3,4,5
CO4	Compare AVL tree, splay tree, B tree and B+ trees.	K2	5
CO5	Apply fundamental algorithms and data structures to real - world problems.	K3	1

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	Group Presentation & Cooperative Learning Report
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Role of Algorithms in Computing – Analysing algorithms – Designing algorithms – Growth of functions – Divide and Conquer – Probabilistic analysis – Randomized algorithms		
Topic - 2	**SORTING AND SEARCHING**	**9**
Searching - Linear and Binary Search Methods. Sorting - Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort. Trees - Binary trees, Properties, Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix). Graphs - Basic Concepts, Storage Structures and Traversals.		
Topic - 3	**STACK AND HASHING**	**9**
Dictionaries, ADT, The List ADT, Stack ADT, Queue ADT, Hash Table Representation, Hash Functions, Collision Resolution –Separate Chaining, Open Addressing-Linear Probing, Double Hashing.		
Topic - 4	**QUEUES And HEAPS**	**9**
Priority queues - Definition, ADT, Realising a Priority Queue Using Heaps, Definition, Insertion and Deletion.		
Topic - 5	**TREES**	**9**
Search Trees – Binary Search Trees, Definition, ADT, Implementation, Operations - Searching, Insertion, Deletion.		

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

BOOK REFERENCES	
1	Mark Allen Weiss, ―Data Structures and Algorithm Analysis‖ 2/e,Pearson.
2	Adam Drozdek, ―Data Structures and Algorithms‖ 3/e, ,Cengage.
3	N.B.Venkateswarulu, E. V. Prasad, S Chand & Co, C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples‖,2009

OTHER REFERENCES	
1	**https://www.youtube.com/watch?v=8hly31xKli0**
2	**https://www.youtube.com/watch?v=bum_19loj9A**
3	**https://www.youtube.com/watch?v=5_5oE5lgrhw**
4	**https://www.youtube.com/watch?v=92S4zgXN17o**
5	**https://www.youtube.com/watch?v=4RLhuZ3N9nc**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	20MC1T3	RESEARCH METHODOLOGY AND IPR	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Compare and formulation of research concepts.	K2	1
CO2	Analyze statistical and other research tools to interpret data.	K4	2,3
CO3	Illustrate plagiarism and follow research ethics & Statistics	K.2	4,3
CO4	Estimate that when IPR would take such important place in growth of individuals & nation	K6	4,5
CO5	Analyze that IPR protection provides an incentive to inventors for further research work and investment in R & D	K4	4,5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	Group Presentation & Cooperative Learning Report
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO RESEARCH METHODS**	**9 + 3**
Definition and Objectives of Research, Scientific Methods, Various Steps in Scientific Research, Research planning, Selection of a Problem for Research, Formulation of the Selected Problems, Purpose of the Research, Formulation of research objectives, Formulation of research questions, Hypotheses Generation and Evaluation, Literature search, and review, Research abstract		
Topic - 2	**INTRODUCTION TO STATISTICS**	**9+3**
Population and Sample, Sampling and sample size, Population Proportion and Population Mean, Sample Proportion and Sample Mean, Estimation of Standard Error and confidence Interval, Identifying the dependent and independent variables, Introduction to data, Types of data and their importance, Descriptive Statistics and Inferential Statistics, Summarizing and describing data, Measures of Central Tendency and Measures of Dispersion, Mean, Median, Mode, Range, Variance, Standard Deviation		
Topic - 3	**STATISTICAL MODELING AND ANALYSIS**	**9+3**
Probability Distributions, Normal, Binomial, Poisson, Fundamentals of Statistical Analysis and Inference, Hypothesis Testing, Confidence interval, Test of Significance, Comparison of Means (T test, Z test), Analysis of variance (ANOVA), Measures of association/Relationship, Chi-square test, Simple Regression Analysis, Multiple Regression analysis, Correlation, Data visualization techniques		
Topic - 4	**RESEARCH DESIGN/PLAN**	**9+3**
Types and Methods of Research, Classification of Research, Research Ethics, Sampling Techniques, Methods of Collecting Primary Data, Use of Secondary Data, Experimentation, Design of Experiments, Survey Research and Construction of Questionnaires, Pilot Studies and Pre-tests, Data Collection methods, Processing of Data, Editing, Classification and Coding, Transcription, Tabulation, Validity and Reliability,.		
Topic - 5	**RESEARCH REPORTS**	**9+3**
Structure and Components of Research Report/thesis, Types of Report, Planning of Report/thesis Writing, Research Report Format, Layout of Research Report, Presentation of data and Data Analysis Reporting, Mechanism of writing a research report, Principles of Writing, Writing of Report		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	C.R. Kothari, Research Methodology Methods and Techniques, 3/e, New Age International Publishers, 2014. 2. Ranjit Kumar, Research Methodology A Step
2	Ranjit Kumar, Research Methodology A Step-by-Step Guide for Beginners, 4th Edition, Sage Publishing, 2014
3	R. Pannerselvam, Research Methodology, 2nd edition, Prentice Hall India, 2014
OTHER REFERENCES	
1	**https://www.youtube.com/watch?v=GSeeyJVD0JU**
2	**https://www.youtube.com/watch?v=EVcPmmfK1Do**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	20MC1E1	HUMAN COMPUTER INTERACTION	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 principles and guidelines of HCI for developing effective user interaction	K2	1
CO2	Applying the concepts of Information architecture and User Interface foF Mobile UI	K3	2
CO3	Applying the collections and control flows in mobile based programming	K3	3,4
CO4	Analyzing advanced programming concepts in mobile application Development	K4	5
CO5	Analyzing research directions in computer interaction for real time Applications	K4	1,2,5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	Group Presentation & Cooperative Learning Report
	4	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**DESIGN OF HCI**	**7**
Principles of HCI - HCI Guidelines - HCI Design - User Interface Layer - User Interface Evaluation.		
Topic - 2	**MOBILE HCI**	**8**
Mobile Ecosystem -Mobile Applications -Mobile Information Architecture (MIA) - Mobile Design Elements –Mobile User Interface Building and Advances - Universal Design - Best Practices in MobileUI.		
Topic - 3	**MOBILE PROGRAMMING**	**10**
Basic Operators -Strings & Characters - Collection Types - Control Flow - Functions - Closures - Enumerations.		
Topic - 4	**ADVANCED CONTROLS**	**10**
Classes & Structures - Properties - Methods - Subscripts - Inheritance - Initialization - De - initialization - Automatic Reference Counting - Error Handling.		
Topic - 5	**APPLICATIONS**	**10**
Speech and Language interfaces and Technologies - Multimedia User Interface Design - Multimodal interfaces - Decision - Support Systems - Online Communities - Privacy, Security, and Trust.		

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

BOOK REFERENCES	
1	Gerard JounghyunKim,—HumanComputerInteraction:FundamentalsandPractice‖,CRC Press,2015.
2	Brian Fling, "Mobile Design and Development‖, O'Reilly Media Inc., 2009.
4	—The Swift Programming Language -Swift3.0.1",AppleInc –Swift Programming series, 2016.

OTHER REFERENCES	
1	**https://youtu.be/v_Yhk1U94k**
2	**https://youtu.be/SoTLNrkDN4U**
3	**https://youtu.be/fis26HvvDII**
4	**https://youtu.be/SD9KnFsVKsQ**
5	**https://youtu.be/oGZCYnlDFtQ**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	20MC1E2	ADVANCED COMPILER DESIGN	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	Explain the working of various phases of the compiler and the specification and recognition of language tokens	K2	1,2,3
CO2	Applying Construct top - down and bottom - up parsers for simple grammars	K3	2
CO3	Applying the Syntax directed translation schemes for the generation of intermediate code	K3	3
CO4	Deploy run time memory management and code generation techniques	K4	4
CO5	Apply optimization strategies to improve the code generated by Compilers	K4	5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	Group Presentation & Cooperative Learning Report
	4	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**LEXICAL ANALYSIS**	**9**
Grammars and Languages - Structure of the Compiler - Applications of Compiler Technology. Lexical Analysis: Input Buffering - Specification of Tokens - Recognition of Tokens - Finite automata - Regular expression to finite automaton - Optimization of DFA based pattern matchers - Lexical Analyzer Generator - LEX.		
Topic - 2	**SYNTAX ANALYSIS**	**9**
Role of a parser - Context - free grammars - Top - down parsing - Bottom - up parsing - LR parser - Introduction to language for specifying parser - YACC - Implementation of parser using YACC.		
Topic - 3	**SYNTAX DIRECTED TRANSLATION&INTERMEDIATECODEGENERATION**	**9**
Syntax Directed Translation: Syntax - direct definitions - Evaluation Order - Applications and Schemes. Intermediate Code Generation: Intermediate languages - Types and Declarations - Expressions - Type - Checking - Control Flow - Back patching - Switch statements Procedures		
Topic - 4	**CODE GENERATION**	**9**
Run time Environments: Storage Organization- Stack Allocation- Access to Non local Data- Heap Management- Introduction to Garbage Collection Code Generation: Issues in Designing a codegenerator- Target machine- Basic blocks and flow graphs - Next use Information- A Simple code generator- Register allocation and assignment- Peephole Optimization.		
Topic - 5	**CODE OPTIMIZATION**	**9**
Principal sources of optimization - Data Flow Analysis - Optimizing for Parallelism and Locality - Matrix Multiplication - Iteration Spaces - Affine Array Indexes - Data Reuse - Array Data - Dependence Analysis - Finding Synchronization free parallelism.		

THEORY	45		TUTORIAL	0		PRACTICAL	0		TOTAL	45

BOOK REFERENCES	
1	Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, —Compilers – Principles, Techniques and Tools‖, Second Edition, Addison - Wesley, 2006.
2	Kenneth.C.Louden,—Compiler Construction Principles and Practice Practice‖, Vikas publishing House, 2003.
3	Andrew.W.AppeI, —Modern Compiler Implementation in Java‖, Second Edition, Cambridge University Press,2002.

OTHER REFERENCES	
1	**https://youtu.be/PT9iWM80PDU**
2	**https://youtu.be/6j73Z6-X3BM**
3	**https://youtu.be/by7yPDu_JDA**
4	**https://youtu.be/W0068fRJTGQ**
5	**https://youtu.be/3SjQ9WRmI4M**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	20MC1E3	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	Demonstrate the awareness of intelligent agents and problem solving using different search algorithms	K2	1
CO2	Apply the use of different knowledge representation methods.	K3	2
CO3	Evaluate the use of uncertain knowledge for planning in AI applications	K5	3
CO4	Differentiate between supervised, unsupervised, semi-supervised machine learning approaches.	K4	4
CO5	Analyzing tree algorithm and overcome the problem of Over fitting	K4	5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	Group Presentation & Cooperative Learning Report
	4	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION AND PROBLEM SOLVING**	**10**
Intelligent Agents. Forward and backward - state-space - blind – heuristic - problem-reduction - A, A*,AO* - minimax - constraint propagation – neural - stochastic and evolutionary search algorithms		
Topic - 2	**KNOWLEDGE REPRESENTATION AND REASONING**	**9**
Ontologies - foundations of knowledge representation and reasoning - representing and reasoning about objects - relations - events–actions - time and space - predicate logic -situation calculus - description logics - reasoning with defaults - reasoning about knowledge		
Topic - 3	**PLANNING& REASONING WITH UNCERTAIN KNOWLEDGE**	**9**
Planning as search - partial order planning - construction and use of planning graphs – probability - connection to logic – independence Bayes rule - Bayesian networks- probabilistic inference		
Topic - 4	**LEARNING PROBLEMS**	**10**
Learning Problems–Perspectives and Issues–Concept Learning –Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm– Heuristic Space Search		
Topic - 5	**NEURAL NETWORKS AND GENETIC ALGORITHMS**	**7**
Neural Network Representation – Problems – Perceptron's – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.		

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

BOOK REFERENCES	
1	Stuart Russell, Peter Norvig, —Artificial Intelligence –A Modern Approach‖, 3rd Edition, Pearson Education / Prentice Hall of India,2015.
2	Judith Hurwitz, Marcia Kaufman, —Cognitive Computing and Big Data Analytics‖, Wiley Publication, April2015
3	Elaine Rich, Kevin Knight, Shiva shankar B.Nair, Artificial Intelligence ,‖ Tata McGraw Hill Publishing Company Limited. Third Edition ,2009
4	Kevin P. Murphy , Machine Learning A Probabilistic Perspective, The MITPress,2012
5	Jason Bell, —Machine learning – Hands on for Developers and Technical Professionals, First Edition, Wiley,2014

OTHER REFERENCES	
1	**https://youtu.be/_D8Os_m1gxQ**
2	**https://youtu.be/ZIuWSWbSoJE**
3	**https://youtu.be/TK7ORfbT5UI**
4	**https://youtu.be/4dwsSz_fNSQ**
5	**https://youtu.be/_syf8H9-Pg**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	20MC1E4	NETWORK DESIGN AND 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	Differentiate the working of various TCP congestion control techniques in wired and wireless networks.	K3	1
CO2	Design wired and wireless network with suitable IP addressing using appropriate routing protocol.	K3	2,3
CO3	Compare the performance of a network after applying virtualization concepts and network management protocols.	K4	3
CO4	Analyze various stools and advanced queuing policies used for improving quality of service in a network.	K4	4,5
CO5	Analyze the quality of service offered in various real time applications.	K4	4,5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments, Presentation, Journal Paper Review, Poster Preparation
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**RELIABLE SERVICES**	**9**
Packet Switched Network –Congestion Issues and TCP –Managing Congestion - Measuring Network Congestion –Source Based Congestion Control Mechanisms –Congestion Control for Wireless and Multimedia Networks.		
Topic - 2	**INTERNETWORKING**	**9**
Internet Addressing -IPv4 and lPv6 Addressing scheme - lPv6 Transition - Datagram Delivery - Error and Control Messages: ICMPv6 - DHCP - Routing Protocols: Distance Vector, Link State Routing - Mobility and Mobile IP.		
Topic - 3	**VIRTUALIZATION AND MANAGEMENT**	**9**
Network Virtualization - Virtual Private Networks - Tunneling and Encapsulation - Network Address Translation - Overlay Networks - Software Defined Networks - Architecture - Open flow Technology. Network Management -Architecture - MIB for lPv6 - SNMP and Security.		
Topic - 4	**QUEUING AND SCHEDULING**	**9**
QoS Tools -Challenges - Classifiers - Policing and Shaping - Queuing and Scheduling - Queuing Disciplines - Advanced Queuing Concepts - Random Early Discard.		
Topic - 5	**QUALITY OF SERVICE**	**9**
Case Studies –QoS in Virtual Private LAN Service: Classes of Service – Admission Control – Queues and Schedules; QoS in Data Center –Traffic Model – uses of Congestion; IPRAN and Mobile Backhaul QoS – Network Components and Traffic in 2G/3G and Networks.		

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

BOOK REFERENCES	
1	Christos N Houmkozlis, George A Rovithakis,– End - to – End Adaptive Congestion Control in TCP/IP Networks‖, CRC Press,2012.
2	Douglas E. Comer, —Internetworking with TCP/IP: Principles, Protocol and Architecture Volume I‖, 6th Edition, Pearson Education, 2014.
3	Miguel Barreiros, Peter Lundqvist, —QoS Enabled Networks: Tools and Foundations‖, 2nd Edition, John Wiley & Sons, 2016.
4	James F.Kurose, KeithW.Ross,— Computer Networking –A top down Approach Featuring the Internet‖, 7*^ Edition, Pearson Education,2016.

OTHER REFERENCES	
1	**https://www.bitpipe.com/data/tlist?b=ka_bp_netmgmt**
2	**https://link.springer.com/chapter/10.1007/978-1-4899-1298-5_38**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	20MC1E5	SOFT COMPUTING 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	Describe the concept of Soft Computing for building intelligent systems	K2	1
CO2	Apply the fuzzy logic and reasoning approaches to solve various engineering Problems.	K3	2,5
CO3	Analyze various learning techniques and architectures using Neural Network.	K4	3,5
CO4	Describe the generic scheme of evolutionary algorithm for problem - Solving.	K2	4,5
CO5	Develop hybrid intelligent systems for solving optimization 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	PSO1	PSO2
CO1	2		3			
CO2		2		2		2
CO3		2		2		
CO4	2		3		2	
CO5	2	2		3	3	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments, Presentation, Journal Paper Review, Poster Preparation
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO SOFT COMPUTING**	**9**
Intelligent system - Knowledge based system - Experts system - Knowledge representation processing - Soft computing - Machine Learning basics.		
Topic - 2	**FUZZY LOGIC**	**9**
Fundamentals of Fuzzy logic system - Fuzzy set - Fuzzy operation -Fuzzy resolution Fuzzy relations - Composition and inference - Fuzzy Decision Making - Fuzzy logic control.		
Topic - 3	**NEURAL NETWORK**	**9**
Machine Learning Using Neural Network, Adaptive Networks - Feed forward Networks Supervised Learning Neural Networks - Reinforcement Learning - Unsupervised Learning Neural Networks - Adaptive Resonance architectures - Advances in Neural networks.		
Topic - 4	**EVOLUTIONARY COMPUTING**	**9**
Evolutionary Computing: The Origins -Evolutionary Algorithm - Components of Evolutionary Algorithms - Representation, Mutation, and Recombination. - Fitness, Selection, and Population Management - Popular Evolutionary Algorithm.		
Topic - 5	**GENETIC ALGORITHM**	**9**
Genetic algorithm and Optimization - Genetic algorithm operators - Integration of genetic algorithm with Neural network & Fuzzy logic - Applications.		

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

BOOK REFERENCES	
1	Jyh – Shing Roger Jang,Chuen - TsaiSun, Eiji Mizutani,—Neuro – Fuzzy and Soft Computing‖, Prentice - Hall of India,2003.
2	Timothy J. Ross, —Fuzzy Logic with Engineering Third Edition, Wiley, 2010.
3	Simon Haykin, —Neural Networks and Learning Third Edition, Prentice Hall, 2009.
4	Fakhreddine O. Karray, —Soft Computing and Intelligent Systems Design: Theory, Tools and Applications‖, Pearson Education India, 2004.
5	A.E.EibenJ.E.Smith,—IntroductiontoEvolutionaryComputing‖,NaturalComputingSeries, Springer, New York,2015.

OTHER REFERENCES	
1	**https://www.sciencedirect.com/topics/computer-science/soft-computing-technique**
2	**https://www.javatpoint.com/what-is-soft-computing**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	20MC1E6	DATA SCIENCE	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	Explore the fundamental concepts of data science.	K4	1
CO2	Understand data analysis techniques for applications handling large data.	K2	2
CO3	Understand various machine learning algorithms used in data science process.	K2	3
CO4	Learn to think through the ethics surrounding privacy, data sharing and algorithmic decision-making of deep learning	K4	4
CO5	Visualize and present the inference of using various development tools.	K3	5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments, Presentation, Journal Paper Review, Poster Preparation
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO DATA SCIENCE**	**9**
Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Who is Data Scientist? - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation		
Topic - 2	**BIG DATA**	**9**
Problems when handling large data – General techniques for handling large data – Case study – Steps in big data – Distributing data storage and processing with Frameworks – Case study.		
Topic - 3	**MACHINE LEARNING**	**9**
Machine learning – Modeling Process – Training model – Validating model – Predicting new observations –Supervised learning algorithms – Unsupervised learning algorithms.		
Topic - 4	**DEEP LEARNING**	**9**
Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs –Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Application.		
Topic - 5	**DATA VISUALIZATION**	**9**
Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools – Creating an interactive dashboard with dc.js-summary		

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

BOOK REFERENCES	
1	Siamak —Software Defined Networking with Open Flow, Packet Publishing, 2013.
2	VivekTiwari, —SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc.2013.
3	Fei Hu, Editor, —Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

OTHER REFERENCES	
1	**https://ischoolonline.berkeley.edu/data-science/what-is-data-science/**
2	**https://builtin.com/data-science**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	M.E. CSE	20MC1L1	DATA STRUCTURES AND ALGORITHMS LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Construct Various operations of Balanced Tree Structures.	K3	2,4
CO2	Estimate Appropriate data structures to perform efficient search on spatial data.	K5	1,3
CO3	Analyze suitable algorithm to perform search on string data.	K4	9,10
CO4	Solve Graph based problem using suitable algorithm design technique.	K5	7,8
CO5	Solve Optimization Problem using randomized and approximation algorithms.	K3	5,6

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Lab Record
	2	Lab Manual
	3	End Semester Examinations
INDIRECT	1	Course End Survey

LIST OF EXPERIMENTS	
1	Implementation of recursion for Problem Solving
2	Implementation of AVL Trees
3	Implementation of Treap
4	Implementation of K - d Trees
5	Implementation of Travelling Sales man Problem
6	Implementation of Vector Cover Problem
7	Implementation of minimum spanning tree construction using randomized algorithm
8	Implementation of approximation algorithm for 0 / 1 knapsack problem
9	Implementation of Tries
10	Implementation of String Matching Algorithms problem solving using suitable

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	Mrs.S.M.Karpagavalli Data Structures and Algorithms Laboratory Manual, Al - Ameen Publications, 2020
2	Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
3	Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.

OTHER REFERENCES	
1	**https://mrcet.com/pdf/Lab%20Manuals/CSE/DATA%20STRUCTURES%20LAB.pdf**
2	**https://www.iare.ac.in/sites/default/files/lab1/IARE_DS_Lab_Manual.pdf**
3	**https://www.srmvalliammai.ac.in/qb/IT/III%20Semester/1908305ata%20Structures%20Lab%20Manual.pdf**
4	**http://users.utcluj.ro/~jim/DSA/Resources/LabCode/DSALab.pdf**
5	**https://www.ctae.ac.in/images/editorFiles/file/Lab%20Solutions%20of%20CSE_IT/Data%20Structure**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	ME-CSE	20MC1L2	NETWORKS LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Design network applications using appropriate socket programming.	K6	1-10
CO2	Design IP LAN and WAN Network using subnetting and IP address configuration.	K6	4
CO3	Implement Routing Protocol and Congestion Control Techniques in multi Router networks.	K4	3,6
CO4	Implement network virtualization and management protocols using simulation tools.	K4	7,8
CO5	Apply Queuing and Scheduling policies to provide Quality of Service.	K3	9

PRE-REQUISITE	NIL

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

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

LIST OF EXPERIMENTS	
1	Application Developing Using Socket Programming
2	Performance analysis of Transport layer protocols
3	Implementation of Congestion control algorithms
4	Design local area network with IP address Configuration
5	Design Multi router network and testing using simulation tools.
6	Implementation of Routing Protocols
7	Design of Network Virtualization using simulation tools
8	Demonstration of network management using SNMP
9	Implementation of Queuing and Scheduling Policies
10	Analysis of LAN traffic using simulation tools

THEORY	0		TUTORIAL	0		PRACTICAL	30		TOTAL	30

BOOK REFERENCES	
1	Networks Laboratory, Al-Ameen Publications 2020

OTHER REFERENCES	
1	**https://www.networklabs.in/**
2	**https://www.w3schools.in/python-tutorial/network-programming/**
3	**http://www.ace-edu.in/wp-content/uploads/2018/06/CN-Lab-Manual.pdf**
4	**http://enggedu.com/network_lab_exercise_programs/index.php**
5	**https://www.scribd.com/document/496117575/Computer-Network-Lab-Manual**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	ME-CSE	20MC1L3	RESEARCH PAPER WRITING	2	0	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Describe how to Improve the Writing Skills and level of Readability.	K2	1-3
CO2	Apply research Writing Skills and Level of Readability.	K3	1
CO3	Using the Skills needed When Writing Titles.	K3	3
CO4	Apply abilities in grammar, oral skills, reading, writing and study skills	K3	2
CO5	Analyze research skills of administrating research tools and data	K4	1

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	Group Presentation & Cooperative Learning Report
	4	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**RESEARCH PLAN AND PREPARATORY TOOLS**	**10**
Plan - Word Order - Break up long Sentences – Paragraph and Sentences Structures – Concise and Remove Redundancy – Avoid Ambiguity and Vagueness Preparation.		
Topic - 2	**GRAMMER FOR RESEARCH**	**10**
Expand the Vocabulary and Phrases – Grammar and Punctuation – Ensure the Content – Review of Literature -Conclusions		
Topic - 3	**KEY SKILLS FOR PREPARATION**	**10**
Clarity who did what – Highlight the findings – Hedge and criticise – Pharaparse – Check Plagiarism – Sections of a Paper – Abstracts – Introduction – Key Skills needed when Writing – a Title ,an abstract, an Introduction, a Review of the Literature, methods ,results, Discussion ,Conclusions.		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

BOOK REFERENCES	
1	Day R How to Write and Publish a Scientific Paper Cambridge University Press 2006.
2	Adrian Wall work ,English for Writing Research Paper, Springer Newyork Dordrecht Heidelberg London 2011
3	A Manual for Writers of Research Papers, Theses, and Dissertations, Eighth Edition.
4	Science Research Writing: For Native And Non-native Speakers Of English (second Edition)
5	Writing Scientific Research Articles: Strategy and Steps - 2nd Edition

OTHER REFERENCES	
1	**https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4548564/**
2	**https://www.aje.com/arc/materials-and-methods-7-writing-tips/**
3	**https://wiu.libguides.com/c.php**
4	**https://www.annaclemens.com/blog/5-advanced-tips-writing-materials-methods-sections**
5	**https://www.eophtha.com/posts/writing-the-materials-and-methods-and-summarizing-the-thesis**

CURRICULUM

SEMESTER II

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
	THEORY								
1	20MC2T1	Data Management and Analytics	PC	50	50	3	1	0	4
2	20MC2T2	Object Oriented Software Engineering	PC	50	50	3	0	0	3
3	20MC2T3	Modern Operating Systems	PC	50	50	3	0	0	3
4	20MC2E1 TO 20MC2E3	Professional Elective – III	PE	50	50	3	0	0	3
5	20MC2E4 TO 20MC2E6	Professional Elective – IV	PE	50	50	3	0	0	3
	PRACTICAL								
6	20MC2L1	Data Management and Analytics Laboratory	PC	50	50	0	0	3	1.5
7	20MC2L2	Mini Project with Seminar	EEC	50	50	0	0	3	1.5
8	20MC2L3	Teaching and Learning in Engineering	MC	100	--	2	0	0	0
Total						**17**	**1**	**6**	**19**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	ME-CSE	20MC2T1	DATA MANAGEMENT AND ANALYTICS	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand how to leverage the insights from big data analytics.	K2	1,5
CO2	Analyze data by utilizing various statistical and data mining approaches.	K4	3
CO3	Perform analytics on real - time streaming data.	K3	4
CO4	Understand the various No Sql alternative database models.	K2	5
CO5	Evaluate the proficiency with statistical analysis of data.	K5	3

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	Group Presentation & Cooperative Learning Report
	4	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO BIG DATA**	**7+3**
Big Data – Definition, Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools		
Topic - 2	**HADOOP FRAMEWORK**	**9+3**
Distributed File Systems - Large - Scale File System Organization – HDFS concepts - Map Reduce Execution, Algorithms using Map Reduce, Matrix - Vector Multiplication – Hadoop YARN		
Topic - 3	**DATA ANALYSIS**	**13+3**
Statistical Methods: Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.		
Topic - 4	**MINING DATA STREAMS**	**7+3**
Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams and Mining Time - series data - Real Time Analytics Platform (RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.		
Topic - 5	**BIG DATA FRAMEWORKS**	**9+3**
Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase Clients – Examples – Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data Types and File Formats – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries		

THEORY	45		TUTORIAL	15		PRACTICAL	0		TOTAL	60

BOOK REFERENCES	
1	Bill Franks, —Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012.
2	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
3	Michael Berthold, David J. Hand, —Intelligent Data Analysis‖, Springer, Second Edition,2007
4	Richard Cotton, "Learning R – A Step - by - step Function Guide to Data Analysis, , O_Reilly Media, 2013
5	Learning Spark: Lightning-Fast Big Data Analysis‖ by Holden Karau.

OTHER REFERENCES	
1	**https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs33/**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	ME-CSE	20MC2T2	OBJECT ORIENTED SOFTWARE 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	Understand the advantages of various Software Development Lifecycle Models.	K2	1
CO2	Gain knowledge on project management approaches as well as cost and schedule estimation strategies.	K1	1,2
CO3	Perform formal analysis on specifications.	K4	2,4
CO4	Use UML diagrams for analysis and design.	K4	2,3
CO5	Architect and design using architectural styles and design patterns.	K6	3,5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	Group Presentation & Cooperative Learning Report
	4	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Software engineering concepts – Development activities – Software lifecycle models - Classical waterfall - Iterative waterfall – Prototyping – Evolutionary - Spiral – Software project management– Project planning – Estimation – Scheduling – Risk management – Software configuration management.		
Topic - 2	**SOFTWARE REQUIREMENT SPECIFICATION**	**9**
Requirement analysis and specification– Requirements gathering and analysis– Software Requirement Specification– Formal system specification– Finite State Machines Petrinets– Object modelling using UML –Use case Model Class diagrams Interaction diagrams Activity diagrams – State chart diagrams –Functional modelling –Data Flow Diagram.		
Topic - 3	**ARCHITECTURE AND DESIGN**	**9**
Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model - view - controller – Publish - subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client - server - Tiered - Pipe and filter. - User interface design		
Topic - 4	**TESTING**	**9**
Testing – Unit testing – Black box testing– White box testing – Integration and System testing – Regression testing – Debugging - Program analysis – Symbolic execution – Model Checking		
Topic - 5	**DEVOPS**	**9**
DevOps:Motivation - Cloud as a platform - Operations - Deployment Pipeline:Overall Architecture - Building and Testing - Deployment - Case study: Migrating to Microservices.		

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

BOOK REFERENCES	
1	Bernd Bruegge, Alan H Dutoit, Object - Oriented Software Engineering, 2nd edition, Pearso Education, 2004.
2	Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.
3	Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.
4	Len Bass, Ingo Weber and Liming Zhu, —DevOps: A Software Architect_s Perspective‖,Pearson Education, 2016
5	Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.

OTHER REFERENCES	
1	**https://edutechlearners.com/oose-notes/**
2	**https://noteshub.co.in/Object-Oriented-Software-Engineering**
3	**http://www.engppt.com/2011/12/object-oriented-software-engineering.html**
4	**https://www.university.youth4work.com/study-material/object-oriented-software-lecture**
5	**https://examstime.in/object-oriented-analysis-and-design-study-materials**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	20MC2T3	MODERN OPERATING SYSTEMS	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	Explain the functionality of a large software system by reading its source	K2	1
CO2	Revise any algorithm present in a system using Destroying Processes	K4	1,2
CO3	Design a new algorithm to replace an existing one	K5	3
CO4	Appropriately modify and use the data structures of the linux kernel for a different software system.	K4	2,3
CO5	Evaluate a Program Segments and Process Memory Regions by using different process communication	K5	5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Basic Operating System Concepts - Overview of Unix File System - Files - Links - Types – Inodes - Access Rights - System Calls - Overview of Unix Kernels - Model - Implementation – Reentrant Kernels - Address Space - Synchronization - Inter process Communication - Process Management - Memory Management - Device Drivers.		
Topic - 2	**PROCESSES9**	**9**
Processes, Lightweight Processes, and Threads - Process Descriptor - State - Identifying a Process - Relationships among processes - Organization - Resource Limits - Creating Processes - System Calls - Kernel Threads - Destroying Processes - Termination - Rem		
Topic - 3	**FILE SYSTEM**	**9**
The Virtual File System (VFS) - Role - File Model - System Calls - Data Structures - Super Block, I node, File, dentry Objects – dentry Cache – Files Associated with a File system Types Process – Special File systems Type Registration - File sytem Handling - Namespaces – Files System Type Registration - File sytem Handling - Namespaces – Mounting - Unmounting - Implementation of VFS System Calls.		
Topic - 4	**MEMORY MANAGEMENT**	**9**
Page frame management - page descriptors - non - uniform memory access - memory zones - reserved page frames - zoned page frame allocator - kernel mappings - buddy system algorithm - page frame cache - zone allocator.		
Topic - 5	**PROCESS COMMUNICATION AND PROGRAM EXECUTION**	**9**
Process Communication – Pipe – Usage –Data Structures – Creating and Destroying a pipe – Reading From and Writing into a Pipe. Program Execution – Execution Files – Process Credentials – Command – Line Aruguments and Shell Environment – Libraries – Program Segments and Process Memory Regions – Execution tracing – Executable Formats – Execution Domains – The exec Functions.		

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

BOOK REFERENCES	
1	Daniel P. Bovet and Marco Cesati, "Understanding the Linux Kernel", 3rd Edition, O'Reilly Publications, 2005
2	Harold Abelson, Gerald Jay Suss man and Julie Suss man, ―Structure and Interpretation of Computer Programs‖, Second Edition, Universities Press, 2013
3	Maurice J. Bach, ―The Design of the Unix Operating System‖ 1st Edition Pearson Education, 2003

OTHER REFERENCES	
1	**https://www.amazon.com/Modern-Operating-Systems-Andrew-Tanenbaum/dp/013359162X**
2	**https://en.wikipedia.org/wiki/Modern_Operating_Systems**
3	**https://youtu.be/dR2FH8z7L04**
4	**https://youtu.be/mXw9ruZaxzQ**
5	**https://edu.gcfglobal.org/en/computerbasics/understanding-operating-systems/1/**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	20MC2E1	CLOUD COMPUTING AND IOT	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 evolutionary changes that have occurred in parallel, distributed and Cloud Computing with real time examples	K4	1
CO2	Apply the design principles, architectures and enabling technologies for cloud infrastructure	K3	1,2
CO3	Interpret the genesis and impact of IOT architectures with its application	K4	2,3
CO4	Analyze various IOT Protocols and methods for secure communication	K4	4
CO5	Illustrate different applications of IOT in real time scenario	K5	4,5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**CLOUD COMPUTING AND MODELS**	**9**
Distributed System Models and Enabling Technologies -Cloud Computing: Cloud Types - Characteristics - Measuring Cloud Value and cloud computing cost - Cloud Architecture: Cloud Computing Stack - Cloud Services: IaaS - PaaS - SaaS.		
Topic - 2	**CLOUD INFRASTRUCTURE**	**9**
Data - Centre Design and Interconnection Networks - Architectural Design of Compute and Storage Clouds - Public Cloud platforms - Inter Cloud Resource Management		
Topic - 3	**INTRODUCTION TO IOT**	**9**
Genesis of IOT, Digitization, Impact, Convergence of IT and IOT , IOT Challenges, Network Architecture and Design, Comparing IOT Architectures, Core IOT Functional Stack, Data Management.		
Topic - 4	**IOT NETWORKS & PROTOCOLS**	**9**
Sensors, Actuators, and Smart Objects - Sensor Networks - Connecting Smart Objects - Communication Criteria - IOT Access Technologies - IOT Network Layer - Business Case for IP - Optimizing IP for IOT - Profiles and Compliances - Application Protocols for IOT - Transport Layer - IOT Application Transport Methods - Securing IOT.		
Topic - 5	**APPLICATION**	**9**
Manufacturing - Smart and Connected Cities - Transportation - Mining - Public Safety - Home automation - Agriculture - productivity applications - Structural Health Monitoring.		

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

BOOK REFERENCES	
1	Barrie Sosinsky , ―Cloud Computing Bible‖, Wiley Publishing, 2011
2	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, ―Distributed and Cloud Computing, From Parallel Processing to the Internet of Things‖, Morgan Kaufmann Publishers, 2012
3	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things‖, Pearson Education, 2017.
4	Olivier Hersent, David Boswarthick and Omar Elloumi, –The Internet of Things -Key Applications and Protocols‖, 2‘ d Edition, Wiley, 2012

OTHER REFERENCES	
1	**https://www.geeksforgeeks.org/iot-and-cloud-computing/**
2	**https://blog.resellerclub.com/what-is-the-role-of-cloud-computing-in-iot/**
3	**https://contenteratechspace.com/blog/what-is-the-role-of-cloud-computing-in-iot/**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	20MC2E2	PARALLEL 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	Describe the working principles of parallel computing hardware and software architectures	K4	1
CO2	Design and analyze parallel algorithms using Foster's Design Methodology	K3	2
CO3	Evaluate the parallel programs using the message passing paradigm	K5	3,2
CO4	Develop Shared Memory programs using Open MP	K4	4
CO5	Conclude the common architectures and programming models for GPU processors	K5	5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**PARALLEL HARDWARE AND PARALLEL SOFTWARE**	**9**
Need for Parallel Computing - Concurrency in computing - Von Neumann Architecture and modifications - Parallel Hardware - Parallel Software.		
Topic - 2	**PARALLEL ALGORITHM DESIGN**	**9**
Task / Channel Model - Foster's Design Methodology - Examples - Adding Data Input - Performance Analysis - Speedup and Efficiency - Metrics and Laws		
Topic - 3	**MESSAGE PASSING PARADIGM**	**9**
MPI programming - MPI communicators - Single Program Multiple Data programs - Communication - Message matching - MPI l/O - Collective communication - Performance evaluation of MPI programs		
Topic - 4	**SHARED MEMORY PROGRAMMING WITH OPENMP**	**9**
Open MP programming - Scope of variables - Reduction clause - Loops in Open MP - Scheduling loops - Synchronization - Producer - Consumer problem - Cache issues - Thread safety in Open Mp		
Topic - 5	**SHARED MEMORY PROGRAMMING WITH CUDA**	**9**
Introduction to GPU - Understanding Parallelism with GPUs - Anatomy of CUDA Programming - CUDA Parallelism Model - CUDA Grid, Blocks and Threads - Memory Handling with CUDA - Multi - CPU and Multi - GPU Solutions - Case Study: Matrix multiplication		

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

BOOK REFERENCES	
1	Barrie Sosinsky, —Cloud Computing Bible‖, Wiley Publishing, 2011
2	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, —Distributed and Cloud Computing, From Parallel Processing to the Internet of Things‖, Morgan Kaufmann Publishers, 2012
3	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, –IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things‖, Pearson Education, 2017.
4	Olivier Hersent, David Boswarthick and Omar Elloumi, ―The Internet of Things -Key Applications and Protocols‖, 2‘ d Edition, Wiley, 2012.

OTHER REFERENCES	
1	**https://en.wikipedia.org/wiki/Parallel_computing**
2	**https://hpc.llnl.gov/training/tutorials/introduction-parallel-computing-tutorial**
3	**https://www.springer.com/gp/book/9783540573074**
4	**https://docs.oracle.com/cd/A57673_01/DOC/server/doc/SPS73/chap3.htm**
5	**https://www.geeksforgeeks.org/what-is-parallel-processing/**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE.	20MC2E3	SOFTWARE QUALITY ASSURANCE	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	Utilize the concepts in software development life cycle.	K3	2
CO2	Demonstrate their capability to adopt quality standards.	K4	1,3
CO3	Assess the quality of software product using Taylor's series expansion	K5	4
CO4	Apply the concepts in preparing the quality plan & documents	K3	1,3,4
CO5	Determine the concepts in preparing the quality Standards & Models	K5	5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE**	**9**
Eigen values and Eigen vectors of a real matrix – properties of Eigen values and Eigen vectors (without proof) – Cayley-Hamilton theorem (statement and applications) – orthogonal transformation of a symmetric matrix to diagonal form (concept only) – Reduction of quadratic form to canonical form by an orthogonal transformation		
Topic - 2	**SQA COMPONENTS AND PROJECT LIFECYCLE**	**9**
Basic differentiation formula for algebraic and transcendental functions – derivatives – differentiability rules and properties (without proof) – basic integral formula for algebraic and transcendental functions – integration by parts – partial fraction methods.		
Topic - 3	**SOFTWARE QUALITY INFRASTRUCTURE**	**9**
Total derivatives – Taylor's series expansion – maxima and minima – Lagrange's multipliers method – Jacobian's method		
Topic - 4	**SOFTWARE QUALITY MANAGEMENT & METRICS**	**9**
Leibnitz's equations – Bernoulli's equation – equation of first order and higher degree – Clairaut's form – Linear first order differential equations and its applications.		
Topic - 5	**STANDARDS, CERTIFICATIONS & ASSESSMENTS**	**9**
Double integrals: Double integration in Cartesian co-ordinates – change of order of integration – area as a double integration in Cartesian–volume as a triple integral in Cartesian co-ordinates (simple problems)		

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

BOOK REFERENCES	
1	Alan C. Gillies, —Software Quality: Theory and Management‖, International Thomson Computer Press, 1997.
2	Mordechai Ben-Menachem —Software Quality: Producing Practical Consistent Software‖,International Thompson Computer Press, 1997.

OTHER REFERENCES	
1	**https://en.wikipedia.org/wiki/Software_quality_assurance**
2	**https://www.javatpoint.com/software-quality-assurance**
3	**https://www.tutorialspoint.com/software_quality_management/software_quality_management**
4	**https://www.tutorialspoint.com/tutor_connect/index.php**
5	**https://www.bmc.com/blogs/quality-assurance-software-testing/**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E CSE	20MC2E4	SECURITY IN 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	Apply the basic concepts in Cryptography and symmetric ciphers for secure communication using single key.	K4	1
CO2	Apply the working of Public Key Encryption and Hash Functions secure communication using public and private key.	K3	1,2
CO3	Summarize various types of security provided in maintaining a secure Database.	K4	2,3
CO4	Describe issues related to security while administering the networks.	K4	3,4
CO5	Explain legal and ethical issues in computer security and privacy in Computing.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 Weak, 2 Medium, 3 Strong)						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PSO1	PSO2
CO 1	3	3		2	2	
CO 2	3				2	
CO 3		3	2			
CO 4			2		3	
CO 5	3	3		2		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**SYMMETRIC CIPHERS**	**9**
Introduction -Security Attacks - Security Services - Security Mechanisms - Symmetric Ciphers: Classical Encryption Techniques - Block Ciphers and the Data Encryption Standard - Advanced Encryption Standard.		
Topic - 2	**PUBLIC KEY ENCRYPTION AND HASH FUNCTIONS**	**9**
Asymmetric Ciphers: Mathematical Concepts - Public - Key Cryptography and RSA - Other Public - Key Cryptosystems - Message Authentication and Hash Functions: Authentication Requirements - Authentication Functions - Message Authentication Codes - Hash Functions - Security of Hash Functions and MACs.		
Topic - 3	**PROGRAM, DATABASE AND DATA MINING SECURITY**	**9**
Secure Programs - Non - malicious Program Errors - Viruses and Other Malicious Code - Targeted Malicious Code - Controls Against Program Threats - Database Security Requirements - Reliability and Integrity - Sensitive Data - Inference - Multilevel Databases - Proposals for Multilevel Security - Data Mining		
Topic - 4	**SECURITY IN NETWORKS AND ADMINISTERING SECURITY**	**9**
Network Concepts -Threats in Networks - Network Security Controls - Firewalls - Security Planning - Risk Analysis - Organizational Security Policies - Physical Security.		
Topic - 5	**ISSUES IN COMPUTER SECURITY**	**9**
Privacy Concepts - Privacy Principles and Policies - Authentication and Privacy - Privacy on the Web - E - mail Security - Impacts on Emerging Technologies - Protecting Programs and Data - Information and the Law - Rights of Employees and Employers - Redress for Software Failures - Computer Crime - Ethical Issues in Computer Security.		

THEORY	45		TUTORIAL	0		PRACTICAL	0		TOTAL	45

BOOK REFERENCES	
1	William Stallings, "Cryptography and Network Security", Fifth Edition, Prentice Hall, 2010.
2	Charles. P. P fIeeger and Shari Lawrence P fleeger, —Security in Computing‖, Fourth Edition, Pearson Education, 2007
3	Behrouz A Forouzan and Debdeep Mukhopadhyay, —Cryptography and Network Security‖, Second Edition, Tata McGraw Hill Education Pvt Ltd Publication, 2010.
4	Marjie T. Britz, —Computer Forensics and Cyber Crime - An Introduction‖, Third Edition, Pearson Education, 2013.
5	Bernard L. Menezes, —Network Security and Cryptography‖, Cengage Learning India, 2010.
OTHER REFERENCES	
1	**https://nptel.ac.in/courses/106/106/106106129/**
2	**https://www.youtube.com/watch?v=cs3B0zcRJco**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E CSE	20MC2E5	SOFTWARE PROJECT 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	Describe the fundamental concepts in managing projects with real time examples.	K4	1
CO2	Identify appropriate tools, template and process for managing a project.	K3	1,2
CO3	Design, adapt and deploy project life cycle based on changing characteristics of a project.	K4	2,3
CO4	Analyze the benefits of Agile and Extreme Project Management using Tools, templates and processes.	K4	4
CO5	Explain the organizational contribution for the success of a project.	K5	4,5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 Weak, 2 Medium, 3 Strong)						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PSO1	PSO2
CO 1	3	2	2	2	2	
CO 2	3		2		2	
CO 3	3	3		2		2
CO 4	2		2		3	
CO 5	3	2		2		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**PROJECT MANAGEMENT**	**9**
Project - Understanding the Scope Triangle - Envisioning the Scope Triangle as a System in Balance - Managing the Creeps - Applying the Scope Triangle - The Importance of Classifying Projects - Fundamentals of Project Management - Process Groups - Knowledge Areas - Scoping a Project		
Topic - 2	**PROJECT MANAGEMENT PROCESS**	**9**
Tools, Templates and Processes: Planning, Launching, Monitoring and Control, Closing Project activities - Installing Project Deliverables - Documenting the Project - Conducting the Post Implementation Audit - Final Report.		
Topic - 3	**PROJECT MANAGEMENT LIFE CYCLE**	**9**
Project Management Landscape -Traditional Project Management: Linear Project Management Life Cycle, Incremental Project Management Life Cycle - Critical chain Project Management		
Topic - 4	**AGILE AND EXTREME PROJECT MANAGEMENT**	**9**
Agile Project Management - Iterative Project Management Life Cycle - Adaptive Project Management Life Cycle - Adapting and Integrating the APM Toolkit - Extreme Project Management - Extreme Project Management Life Cycle - Emertxe Project Management - Using the Tools, Templates, and Processes for Maximum xPM Effectiveness.		
Topic - 5	**PROJECT MANAGEMENT INFRASTRUCTURE**	**9**
Project Support Office - Naming - Establishing Mission - Framing Objectives - Exploring support functions - Organizational Structure - Organizational Placement - Need for PSO - Establishing PSO - Challenges of implementing PSO - Project Portfolio Management - PPM Life Cycle - Roles and Responsibilities - Project submission - Agile PPM.		

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

BOOK REFERENCES	
1	Robert K. Wysoki, —Effective Project Management - Traditional, Agile, Extreme", 7th Edition, Wiley, 2013.
2	Bob Hughes, Mikecotterell, —Software Project Management, 3rd Edition, Tata McGraw Hill, 2011
3	Gopalaswamy Ramesh, "Managing Global Projects", Tata McGraw Hill, 2006
4	MuraliChemuturi, Thomas M. Cagley, —Mastering Software project kJanagement: Best Practices, Tools and Techniques", J. Ross publishing, 2010.
5	PankajJalote, "Software Project Management in Practice—, Pearson Education, 2002.

OTHER REFERENCES	
1	**https://nptel.ac.in/courses/106/105/106105218/**
2	**https://www.youtube.com/watch?v=mh3k9kq2Hfg**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E CSE	20MC2E6	SOFTWARE DEFINED 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	Analyze the evolution of software defined networks.	K4	1
CO2	Express the various components of SDN and their uses.	K4	1,2
CO3	Explain the use of SDN in the current networking scenario.	K5	2,3
CO4	Design and develop various applications of SDN.	K3	4
CO5	Analyze the evolution of Networks Functions Virtualization.	K4	4,5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 Weak, 2 Medium, 3 Strong)						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PSO1	PSO2
CO 1	3		2	2	2	
CO 2	3	2		2		2
CO 3	2		2			2
CO 4	3			2	3	
CO 5	3	2	2			2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
History of Software Defined Networking (SDN)– Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes		
Topic - 2	**OPEN FLOW & SDN CONTROLLERS**	**9**
Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts		
Topic - 3	**DATA CENTERS**	**9**
Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE		
Topic - 4	**SDN PROGRAMMING**	**9**
Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs–Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Application		
Topic - 5	**SECURITY AND FUTURE RESEARCH**	**9**
Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration		

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

BOOK REFERENCES	
1	SiamakAzodolmolky, —Software Defined Networking with Open Flow, Packet Publishing, 2013.
2	VivekTiwari, —SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc.,2013.
3	Fei Hu, Editor, —Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

OTHER REFERENCES	
1	**https://www.youtube.com/watch?v=l3E-C1j-SJg**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E CSE	20MC2L1	DATA MANAGEMENT AND ANALYTICS LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Process big data using Hadoop framework.	K5	1,7,8
CO2	Build and apply linear and logistic regression models.	K5	4
CO3	Perform data analysis with machine learning methods.	K3	3
CO4	Perform graphical data analysis.	K3	2
CO5	Analyze the management of data.	K4	5,6

PRE-REQUISITE	NIL

CO / PO MAPPING (1 Weak, 2 Medium, 3 Strong)						
COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PSO1	PSO2
CO 1		3			3	
CO 2	2	3	2		3	
CO 3	2		2	2	3	
CO 4	2		2	2	3	
CO 5		3		2		

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

LIST OF EXPERIMENTS	
1	Install, configure and run Hadoop and HDFS
2	Implement word count / frequency programs using Map Reduce
3	Implement an MR program that processes a weather dataset R
4	Implement Linear and logistic Regression
5	Implement SVM / Decision tree classification techniques
6	Implement clustering techniques
7	Visualize data using any plotting framework
8	Implement an application that stores big data in Hbase / MongoDB / Pig Using Hadoop / R.

THEORY	0		TUTORIAL	0		PRACTICAL	30		TOTAL	30

BOOK REFERENCES	
1	Bill Franks, —Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012
2	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
3	Michael Berthold, David J. Hand, —Intelligent Data Analysis‖, Springer, Second Edition, 2007.
4	Richard Cotton, "Learning R – A Step - by - step Function Guide to Data Analysis, , O_Reilly Media, 2013

OTHER REFERENCES	
1	**https://libguides.depaul.edu/**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	M.E. CSE	20MC2L3	TEACHING AND LEARNING IN ENGINEERING	2	0	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply Outcome based approach in teaching courses.	K3	1
CO2	Build lecture / practical /tutorial sessions using active learning methods	K6	2
CO3	Choose higher order method assessments using rubrics	K5	3

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT										
Topic - 1	**OUTCOME BASED APPROACH**									**10**
Outcome based Education – Need & Approach – Washington accord – Graduate attributes – Learning outcome – Blooms Taxonomy										
Topic - 2	**ACTIVE LEARNING METHOD**									**10**
Design and Delivery plan for lecturers/practical/tutorial sessions – Need for Active learning methods – Active learning strategies – Benefits of Active learning Methods										
Topic - 3	**ASSESSMENTS**									**10**
Assessments – types of assessments – need for rubrics, Types of rubrics – Assessment using rubrics										
THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

BOOK REFERENCES	
1	William G. Spady and Francis Aldrine A uy(2014). Outcome- Based Education. Critical issues and answer, ISBN 978-971-41-8, maxcor Publishing House, Inc
2	Dr. William G. Spady, Wajid Hussain, Joan Dr. Francis Uy (2018), Beyond Outcomes Accreditation: Exploring the power of Real OBE Practices
3	Richard M. Feider, Rebecca Brent(2016) Teaching and Learning STEM A Practical Guide John Wiley & sons Inc

CURRICULUM

SEMESTER III

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
	THEORY								
1	20MC3E1 TO 20MC3E3	Professional Elective - V	PE	50	50	3	0	0	3
2	20MC3E4 TO 20MC3E6	Professional Elective - VI	PE	50	50	3	0	0	3
	PRACTICAL								
3	20MC3L1	Project Work Phase I / Industry Project	EEC	50	50	0	0	20	10
Total						**6**	**0**	**20**	**16**

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E. CSE	20MC3E1	INFORMATION RETRIEVAL	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 basics of IR and describe various Models in information retrieval.	K4	1,2
CO2	Apply IR principles to locate relevant information large collections of data.	K3	3
CO3	Analyze performance of retrieval systems when dealing with unmanaged data sources	K4	4
CO4	Design retrieval systems for web search tasks	K6	3,4
CO5	Evaluate and use different information retrieval techniques in various application areas	K5	5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Online Quiz
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Introduction – Information versus Data Retrieval. Modelling of Information retrieval. Boolean Model, Vector Model, Probabilistic Model, Set Theoretical Models, Structured Text Retrieval Models.		
Topic - 2	**INFORMATION RETRIEVAL**	**9**
Classification, Measures of Association, Cluster Hypothesis, Single Link Clusters, File Structures, Inverted Files, Index Sequential Files, Ring Structures, Doubly Chained Trees, Hash Addressing.		
Topic - 3	**WEB SEARCH ENGINE INTRODUCTION AND CRAWLING**	**9**
Evaluation, Relevance, Precision and Recall, Interpolation, Averaging techniques, The Swets Model, Search Engines, Boolean Search, Matching Functions, Serial Search, Cluster Representatives, Cluster based retrieval		
Topic - 4	**LINK ANALYSIS AND SPECIALIZED SEARCH**	**9**
Web search basics – Web characteristics - crawling and indexes – Features of a crawler –Crawler architecture – DNS resolution – The URL frontier – Distributing indexes – Connectivity servers.		
Topic - 5	**DOCUMENT TEXT MINING**	**9**
Link Analysis – The Web as a graph – Anchor text and the web graph, Page Rank – Markov chains, Page Rank computation, Topic-specific Page Rank, Hubs and authorities.		

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

BOOK REFERENCES	
1	C. Manning, P. Raghavan, and H. Schütze, ―Introduction to Information Retrieval‖, Cambridge University Press, 2008
2	C.J.VanRijsbergen, Information Retrieval:, http://www.dcs.gla.ac.uk/Keith/Preface.html
3	Ricardo Baexa-Yates and BerthierRibeiro-Neto, ―Modern Information Retrieval‖, Addison Wesley Longman, 1999.
4	Bruce Croft, Donald Metzler and Trevor Strohman, ―Search Engines: Information Retrieval in Practice‖, 1st Edition Addison Wesley, 2009.

OTHER REFERENCES	
1	**https://www.geeksforgeeks.org/what-is-information-retrieval/**
2	**https://www.youtube.com/watch?v=js3MFNs6Qdg**
3	**https://www.youtube.com/watch?v=Y2OybHMjz6U**
4	**https://www.youtube.com/watch?v=fFxpSmyICwI**
5	**https://www.youtube.com/watch?v=m0oiAOgSQFw**

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E. CSE	20MC3E2	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	Design the learning techniques with this basic knowledge	K6	1
CO2	Apply effectively neural networks and genetic algorithms for appropriate applications	K3	2,3
CO3	Apply Bayesian techniques and derive effectively learning rules	K3	3
CO4	Examine the different machine learning techniques and applications	K5	4
CO5	Develop differentiate reinforcement and analytical learning techniques	K6	1,5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Online Quiz
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION, CONCEPT LEARNING AND DECISION TREES**	**9**
Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.		
Topic - 2	**NEURAL NETWORKS AND GENETIC ALGORITHMS**	**9**
Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.		
Topic - 3	**BAYESIAN AND COMPUTATIONAL LEARNING**	**9**
Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.		
Topic - 4	**INSTANT BASED LEARNING AND LEARNING SET OF RULES**	**9**
K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions – Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution.		
Topic - 5	**ANALYTICAL LEARNING AND REINFORCED LEARNING**	**9**
Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.		

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

BOOK REFERENCES	
1	Tom M. Mitchell, ―Machine Learning‖ McGraw-Hill Education (Indian Ed), 2013.
2	EthemAlpaydin,―Intd. to Machine II Ed., PHI Learning Pvt.Ltd., 2013.
3	T. Hastie, R. Tibshirani, J. H. Friedman, ―The Elements of Statistical Learning‖, Springer; 1st edition, 2001.

OTHER REFERENCES	
1	**https://towardsdatascience.com/10-machine-learning-methods-that-every-data-scientist-should-know-3cc96e0eeee9**
2	**https://nptel.ac.in/courses/106/105/106105152/**
3	**https://nptel.ac.in/courses/106/106/106106139/**

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E. CSE	20MC3E3	CYBER SECURITY	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	Examine the fundamental concepts of cybercrime and cyber offenses	K5	1
CO2	Analyze the cybercrimes occurred in mobile and wireless devices	K4	2
CO3	Differentiate the methods used in cybercrime	K4	2,3
CO4	Examine the laws for cybercrime and its respective punishments	K5	3,4
CO5	Apply the rules for forensics Analysis of E-Mail, Network and Social Networking Sites	K3	5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Online Quiz
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO CYBERCRIME AND CYBEROFFENSES**	**9**
Cybercrime and Information Security - Classifications of Cybercrimes - The Legal Perspectives - Cybercrime and the Indian ITA 2000 - A Global Perspective on Cybercrimes - Plan of Attacks – Social Engineering – Cyberstalking – Cybercafe and Cybercrimes – Botnets - Attack Vector.		
Topic - 2	**CYBERCRIME: MOBILE AND WIRELESS DEVICES**	**9**
Proliferation of Mobile and Wireless Devices - Trends in Mobility - Credit Card Frauds in Mobile and Wireless Computing Era–Security challenges posed by mobile devices–registry setting for mobile devices – authentication service security – attacks on mobile/cell phones – Organizational measures for handling mobiles.		
Topic - 3	**TOOLS AND METHODS USED IN CYBERCRIME**	**9**
Proxy Servers and Anonymizers – Phishing - Password Cracking – Key loggers – Spywares -Virus and Worms - Trojan Horses and Backdoors – Steganography - DoS and DDoS Attacks - SQL Injection -Attacks on Wireless Networks.		
Topic - 4	**CYBERCRIMES AND CYBERSECURITY: THE LEGAL PERSPECTIVES**	**9**
Cyber laws- The Indian Context - The Indian IT Act - Challenges to Indian Law and Cybercrime Scenario in India - Consequences of Not Addressing the Weakness in Information Technology Act - Digital Signatures and the Indian IT Act - Amendments to the Indian IT Act - Cybercrime and Punishment.		
Topic - 5	**UNDERSTANDING COMPUTER FORENSICS**	**9**
Digital Forensics - Forensics Analysis of E-Mail - Network Forensics - Forensics and Steganography - Forensics and Social Networking Sites - Challenges in Computer Forensics - Data Privacy Issues – Forensics Auditing – Anti forensics.		

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

BOOK REFERENCES	
1	Robert Jones, ―Internet Forensics: Using Digital Evidence to Solve Computer Crime‖,O"Reilly Media, October, 2005.
2	Chad Steel, ―Windows Forensics: The field guide for conducting corporate computer investigations‖, Wiley India Publications, December, 2006.
3	Charles J.brooks ― Cybersecurity Essentials‖,Sybex Willey Publications, Decemeber 2019.

OTHER REFERENCES	
1	**https://www.w3schools.com/cybersecurity/index.php**
2	**https://www.javatpoint.com/cyber-security-tutorial**
3	**https://nptel.ac.in/courses/106/105/106105031/**
4	**https://nptel.ac.in/courses/106/106/106106178/**

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E CSE	20MC3E4	BIG DATA AND ANALYTICS TOOLS	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 Use Hadoop, Map Reduce framework.	K4	1
CO2	Select areas to apply big data to increase business outcome	K5	2,3
CO3	Analyze techniques to integrate and correlate large amounts of information automatically to gain faster insights.	K4	3,4
CO4	Apply concepts of various clustering techniques.	K3	4
CO5	Discuss the application of big data	K6	5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	Group Presentation & Cooperative Learning Report
	4	Model Examination
	5	End Semester Examination
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**BASICS OF BIG DATA**	**9**
Analytics – Nuances of Big Data – Value – Issues – Case for Big Data – Big Data options Team challenge – Big Data sources – Acquisition – Nuts and Bolts of Big data Features of Big Data – Security, Compliance, Auditing and Protection – Evolution of Big Data – Best Practices for Big data Analytics – Big Data characteristics.		
Topic - 2	**LAMBDA CALCULUS AND DATA ANALYSIS**	**9**
Lambda Notation for Functions – Syntax – Curried Functions – Parametric Polymorphism – Lambda Reduction – Alpha Reduction – Beta Reduction – Beta Abstraction – Extensionality Theorem – Delta Reduction – Reduction strategies – Normal forms – Church-Rosser Theorems – Pure Lambda Calculus – Constants – Arithmetic – Evolution of AnalyticScalability–Convergence – ParallelProcessingsystems–Mapreduce–EnterpriseanalyticSandbaox–AnalyticData Sets–Analytic methods–Analytic tools–Cognos–Micro strategy –Pentaho		
Topic - 3	**STREAM COMPUTING**	**9**
Introduction to Streams Concepts – Stream Data Model and Architecture – Stream Computing, Sampling Data in a stream – Filtering Streams – Counting Distinct Elements in a stream – Estimating Moments – Counting Oneness in a Window – Decaying Window – Real Time Analytics Platform(RTAP) Applications IBM Infosphere – Big Data at rest –Infosphere Streams – Data Stage – Statistical Analysis – Intelligent Scheduler – Infosphere Streams		
Topic - 4	**PREDICTIVE ANALYTICS AND VISUALIZATION**	**9**
PredictiveAnalytics–Supervised–UnsupervisedLearning–NeuralNetworks–KohonenModels–Normal – Deviations from Normal Patterns – Normal Behaviours – Expert Options – Variable Entry – Mining Frequent Itemsets – Market Based Model – Apriori Algorithm – Handling large Data sets in Main memory – Limited Pass algorithm – Counting frequentitemsetsinastream–ClusteringTechniques – Hierarchical–K-Means–ClusteringHighDimensionalData Visualizations – Visual Data Analysis Techniques – Interaction techniques – Systems and Applications		
Topic - 5	**FRAMEWORKS AND APPLICATIONS**	**9**
IBM for Big Data – Map Reduce Framework – Hadoop – Hive – Sharding – NoSQL Databases – S3 – Hadoop Distributed File Systems – Hbase – Impala – Analyzing Big Data with twitter – Big Data for Ecommerce – Big Data for Blogs		

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

BOOK REFERENCES	
1	Colleen Mccue, ―Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis‖, Elsevier, Second Edition, 2015.
2	AnandRajaraman and Jeffrey David Ullman, ―Mining of Massive Datasets‖, Cambridge University Press, 2014
3	Bill Franks, ―Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012

OTHER REFERENCES	
1	**https://www.guru99.com/big-data-analytics-tools.html**
2	**https://www.softwaretestinghelp.com/big-data-tools/**
3	**https://www.vssmonitoring.com/best-big-data-analytics-tools/**
4	**https://www.ibm.com/analytics/hadoop/big-data-analytics**

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E CSE	20MC3E5	INTERNET OF THINGS	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	Identify and design the new models for market strategic interaction.	K3	1
CO2	Construct business intelligence and information security for IoT	K6	1,2
CO3	Compare various protocols for IoT.	K4	2
CO4	Develop a middleware for IoT.	K6	3,4
CO5	Analyze the different models for network dynamics	K4	5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	Group Presentation & Cooperative Learning Report
	4	Model Examination
	5	End Semester Examination
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**BASICS OF INTERNET OF THINGS**	**9**
Definitions and Functional Requirements – Motivation – Architecture – Web 3.0 View of IoT – Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT –Toolkit Approach for End-user Participation in the Internet of Things – Middleware for IoT: Overview – Communication Middleware for IoT – IoT InformationSecurity		
Topic - 2	**IOT PROTOCOLS**	**9**
Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BAC Net Protocol– Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security.		
Topic - 3	**WEB OF THINGS**	**9**
Web of Things versus Internet of Things – Two Pillars of the Web – Architecture standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence – Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards –Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.		
Topic - 4	**IOT MODELS**	**9**
Integrated Billing Solutions in the Internet of Things – Business Models for the Internet of Things – Network Dynamics: Population Models – Information Cascades – Network Effects – Network Dynamics: Structural Models – Cascading Behavior in Networks – Small World Phenomenon		
Topic - 5	**APPLICATIONS OF IOT**	**9**
Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments –Resource Management in the Internet of Things: Clustering– Synchronization and Software Agents –Applications Smart Grid Electrical Vehicle Charging		

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

BOOK REFERENCES	
1	Honbo Zhou, —The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2015.
2	Dieter Uckelmann, Mark Harrison and Florian Michahelles, —Architecting the Internet of Things‖, Springer, 2011.
3	David Easley and Jon Kleinberg, —Networks, Crowds, and Markets: Reasoning About a Highly Connected World‖,Cambridge University Press, 2010.
4	Olivier Hersent, Omar Elloumi and David Boswarthick, —The Internet of Things: Applications to the Smart Grid and Building Automation‖, Wiley, 2012.

OTHER REFERENCES	
1	**https://en.wikipedia.org/wiki/Internet_of_things**
2	**https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT**
3	**https://www.oracle.com/in/internet-of-things/what-is-iot/**
4	**https://www.ibm.com/blogs/internet-of-things/what-is-the-iot/**

Semester	Programme	Course Code	Course Name	L	T	P	C
III	M.E - CSE	20MC3E6	DIGITAL FORENSICS	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 digital investigation and find the evidence for the given problem.	K4	1
CO2	Utilize many sources in collecting the evidences	K3	2
CO3	Analyze and document an investigation.	K4	3
CO4	Analyze various digital forensics to gain information.	K4	4
CO5	Explain about building a career on digital forensics to acquire knowledge	K2	5

PRE-REQUISITE	NIL

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

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	Group Presentation & Cooperative Learning Report
	4	Model Examination
	5	End Semester Examination
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**ANATOMY OF DIGITAL INVESTIGATIONS**	**9**
Digital Forensics Fundamentals: What is Forens Webics -understanding the scope of investigation-the art of documentation -the laws affecting forensic investigation- constitutional implications of forensic investigation- the right to privacy-the expert witness-popular myths about computer forensics, its importance-types of forensic evidence recovered-skills to be possessed by a computer forensic investigator.		
Topic - 2	**EVIDENCE COLLECTION AND DATA SEIZURE**	**9**
Search warrants-what is a search and when it is legal-the warrantless search-legislated. privacy concerns- general privacy -privacy in healthcare and education-privileged information-the admissibility of evidence-the first response and the digital investigator- forensics and controlling the scene of the crime-handling evidence- acquiring evidence in computer Forensics lab: Lab requirements-private sector forensic lab-extracting evidence from a device.		
Topic - 3	**DATA ACQUISITION, ANALYSIS, DOCUMENTING THE INVESTIGATION**	**9**
Data acquisition-memory and running process-acquiring media-finding lost files: file recovery-the deleted file -data carving-document analysis; file identification-understanding metadata-mining the temporary files- identifying the alternate places of hiding data-online investigations: working undercover-website evidence- background searches-online crime-capturing online communications, Documenting: Obtaining evidence- seizing evidence-documenting the evidence- Using tools - writing reports-using expert witnesses at trial- admissibility of digital evidence.		
Topic - 4	**TOOLS-FORENSICS IN EMAIL, WEB, NETWORKS**	**9**
Email: Email technology-information stores-the anatomy of an email-an approach to email analysis, Web: Internet addresses-web browsers-web servers, proxy servers, DHCP servers ,SMTP servers, DNS servers, routers ,IDS, Firewalls, ports, Networks: Searching the network- an eagle's eye view-initial response- understanding the OSI model- advanced persistent threats-investigating a network attack-proactive collection of evidence-post incident collection of evidence-router and switch forensics.		
Topic - 5	**FORENSIC WORKSTATION AND BUSINESS OF DIGITAL FORENSICS**	**9**
What is a forensic workstation?-building a forensic workstation from scratch-licensing and certification: digital forensic certification-vendor neutral certification programs- vendor specific certification program- digital forensic Licensing requirements-starting and maintaining a forensic organization, generating revenue,organizational Certification.		

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

BOOK REFERENCES	
1	Andrew Hoog, ―Android Forensics: Investigation, Analysis and Mobile Security for Google Android‖, Elsevier publications,2011.
2	Angus M.Marshall, ―Digital forensics: Digital evidence in criminal investigation‖, John – Wiley and Sons, 2008.

OTHER REFERENCES	
1	**https://en.wikipedia.org/wiki/Digital_forensics**
2	**https://www.eccouncil.org/what-is-digital-forensics/**
3	**https://www.digitalforensics.com/**
4	**https://youtu.be/Er0okQM7sTo**