KNOWLEDGE INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

Approved by AICTE, Affiliated to Anna University, Chennai.
Accredited by NBA (CSE, ECE, EEE & MECH), Accredited by NAAC with 'A' Grade
KIOT Campus, Kakapalayam (PO), Salem – 637 504, Tamil Nadu, India.

M.E. / M.Tech. Regulations 2023

M.E. – Computer Science and Engineering

Curriculum and Syllabi

(For the Students Admitted from the Academic Year 2023-24 Onwards)

Version: 1.0	**Date:** 09.09.2023

	KNOWLEDGE INSTITUTE OF TECHNOLOGY(AUTONOMOUS), SALEM -637504	
	Approved by AICTE, Affiliated to Anna University, Accredited by NAAC and NBA (B.E.:Mech., ECE, EEE & CSE)	
	Website: www.kiot.ac.in	Version 1.0

M.E. / M.Tech. REGULATIONS 2023 (R 2023)

CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

M.E. COMPUTER SCIENCE AND ENGINEERING

VISION OF THE INSTITUTE
• To be a world class institution to impart value and need based professional education to the aspiring youth and carving them into disciplined world class professional who have the quest for excellence, achievement orientation and social responsibilities

MISSION OF THE INSTITUTE	
A	To promote academic growth by offering state-of-art undergraduate, postgraduate and doctoral programs and to generate new knowledge by engaging in cutting – edge research
B	To nurture talent, innovation, entrepreneurship, all-round personality and value system among the students and to foster competitiveness among students
C	To undertake collaborative projects which offer opportunities for long-term interaction with academia and industry
D	To pursue global standards of excellence in all our endeavors namely teaching, research, consultancy, continuing education and support functions

VISION OF THE DEPARTMENT
To create globally competent software professionals with social values to cater the ever-changing industry requirements.

MISSION OF THE DEPARTMENT	
M1	To provide appropriate infrastructure to impart need-based technical education through effective teaching and research.
M2	To involve the students in collaborative projects on emerging technologies to fulfill the industrial requirements.
M3	To render value based education to students to take better engineering decision with social consciousness and to meet out the global standards.
M4	To inculcate leadership skills in students and encourage them to become a Globally competent professional.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	Develop proficiency as a computer science engineer with an ability to solve a wide range of computational problems and have sustainable development in industry or any other work environment.
PEO 2	Possess the ability to think analytically and logically to understand technical problems with computational systems for a lifelong learning which leads to pursuing research.
PEO 3	Strongly focus on design thinking and critical analysis to create innovative products and become entrepreneurs.

PROGRAM OUTCOMES (POs)	
Engineering Graduates will be able to:	
PO1	An ability to independently carry out research / investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.
PO4	Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms.
PO5	Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas.
PO6	Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation.

KNOWLEDGE INSTITUTE OF TECHNOLOGY(AUTONOMOUS), SALEM – 637504											
M.E. COMPUTER SCIENCE AND ENGINEERING									Version : 1.0		
Courses of Study and Scheme of Assessment (Regulations 2023)									Date : 09.09.23		
Sl. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
SEMESTER I											
-	-	Induction Programme	-	-	-	-	-	-	-	-	-
	THEORY										
1.	ME23MA103	Applied Probability and Statistics for Computer Science Engineers	FC	4	3	1	0	4	40	60	100
2.	ME23RM201	Research Methodology and IPR	RM	3	2	1	0	3	40	60	100
3.	ME23CP301	Advanced Data Structures and Algorithms	PC	3	3	0	0	3	40	60	100
4.	ME23CP302	Database Practices	PC	3	3	0	0	3	40	60	100
5.	ME23CP303	Network Technologies	PC	3	3	0	0	3	40	60	100
6.	ME23CP304	Principles of Programming Languages	PC	3	3	0	0	3	40	60	100
7.	ME23AC7XX	Audit Course – I*	AC	2	2	0	0	NC	40	60	100
	PRACTICALS										
8.	ME23CP305	Advanced Data Structures and Algorithms Laboratory	PC	4	0	0	4	2	60	40	100
9.	ME23CP306	Database Practices Laboratory	PC	4	0	0	4	2	60	40	100
	EMPLOYABILITY ENHANCEMENT										
10.	ME23PT801	Technical Seminar / Case Study Presentation / Presentation	EEC	2	0	0	2	0	100	-	100
TOTAL				**31**	**19**	**2**	**10**	**23**	**500**	**500**	**1000**
SEMESTER II											
	THEORY										
1.	ME23CP307	Advanced Software Engineering	PC	3	3	0	0	3	40	60	100
2.	ME23CP308	Multicore Architecture and Programming	PC	3	3	0	0	3	40	60	100
3.	ME23MC701	Universal Human Values and ethics	MC	3	3	0	0	3	40	60	100
4.	ME23CP4XX	Professional Elective - I	PE	3	3	0	0	3	40	60	100
5.	ME23CP4XX	Professional Elective - II	PE	3	3	0	0	3	40	60	100
6.	ME23AC7XX	Audit Course – II*	AC	2	2	0	0	0	40	60	100
7.	ME23XX5XX	Open Elective - I	OE	3	3	0	0	3	40	60	100
	PRACTICALS										
8.	ME23CP309	Software Engineering Laboratory	PC	2	0	0	2	1	60	40	100
	EMPLOYABILITY ENHANCEMENT										
9.	ME23PT802	Research Paper Review and Presentation	EEC	2	0	0	2	1	100	-	100
TOTAL				**24**	**20**	**0**	**4**	**20**	**440**	**460**	**900**

*Audit Course is Optional

KNOWLEDGE INSTITUTE OF TECHNOLOGY(AUTONOMOUS), SALEM – 637504												
M.E. COMPUTER SCIENCE AND ENGINEERING											Version : 1.0	
Courses of Study and Scheme of Assessment (Regulations 2023)											Date : 09.09.23	
Sl. No.	Course Code	Course Title	Periods / Week						Maximum Marks			
			CAT	CP	L	T	P	C	IA	ESE	Total	
	SEMESTER III											
	THEORY											
1.	ME23CP310	Security Practices	PC	3	3	0	0	3	40	60	100	
2.	ME23CP4XX	Professional Elective - III	PE	3	3	0	0	3	40	60	100	
3.	ME23XX5XX	Open Elective - II	OE	3	3	0	0	3	40	60	100	
	THEORY CUM PRACTICAL											
4.	ME23CP4XX	Professional Elective - IV	PE	5	3	0	2	4	50	50	100	
5.	ME23CP311	Internet of Things	PC	5	3	0	2	4	50	50	100	
	PRACTICAL											
6.	ME23CP601	Project Work – Phase I	PW	12	0	0	12	6	60	40	100	
TOTAL				31	15	0	16	23	280	320	600	
SEMESTER IV												
	PRACTICAL											
1.	ME23CP602	Project Work –Phase II	PW	24	0	0	24	12	60	40	100	
TOTAL				24	0	0	24	12	60	40	100	

PROFESSIONAL ELECTIVES											
SEMESTER II (Professional Electives - I & II)											
S. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1.	ME23CP401	Cloud Computing Technologies	PE	3	3	0	0	3	40	60	100
2.	ME23CP402	Foundations of Data Science	PE	3	3	0	0	3	40	60	100
3.	ME23CP403	Agile Methodologies	PE	3	3	0	0	3	40	60	100
4.	ME23CP404	Digital Image Processing	PE	3	3	0	0	3	40	60	100
5.	ME23CP405	Machine Learning	PE	3	3	0	0	3	40	60	100
6.	ME23CP406	Software Quality Assurance	PE	3	3	0	0	3	40	60	100
7.	ME23CP407	Autonomous Systems	PE	3	3	0	0	3	40	60	100
8.	ME23CP408	Big Data Mining and Analytics	PE	3	3	0	0	3	40	60	100
SEMESTER III (Professional Electives- III & IV)											
S. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
1.	ME23CP409	Web Services and API Design	PE	3	3	0	0	3	40	60	100

2.	ME23CP410	Data Visualization Techniques	PE	3	3	0	0	3	40	60	100
3.	ME23CP411	Compiler Optimization Techniques	PE	3	3	0	0	3	40	60	100
4.	ME23CP412	Robotics	PE	3	3	0	0	3	40	60	100
5.	ME23CP413	Devops and Micro services	PE	5	3	0	2	4	50	50	100
6.	ME23CP414	Deep Learning	PE	5	3	0	2	4	50	50	100
7.	ME23CP415	Block chain Technologies	PE	5	3	0	2	4	50	50	100
8.	ME23CP416	Full Stack Web Application Development	PE	5	3	0	2	4	50	50	100

OPEN ELECTIVES											
S. No.	**Course Code**	**Course Title**	**Periods / Week**						**Maximum Marks**		
			CAT	**CP**	**L**	**T**	**P**	**C**	**IA**	**ESE**	**Total**
Except M.E. Computer Science and Engineering											
1.	ME23CP501/ ME23CP310	Security Practices	OE	3	3	0	0	3	40	60	100
2.	ME23CP502/ ME23CP401	Cloud Computing Technologies	OE	3	3	0	0	3	40	60	100
3.	ME23CP503/ ME23CP415	Block chain Technologies	OE	3	3	0	0	3	40	60	100
4.	ME23CP504/ ME23CP414	Deep Learning	OE	3	3	0	0	3	40	60	100
5.	ME23CP505	Design Thinking	OE	3	3	0	0	3	40	60	100
6.	ME23CP506	Principles of Multimedia	OE	3	3	0	0	3	40	60	100
Except M.E. Industrial Safety Engineering											
7.	ME23IS501	Environmental Safety	OE	3	3	0	0	3	40	60	100
8.	ME23IS502	Electrical safety	OE	3	3	0	0	3	40	60	100
9.	ME23IS503	Safety in Engineering Industry	OE	3	3	0	0	3	40	60	100
10.	ME23IS504	Design of Experiments	OE	3	3	0	0	3	40	60	100
11.	ME23IS505	Circular Economy	OE	3	3	0	0	3	40	60	100
Except M.E. Embedded System Technologies											
12.	ME23ET501 / ME23ET310	IoT for Smart Systems	OE	3	3	0	0	3	40	60	100
13.	ME23ET502 / ME23ET408	Machine Learning and Deep Learning	OE	3	3	0	0	3	40	60	100
14.	ME23ET503	Renewable Energy Technology	OE	3	3	0	0	3	40	60	100
15.	ME23ET504 / ME23ET423	Smart Grid	OE	3	3	0	0	3	40	60	100
Except M.E. VLSI Design											
16.	ME23VL501	Big Data Analytics	OE	3	3	0	0	3	40	60	100
17.	ME23VL502	Internet of Things and Cloud	OE	3	3	0	0	3	40	60	100
18.	ME23VL503	Medical Robotics	OE	3	3	0	0	3	40	60	100
19.	ME23VL504	Embedded Automation	OE	3	3	0	0	3	40	60	100

FOUNDATION COURSES (FC)							
Sl. No.	**COURSE CODE**	**COURSE TITLE**	**PERIODS / WEEK**			**CREDITS**	**SEM**
			Lecture	Tutorial	Practical		

1	ME23MA103	Applied Probability and Statistics for Computer Science Engineers	3	1	0	4	I

AUDIT COURSES / MANDATORY COURSE							
AUDIT COURSES (Optional Courses)							
Sl. No.	COURSE CODE	COURSE TITLE	PERIODS / WEEK			CREDITS	SEM
			Lecture	Tutorial	Practical		
1.	ME23AC701	English for Research Paper Writing	2	0	0	0	I / II
2.	ME23AC702	Disaster Management	2	0	0	0	I / II
3.	ME23AC703	Constitution of India	2	0	0	0	I / II
4.	ME23AC704	நற்றமிழ் இலக்கியம்/ Heritage of Tamil	2	0	0	0	I / II
5.	ME23MC701	Universal Human Values and professional ethics	3	0	0	3	II

SEMESTER-WISE CREDITS DISTRIBUTION

SUMMARY							
Sl. No.	Course Category	Credits per Semester				Credits	Credit %
		I	II	III	IV		
1.	FC	4	-	-	-	4	5
2.	RM	3	-	-	-	3	4
3.	PC	16	7	8	-	31	40
4	PE	-	6	6	-	12	15
5.	OE	-	3	3	-	6	8
6.	PW	-	-	6	12	18	23
7.	MC/AC	-	3	-	-	3	4
8.	EEC	-	1	-	-	1	1
	Total	**23**	**20**	**23**	**12**	**78**	**100**

AT	Category of Course	FC	Foundation Courses	MC	Mandatory Courses
CP	Contact Period	PC	Professional Core Courses	AC	Audit Courses
L	Lecture Period	PE	Professional Elective Courses	IA	Internal Assessment
T	Tutorial Period	OE	Open Elective Courses	ESE	End Semester Examination
P	Laboratory Period	PW	Project Work Courses		
C	Credits	EEC	Employability Enhancement Courses		

ME23MA103	APPLIED PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE ENGINEERS	Version: 1.0				
Programme & Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		4	3	1	0	4

Course Objectives:

1.	To encourage students to develop a working knowledge of the central ideas of Linear Algebra.
2.	To enable students to understand the concepts of Probability and Random Variables.
3.	To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the central limit Theorem.
4.	To apply the small / large sample tests through Tests of hypothesis.
5.	To enable the students to use the concepts of multivariate normal distribution and principal components analysis.

UNIT–I	LINEAR ALGEBRA	9+3

Vector spaces (L1)– norms (L1) – Inner Products (L2) – Eigenvalues using QR transformations (L3) – QR Factorization (L3) – generalized eigenvectors (L2) – Canonical forms (L2) – singular value Decomposition (L3) and applications – pseudo inverse (L3) – least square approximations (L3).

UNIT–II	PROBABILITY AND RANDOM VARIABLES	9+3

Probability (L1) – Axioms of probability(L2) – Conditional probability(L2) – Baye"s theorem(L3) – Random Variables (L1)– Probability function (L2) – Moments (L2) – Moment generating functions (L3) and their Properties (L2) – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal Distributions (L3) – Function of a random variable (L2).

UNIT– III	TWO DIMENSIONAL RANDOM VARIABLES	9+3

Joint distributions (L2) – Marginal and conditional distributions (L3) – Functions of two - dimensional random variables (L3) – Regression curve (L3) – Correlation (L3).

UNIT – IV	TESTING OF HYPOTHESIS	9+3

Sampling distributions (L1) – Type I and Type II errors (L2) – Small and Large samples (L3) – Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions (L3) – Tests for independence of attributes and goodness of fit (L3).

UNIT–V	MULTIVARIATE ANALYSIS	9+3

Random vectors and matrices(L2) – Mean vectors and covariance matrices(L3) – Multivariate normal density(L2) and its properties(L2) – Principal components(L2) – Population principal components(L3) – Principal components from standardized variables(L3).

OPEN ENDED PROBLEMS / QUESTIONS

Course specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.

Total : 60 PERIODS

Course Outcomes: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Apply the concepts of Linear Algebra to solve practical problems.	L3 – Apply
CO2	Use the ideas of probability and random variables in solving engineering problems.	L3 – Apply
CO3	Be familiar with some of the commonly encountered two dimensional random variables andbe equipped for a possible extension to multivariate analysis	L3 – Apply
CO4	Use statistical tests in testing hypotheses on data.	L3 – Apply
CO5	Develop critical thinking based on empirical evidence and the scientific approach to knowledge development.	L3 – Apply

REFERENCE BOOKS:	
1.	Dallas E Johnson, "Applied multivariate methods for data Analysis", Thomson and Duxburypress, Singapore, 1998.
2.	Richard A. Johnson and Dean W. Wichern, "Applied multivariate statistical Analysis",Pearson Education, Fifth Edition, 6th Edition, New Delhi, 2013.
3.	Bronson, R.,"Matrix Operation" Schaum"s outline series,Tata McGraw Hill, New York, 2011.
4.	Oliver C. Ibe, "Fundamentals of Applied probability and Random Processes", Academic Press, Boston, 2014.
5.	Johnson R. A. and Gupta C.B., "Miller and Freund"s Probability and Statistics for Engineers", Pearson India Education, Asia, 9th Edition, New Delhi, 2017.
VIDEO REFERENCES:	
1.	https://youtu.be/14PQawp_rjk (Dr.Somesh kumar IIT-Kharagpur)
2.	https://youtu.be/IEUTRhyoHNc (Prof Jharaeswar maiti IIT-Kharagpur)
WEB REFERENCES:	
1.	https://www.edanz.com/blog/anova-explained
2.	http://stankova.net/book.pdf
ONLINE COURSES:	
1.	https://nptel.ac.in/courses/110105087
2.	https://onlinecourses.nptel.ac.in/noc23_ge25/preview

Mapping of COs with POs and PSOs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	3			1
CO2	3		2	2		3
CO3			1		3	2
CO4	2	1	3	2	2	2
CO5	2	2	1		1	2
Average	2	1.6	2	2	2	2

1–Low, 2 –Medium, 3–High.

ME23RM201	RESEARCH METHODOLOGY AND IPR	Version: 1.0
(COMMON TO ALL BRANCHES)		
Programme & Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP: 3, L: 2, T: 1, P: 0, C: 3

Course Objectives:

1.	Analyze the significance of research and formulate well-defined research questions.
2.	Apply appropriate research methods and critically evaluate research articles.
3.	Create well-structured research papers and utilize research tools proficiently.
4.	Produce effective technical reports and deliver impactful presentations.
5.	Understand forms of intellectual property and analyze their implications on technological research and international cooperation.

UNIT–I	CONCEPT OF RESEARCH	6+3

Meaning and Significance of Research (L2)-Skills, Habits and Attitudes for Research (L1)-Time Management (L3) -Status of Research in India (L2)-Why, How, and What a Research is? (L2)-Types and Process of Research (L2)-Outcome of Research (L2)-Sources of Research Problem (L2)-Characteristics of a Good Research Problem (L2)-Errors in Selecting a Research Problem (L2)-Importance of Keywords (L1)-Literature Collection - Analysis (L2)-Citation Study - Gap Analysis (L2)-Problem Formulation Techniques (L2).

UNIT–II	RESEARCH METHODS AND JOURNALS	6+3

Interdisciplinary Research (L2)-Need for Experimental Investigations (L2)-Data Collection Methods (L3)-Appropriate Choice of Algorithms / Methodologies / Methods (L3)-Measurement and Result Analysis (L3)-Investigation of Solutions for Research Problem (L3)-Interpretation (L2)-Research Limitations (L4)-Journals in Science/Engineering (L2)-Indexing and Impact factor of Journals (L2)-Citations(L2)- h Index (L2)- i10 Index (L2)-Journal Policies (L4)How to Read a Published Paper (L2)-Ethical Issues Related to Publishing(L3)- Plagiarism and Self-Plagiarism (L2).

UNIT–III	PAPER WRITING AND RESEARCH TOOLS	6+3

Types of Research Papers (L2) - Original Article/Review Paper/Short Communication/Case Study (L2) - When and Where to Publish? (L2) - Journal Selection Methods (L2) - Layout of a Research Paper (L2) - Guidelines for Submitting the Research Paper (L2) - Review Process - Addressing Reviewer Comments (L3) - Use of tools / Techniques for Research (L3) – Hands - on Training related to Reference Management Software - EndNote (L3)- Introduction to Origin, SPSS, etc (L2) - Software for Detection of Plagiarism (L2)

UNIT–IV	EFFECTIVE TECHNICAL THESIS WRITING/ PRESENTATION	6+3

How to Write a Report (L3) - Language and Style (L1) - Format of Project Report - Use of Quotations (L2) - Method of Transcription Special Elements (L2) - Title Page - Abstract - Table of Contents - Headings and Sub-Headings (L2) - Footnotes - Tables and Figures - Appendix - Bibliography etc. (L3) - Different Reference Formats (L2) - Presentation using PPTs (L2).

UNIT–V	NATURE OF INTELLECTUAL PROPERTY	6+3

Patents(L1) - Designs(L2) - Trade and Copyright (L2) - Process of Patenting and Development (L2) - Technological research(L2) - innovation(L2) - patenting(L2) - Development International Scenario (L2) - International Cooperation on Intellectual Property (L2) - Procedure for Grants of Patents (L2).

Total: 30 + 15 = 45 PERIODS

OPEN ENDED PROBLEMS /QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOMS Taxonomy**
CO1	Illustrate the importance and objectives of research in contributing to knowledge and solving real-world problems.	L2 – Understand
CO2	Experiment with data collection techniques, choosing fitting approaches to ensure sound research framework and methodology.	L3 – Apply
CO3	Interpret the components and structure of research papers, and apply this knowledge to create organized and effective academic documents.	L2 – Understand
CO4	Apply knowledge to produce engaging presentations and detailed technical reports that effectively communicate research findings.	L3 – Apply
CO5	Differentiate between types of intellectual property and comprehend patenting as essential for safeguarding innovation and creativity.	L4 – Analyze
REFERENCE BOOKS:		
1.	Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).	
2.	DePoy, Elizabeth, and Laura N. Gitlin, "Introduction to Research-E-Book: Understanding and Applying Multiple Strategies", Elsevier Health Sciences, 2015.	
3.	Walliman, Nicholas, "Research Methods: The basics", Routledge, 2017	
4.	Bettig Ronald V., "Copyrighting culture: The political economy of intellectual property", Routledge, 2018.	
VIDEO REFERENCES:		
1.	https://www.youtube.com/watch?v=1vf8ZvADxfY&list=PLLhSIFfDZcUWRlgiXMkd1rNeLSz1You4O	
2.	https://www.youtube.com/watch?v=eIUaS51U05M&list=PLIEVEMAFhG4_JmLtWGr6G0PRGB13xapyC	
WEB REFERENCES:		
1.	https://www.researchgate.net/	
ONLINECOURSES:		
1.	https://onlinecourses.nptel.ac.in/noc23_ge36/preview	
2.	https://onlinecourses.nptel.ac.in/noc22_hs59/preview	

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	2	3	2	3
CO2	3				1	3
CO3	3			1	1	2
CO4	3				1	1
CO5	3			1	1	1
Average	3	2	2	1.7	1.2	2
1–Low, 2 –Medium, 3–High.						

ME23CP301	ADVANCED DATA STRUCTURES AND ALGORITHMS	Version: 1.0				
Programme & Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To understand the usage of algorithms in computing
2.	To learn and use hierarchical data structures and its operations
3.	To learn the usage of graphs and its applications
4.	To select and design data structures and algorithms that is appropriate for problems
5.	To study about NP Completeness of problems.

UNIT–I	ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY ANALYSIS	9

Algorithms (L1) – Algorithms as a Technology (L2) - Time and Space complexity of algorithms (L3)- Asymptotic analysis (L4)-Average and worst-case analysis (L4) - Asymptotic notation (L3)- Importance of efficient algorithms (L2) - Program performance measurement (L4) - Recurrences: The Substitution Method (L3) – The Recursion-Tree Method (L3) - Data structures and algorithms (L2).

UNIT–II	HIERARCHICAL DATA STRUCTURES	9

Binary Search Trees: Basics (L1) – Querying a Binary search tree (L2) – Insertion and Deletion (L3)- Red Black trees: Properties of Red-Black Trees (L2) – Rotations (L2) – Insertion – Deletion (L3) – B - Trees: Definition of B – trees (L2) – Basic operations on B-Trees (L3) – Deleting a key from a B - Tree (L3) - Heap (L2) –Heap Implementation(L3) – Disjoint Sets(L3) - Fibonacci Heaps: structure (L2) – Mergeable (L2) - heap operations (L3) - Decreasing a key and deleting a node (L3) - Bounding the maximum degree (L3).

UNIT–III	GRAPHS	9

Elementary Graph Algorithms: Representations of Graphs (L1) – Breadth-First Search (L2) – Depth-First Search (L2) – Topological Sort (L2) – Strongly Connected Components (L3) - Minimum Spanning Trees: Growing a Minimum Spanning Tree (L2) – Kruskal and Prim (L3)- Single-Source Shortest Paths: The Bellman-Ford algorithm (L3) – Single-Source Shortest paths in Directed Acyclic Graphs (L2) – Dijkstra„s Algorithm (L3); Dynamic Programming - All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication (L2) – The Floyd-Warshall Algorithm (L3).

UNIT–IV	ALGORITHM DESIGN TECHNIQUES	9

Dynamic Programming: Matrix-Chain Multiplication (L2) – Elements of Dynamic Programming (L2) – Longest Common Subsequence (L3) - Greedy Algorithms: – Elements of the Greedy Strategy (L2)- An Activity - Selection Problem (L3) - Huffman Coding (L3).

UNIT–V	NP COMPLETE AND NP HARD	9

NP-Completeness: Polynomial Time (L2) – Polynomial-Time Verification (L3) – NP - Completeness and Reducibility (L3) – NP-Completeness Proofs (L4) – NP-Complete Problems (L4).

Total:- 45 PERIODS

OPEN ENDED PROBLEMS /QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

Course Outcomes: Upon completion of this course the students will be able to:		BLOOMS Taxonomy
CO1	Design data structures and algorithms to solve computing problems.	L2 – Understand
CO2	Choose and implement efficient data structures and apply them to solve problems.	L3 – Apply
CO3	Design algorithms using graph structure and various string-matching algorithms to solve real-life problems	L3 – Apply
CO4	Design one"s own algorithm for an unknown problem.	L2 – Understand
CO5	Apply suitable design strategy for problem solving.	L3 – Apply
REFERENCE BOOKS:		
1.	S.Sridhar," Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2014.	
2.	Adam Drozdex, "Data Structures and algorithms in C++", Cengage Learning, 4th Edition, 2013.	
3.	T.H. Cormen, C.E.Leiserson, R.L. Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2012.	
4.	Mark Allen Weiss, "Data Structures and Algorithms in C++", Pearson Education, 3rd Edition, 2009.	
5.	E. Horowitz, S. Sahni and S. Rajasekaran, "Fundamentals of Computer Algorithms", University Press, 2nd Edition, 2008.	
VIDEO REFERENCES:		
1.	https://youtu.be/8h80p_rYv1Y?si=6KMk6GYJpwRQ0pZj	
WEB REFERENCES:		
2.	https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/	
ONLINE COURSES:		
3.	https://www.coursera.org/learn/advanced-data-structures	

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	2	3	1	3
CO2	3	1			2	3
CO3	3		1	1		2
CO4	3	2	1		2	1
CO5	3	3	1	1		1
Average	3	2	1.3	1.7	1.7	2
1–Low, 2 –Medium, 3–High.						

ME23CP302	DATABASE PRACTICES	Version: 1.0				
Programme & Branch	M.E. COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	Describe the fundamental elements of relational database management systems.
2.	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
3.	Understand query processing in a distributed database system.
4.	Understand the basics of XML and create well-formed and valid XML documents.
5.	Distinguish the different types of NoSQL databases.

UNIT – I	RELATIONAL DATA MODEL	9

Entity Relationship Model (L2) – Relational Data Model (L2) – Mapping Entity Relationship Model to Relational Model (L2) – Relational Algebra (L3) – Structured Query Language (L3) – Database Normalization (L3).

UNIT – II	DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY	9

Distributed Database Architecture (L2) – Distributed Data Storage (L2) – Distributed Transactions (L3) – Distributed Query Processing (L3) – Distributed Transaction Management (L2)– Event Condition Action Model (L3) – Design and Implementation Issues for Active Databases (L2) – Open Database Connectivity (L3)

UNIT – III	XML DATABASES	9

Structured, Semi structured, and Unstructured Data (L2) – XML Hierarchical Data Model (L2)– XML Documents (L3) – Document Type Definition (L3) – XML Schema (L3) – XML Documents and Databases (L3)– XML Querying (L3) – XPath (L3)– XQuery (L3)

UNIT – IV	NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS	9

NoSQL (L2) – Categories of NoSQL Systems (L2) – CAP Theorem (L2)– Document -Based NoSQL Systems and MongoDB (L3) – MongoDB Data Model (L3) – MongoDB Distributed Systems Characteristics (L2) – NoSQL Key-Value Stores (L3) – DynamoDB Overview (L2) – Voldemort Key-Value Distributed Data Store (L3) – Wide Column NoSQL Systems (L2) – Hbase Data Model (L2) – Hbase Crud Operations (L3) – Hbase Storage and Distributed System Concepts (L2) – NoSQL Graph Databases and Neo4j (L3) – Cypher Query Language of Neo4j (L2) – Big Data (L2) – MapReduce – Hadoop (L2) – YARN (L2)

UNIT – V	DATABASE SECURITY	9

Database Security Issues (L2) – Discretionary Access Control Based on Granting and Revoking Privileges (L2) – Mandatory Access Control and Role-Based Access Control for Multilevel Security (L3) – SQL Injection (L3)– Statistical Database Security (L3) – Flow Control (L2) – Encryption and Public Key Infrastructures (L2)– Preserving Data Privacy (L2) – Challenges to Maintaining Database Security (L2) – Database Survivability (L2)– Oracle Label-Based Security (L3).

Total : 45 PERIODS

OPEN ENDED PROBLEMS /QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Outcomes: Upon completion of this course the students will be able to:		**BLOOM'S Taxonomy**
CO1	Convert the ER-model to relational tables, populate relational databases and formulate SQL queries on data.	L3 – Apply
CO2	Understand and write well-formed XML documents	L3 – Apply
CO3	Be able to apply methods and techniques for distributed query processing.	L3 – Apply
CO4	Design and Implement secure database systems.	L3 – Apply
CO5	Use the data control, definition, and manipulation languages of the NoSQL databases	L3 – Apply
REFERENCE BOOKS:		
1.	R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education 2016.	
2.	Henry F. Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2019.	
4.	R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education 2016.	
5.	Henry F. Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2019.	
6.	C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006	
7.	Raghu Ramakrishnan , Johannes Gehrke "Database Management Systems", Fourth Edition, McGraw Hill Education, 2015.	
VIDEO REFERENCES:		
1.	https://www.youtube.com/watch?v=ztHopE5Wnpc	
2.	https://www.youtube.com/watch?v=HXV3zeQKqGY	
WEB REFERENCES:		
1.	https://www.sqltutorial.org/	
2.	https://beginnersbook.com/2018/10/xml-tutorial-learn-xml/	
ONLINE COURSES:		
1.	https://www.udacity.com/course/sql-and-relational-databases--ud197	
2.	https://www.edx.org/professional-certificate/database-management-essentials	

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2	2	1	3	1	2
CO2	2	2		2	1	1
CO3	3	1	2	1		1
CO4	3	2	2	1	1	1
CO5	2	3	1	1		1
Average	2.4	2	1.5	1.6	1	1.2
1–Low, 2 –Medium, 3–High						

ME23CP303	NETWORK TECHNOLOGIES	Version: 1.0				
Programme & Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To understand the basic concepts of network.
2.	To explore various technologies in the wireless domain.
3.	To study about 4G and 5G cellular networks.
4.	To learn about Network Function Virtualization.
5.	To understand the paradigm of Software defined networks.

UNIT -I	NETWORKING CONCEPTS	9

Peer To Peer Vs Client (L2) - Server Networks (L2) - Network Devices (L2) - Network Terminology (L1) - Network Speeds (L2) - Network throughput, delay (L2) - OSI Model (L1) - Packets, Frames, And Headers (L2) - Collision And Broadcast Domains (L2) - LAN Vs WAN (L2) - Network Adapter(L3) – Hub (L3) – Switch (L3) – Router (L3) – Firewall (L1), IP addressing (L3).

UNIT–II	WIRELESS NETWORKS	9

Wireless access techniques (L2)- IEEE 802.11a, 802.11g, 802.11e, 802.11n/ac/ax/ay/ba/be (L2) QoS (L2) – Bluetooth (L3) – Protocol Stack (L2) – Security (L3) – Profiles (L2) – zigbee (L3)

UNIT–III	MOBILE DATA NETWORKS	9

4G Networks and Composite Radio Environment (L2) – Protocol Boosters(L2) – Hybrid 4G Wireless Networks Protocols (L2) – Green Wireless Networks (L2) – Physical Layer and Multiple Access (L2) – Channel Modelling for 4G (L2) – Concepts of 5G (L2) – channel access (L2) –air interface (L2) - Cognitive Radio spectrum management (L2) – C-RAN architecture (L2) - Vehicular communications-protocol (L2) – Network slicing (L2) – MIMO, mmWave, Introduction to 6G (L2).

UNIT–IV	SOFTWARE DEFINED NETWORKS	9

SDN Architecture (L1) - Characteristics of Software-Defined Networking (L1) - SDN- and NFV-Related Standards (L1) - SDN Data Plane(L2) - Data Plane Functions (L3) - Data Plane Protocols (L1) - OpenFlow Logical Network Device (L2) - Flow Table Structure (L2) - Flow Table Pipeline (L2) - The Use of Multiple Tables (L2) - Group Table (L2) - OpenFlow Protocol (L1) - SDN Control Plane Architecture (L2) - Control Plane Functions (L2) - Southbound Interface(L2) - Northbound Interface (L2) – Routing (L3) - ITU-T Model (L1) - Open Daylight: Open Daylight Architecture (L2) – Open Daylight Helium (L1)- SDN Application Plane Architecture (L2) - Northbound Interface (L2) - Network Services Abstraction Layer (L2) - Network Applications (L3) - User Interface (L3).

UNIT – V	NETWORK FUNCTIONS VIRTUALIZATION	9

Motivation (L1) - Virtual Machines (L2) – NFV benefits (L1) – requirements (L2) – architecture (L2) - NFV Infrastructure (L3) - Virtualized Network Functions (L2) - NFV Management and Orchestration (L2)- NFV Use Cases (L2) - NFV and SDN (L2) – Network virtualization – VLAN and VPN (L2)

Total:- 45 PERIODS

OPEN ENDED PROBLEMS /QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOMS Taxonomy**
CO1	Explain basic networking concepts	L3 – Apply
CO2	Build different wireless networking protocols	L3 – Apply
CO3	Describe the developments in each generation of mobile data networks	L2 – Understand
CO4	Determine and develop SDN based applications	L3 – Apply
CO5	Experiment with the concepts of network function virtualization	L3 – Apply

REFERENCEBOOKS:

1.	James Bernstein, "Networking made Easy", 2018.
2.	HoudaLabiod, Costantino de Santis, HossamAfifi "Wi-Fi, Bluetooth, Zigbee and WiMax", Springer 2007
3.	Erik Dahlman, Stefan Parkvall, Johan Skold, 4G: LTE/LTE-Advanced for Mobile Broadband, Academic Press, 2013
4.	Saad Z. Asif "5G Mobile Communications Concepts and Technologies" CRC press – 2019
5.	William Stallings "Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud" 1st Edition, Pearson Education, 2016.
6.	Thomas D.Nadeau and Ken Gray, SDN – Software Defined Networks, O"Reilly Publishers, 2013.
7.	Guy Pujolle, "Software Networks", Second Edition, Wiley-ISTE, 2020

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	3	2		1	
CO2	1	3	3	3		1
CO3	1	3	3	2	2	2
CO4	1	2	2	1	2	1
CO5	1	3	1	1	1	2
Average	1	2.8	2.2	1.8	1.5	1.5
1–Low, 2 –Medium, 3–High						

ME23CP304	PRINCIPLES OF PROGRAMMING LANGUAGES	Version: 1.0				
Programme & Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To understand and describe syntax and semantics of programming languages
2.	To understand data, data types, and basic statements
3.	To understand call-return architecture and ways of implementing them
4.	To understand object-orientation, concurrency, and event handling in programming languages
5.	To develop programs in non-procedural programming paradigms

UNIT–I	SYNTAX AND SEMANTICS	9

Evolution of programming languages (L1) – describing syntax (L1) – context (L2) – free grammars (L2) – attribute grammars (L1) – describing semantics (L1) – lexical analysis (L3) – parsing (L1) – recursive (L2) – descent (L2) – bottom (L2) - up parsing

UNIT–II	DATA, DATA TYPES, AND BASIC STATEMENTS	9

Names (L1) – variables (L2) – binding (L1) – type checking (L1) – scope (L2) – scope rules(L2) – lifetime and garbage collection (L1) – primitive data types (L2) – strings (L2) – array types (L1) – associative arrays (L2) – record types (L1) – union types (L2) – pointers and references (L1) – Arithmetic expressions (L2) – overloaded operators (L3) – type conversions (L2) – relational and boolean expressions (L2) – assignment statements (L3) – mixed (L2) - mode assignments (L1) – control structures (L2) – selection (L1) – iterations – branching (L2) – guarded statements (L1)

UNIT–III	SUBPROGRAMS AND IMPLEMENTATIONS	9

Subprograms (L1) – design issues (L2) – local referencing (L1) – parameter passing (L2) – overloaded methods (L3) – generic methods (L1) – design issues for functions (L2) – semantics of call and return (L3) – implementing simple subprograms (L2) – stack and dynamic local variables (L2) – nested subprograms (L1) – blocks (L1) – dynamic scoping (L1)

UNIT–IV	OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING	9

Object-orientation (L1) –design issues for OOP languages (L2) – implementation of object (L1) - oriented constructs (L2) – concurrency (L3) – semaphores (L3) – monitors (L2) – message passing (L21 – threads (L2) – statement level concurrency (L2) – exception handling (L2) – event handling (L1)

UNIT–V	FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES	9

Introduction to lambda calculus (L2) – fundamentals of functional programming languages (L3) – Programming with Scheme (L1) – Programming with ML (L3) – Introduction to logic and logic programming (L2) – Programming with Prolog (L3) – multi-paradigm languages (L1)

Total:- 45 PERIODS

OPEN ENDED PROBLEMS /QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOMS Taxonomy**
CO1	Describe syntax and semantics of programming languages	L2 – Understand
CO2	Explain data, data types, and basic statements of programming languages	L3 – Apply
CO3	Design and implement subprogram constructs	L3 – Apply
CO4	Apply object-oriented, concurrency, and event handling programming constructs	L3 – Apply
CO5	Develop programs in Scheme, ML, and Prolog and Understand and adopt new programming language	L3 – Apply
REFERENCE BOOKS:		
1.	Robert W. Sebesta, "Concepts of Programming Languages", Eleventh Edition, Addison Wesley, 2012	
2.	W. F. Clocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003	
3.	Michael L.Scott, "Programming Language Pragmatics", Fourth Edition, Morgan Kaufmann, 2009.	
4.	R.KentDybvig,"TheSchemeprogramminglanguage",FourthEdition,MITPress, 2009	
5.	W.F.ClocksinandC.S.Mellish,"ProgramminginProlog:UsingtheISOStandard", Fifth Edition, Springer, 2003	

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1					1
CO2	1	1			1	2
CO3	1	1			1	2
CO4		2	1	1	2	2
CO5	1	2	1		2	3
Average	1	1.7	1	1	1.5	2

ME23CP305	ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY	Version: 1.0				
Programme & Branch	M.E –COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		4	0	0	4	2

Course Objectives:

1.	To acquire the knowledge of using advanced tree structures.
2.	To learn and usage of heap structures.
3.	To understand the usage of graph structures and spanning trees.
4.	To understand the problems such as matrix chain multiplication, activity selection and Huffman coding.
5.	To understand the necessary mathematical abstraction to solve problems.

List of Experiments / Exercises

1.	Implementation of recursive functions for tree traversal and Fibonacci.
2.	Implementation of iteration functions for tree traversal and Fibonacci.
3.	Implementation of Merge Sort and Quick Sort.
4.	Implementation of a Binary Search Tree.
5.	Red-Black Tree Implementation.
6.	Heap Implementation.
7.	Fibonacci Heap Implementation.
8.	Graph Traversals.
9.	Spanning Tree Implementation.
10.	Shortest Path Algorithms (Dijkstra's algorithm, Bellman Ford Algorithm).
11.	Implementation of Matrix Chain Multiplication.
12.	Activity Selection and Huffman Coding Implementation.

Total: 60 PERIODS

HARDWARE/SOFTWARE REQUIREMENTS

1.	64-bit Open source Linux or its derivative.
2.	Open Source C++ Programming tool like G++/GCC.

Course Outcomes: Upon completion of this course the students will be able to:		**BLOOM'S Taxonomy**
1.	Design and implement basic and advanced data structures	L3 – Apply
2.	Design algorithms using graph structures.	L3 – Apply
3.	Design and develop efficient algorithms with minimum complexity using design techniques.	L3 – Apply
4.	Develop programs using various algorithms.	L3 – Apply
5.	Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.	L3 – Apply

REFERENCES :	
1.	Lipschutz Seymour, "Data Structures Schaum's Outlines Series", Tata McGraw Hill, 3rd Edition, 2014.
2.	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3.	http://www.coursera.org/specializations/data-structures-algorithms
4.	http://www.tutorialspoint.com/data_structures_algorithms
5.	http://www.geeksforgeeks.org/data-structures/

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	1		1	1	
CO2	1		1	2	2	1
CO3	1	1	1	1	2	1
CO4	1	2	2	2	2	1
CO5		2	3	1	3	1
Average	1	1.5	1.75	1.4	2	1
1–Low, 2 –Medium, 3–High						

ME23CP306	DATABASE PRACTICES LABORATORY	Version: 1.0				
Programme & Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		4	0	0	4	2

Course Objectives:

1.	Execute the foundational components of relational database management systems.
2.	Explore the fundamental concepts of the relational data model, entity-relationship model, relational database design, relational algebra, and SQL through experimentation.
3.	Perform query processing within a distributed database system.
4.	Analyze the fundamentals of XML and generate XML documents that are well-formed and valid.
5.	Distinguish the different types of NoSQL databases.

List of Experiments / Exercises

1.	Implementation of Data Definition Language • Create, Alter and Drop • Enforce Primary Key, Foreign Key, Check, Unique and Not Null Constraints • Creating Views
2.	Implementation of Data Manipulation Language • Insert, Delete, Update • Cartesian Product, Equi Join, Left Outer Join, Right Outer Join and Full Outer Join Aggregate Functions • Set Operations • Nested Queries
3.	Implementation of Transaction Control Language. • Commit, Rollback and Save Points
4.	Implementation of Distributed Database Design.
5.	Implementation of Row Level and Statement Level Triggers.
6.	Implementation of Accessing a Relational Database using PHP, Python and R.
7.	Creating XML Documents, Document Type Definition and XML Schema.
8.	Using a Relational Database to store the XML documents as text and data elements.
9.	Creating or publishing customized XML documents from pre-existing relational databases.
10.	Extracting XML Documents from Relational Databases.
11.	Creating Databases using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j.
12.	Implementing Access Control in Relational Databases.

Total: 60 PERIODS

Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
1.	Transform the ER model into relational tables, populate the relational databases, and create SQL queries to retrieve data.	L3 – Apply
2.	Gain a comprehension of well-formed XML documents and be able to write them proficiently.	L3 – Apply
3.	Develop the ability to utilize methods and techniques for distributed query processing.	L3 – Apply
4.	Create and execute secure database systems through design and implementation.	L3 – Apply
5.	Utilize the data control, definition, and manipulation languages specific to NoSQL databases.	L3 – Apply

Mapping of COs with POs and PSOs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	3	1	2
CO2	2	2		2	1	1
CO3	3	1	2	1		1
CO4	3	2	2	1	1	1
CO5	2	3	1	1		1
Average	2.4	2	1.5	1.6	1	1.2
1–Low, 2 –Medium, 3–High						

ME23PT801	TECHNICAL SEMINAR / CASE STUDY PRESENTATION	Version : 1.0
(COMMON TO ALL BRANCHES)		

Programme & Branch	M.E. COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		2	0	0	2	0

Course Objectives:

1.	To encourage the students to study advanced engineering developments.
2.	To prepare and present the technical and case study reports.

Method of Evaluation:

The students need to identify an area of interest or topic in their programme of study or case study and prepare a 5-10 page report and a presentation. Based on the report and presentation, the course is evaluated for 100 marks. Minimum 50 marks is essential to pass. In case a student fails, he / she has to make such presentation in the subsequent semesters. The evaluation guidelines will be issued by the Head of the Department before the commencements of the course. The objectives are improving literature searching capabilities, comprehension and ability to write reports and to make presentations. It is assessed in Internal Assessment mode only and no End Semester Examination.

Total : 30 PERIODS

Course Outcomes: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Perform the review and present technological developments in their field	L3 - Apply
CO2	Interpret the case study report and make a decision	L3 - Apply

Mapping of COs with POs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1		3				
2		3				
Average		3				
1–Low, 2 –Medium, 3–High.						

ME23CP307	ADVANCED SOFTWARE ENGINEERING	Version: 1.0				
Programme& Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Instructions if any

Course Objectives:

1.	To understand the rationale for software development process models
2.	To understand why the architectural design of software is important
3.	To understand the five important dimensions of dependability, namely, availability,reliability, safety, security and resilience
4.	To understand the basic notions of a web service, web service standards and service-oriented architecture
5.	To understand the different stages of testing during development of a software system

UNIT–I	SOFTWARE PROCESS & MODELING	9

Prescriptive Process Models (L1) – Agility and Process (L1) – Scrum (L2) – XP (L2) – Kanban (L2) – DevOps (L2) – Prototype Construction (L2) –Prototype Evaluation (L2) –Prototype Evolution (L2) –Modelling (L2) – Principles (L1) - Requirements Engineering (L1) – Scenario-based Modelling (L2) – Class-based Modelling (L2) - Functional Modelling (L2) – Behavioural Modelling (L2).

UNIT–II	SOFTWARE DESIGN	9

Design Concepts (L1) – Design Model (L2) – Software Architecture (L2) – Architectural Styles (L2) – Architectural Design (L2) – Component-Level Design (L2) – User Experience Design (L2) – Design for Mobility (L2) – Pattern-Based Design (L2).

UNIT–III	SYSTEM DEPENDABILITY AND SECURITY	9

Dependable Systems(L1) – Dependability Properties(L1) – Socio technical Systems(L1) – Redundancy and Diversity(L2) – Dependable Processes(L2) – Formal Methods and Dependability(L2) – Reliability Engineering(L2) –Availability and Reliability(L2) – Reliability Requirements(L2) – Fault-tolerant Architectures(L2) – Programming for Reliability(L2) – Reliability Measurement(L2) – Safety Engineering(L2) – Safety-critical Systems(L2) – Safety Requirements(L2) – Safety Engineering Processes(L2) – Safety Cases(L2) – Security Engineering(L2) – Security and Dependability(L2) – Safety and Organizations(L2) – Security Requirements(L2)– Secure System Design(L2) –Security Testing and Assurance(L2) –Resilience Engineering(L2) –Cyber security(L2)–Socio technical Resilience(L2)– Resilient Systems Design (L2).

UNIT–IV	SERVICE-ORIENTED SOFTWARE ENGINEERING, SYSTEMS ENGINEERING AND REAL-TIME SOFTWARE ENGINEERING	9

Service-oriented Architecture(L2) – RESTful Services(L2) – Service Engineering(L2) – Service Composition(L2) –Systems Engineering(L2) – Socio technical Systems(L2) – Conceptual Design(L3) – System Procurement(L2) –System Development(L3) – System Operation and Evolution(L3) – Real-time Software Engineering(L2) –Embedded System Design(L3) – Architectural Patterns for Real-time Software(L3) – Timing Analysis(L3) –Real-time Operating Systems(L3).

UNIT–V	SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT	9

Software Testing Strategy(L2) – Unit Testing(L2) – Integration Testing(L2) – Validation Testing(L2) – System Testing(L2) – Debugging(L2) – White-Box Testing(L2) – Basis Path Testing(L2) – Control Structure Testing(L2) –Black-Box Testing(L2) –Software Configuration Management (SCM) (L2) –SCM Repository(L2) –SCM Process(L2) –Configuration Management for Web and Mobile Apps(L3).

Total: PERIODS: 45

OPEN ENDED PROBLEMS / QUESTIONS		
Course Specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOMS Taxonomy**
CO1	Identify appropriate process models based on the Project requirements	L2- Understand
CO2	Understand the importance of having a good Software Architecture.	L2- Understand
CO3	Understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.	L2- Understand
CO4	Understand the basics of a web service, web service standards and service-oriented architecture	L3- Apply
CO5	Be familiar with various levels of Software testing	L3- Apply
TEXT BOOKS:		
1.	Software Engineering : A Practitioner's Approach,9th Edition.Roger Pressman and Bruce Maxim, McGraw-Hill 2019	
2.	Software Engineering, 10th Edition, Ian Somerville, Pearson Education Asia 2016.	
REFERENCE BOOKS:		
1.	Software Architecture In Practice,3rd Edition, Len Bass, Paul Clements and Rick Kazman, Pearson India 2018	
2.	An integrated approach to Software Engineering,3rd Edition, Pankaj Jalote, Narosa Publishing House,2018	
3.	Fundamentals of Software Engineering,5th Edition, Rajib Mall,PHI Learning Private Ltd,2018	
VIDEO REFERENCES:		
1.	https://www.youtube.com/watch?v=3knajKr7Zzs&list=PL4dfXPSoX1m4LJu8ZlcDZahE85FK1QPdZ&ab_channel=AjayJames	
2.	https://nptel.ac.in/courses/106101061	
ONLINE REFERENCES:		
1.	https://www.tutorialride.com/software-engineering/advanced-software-engineering.htm	
ONLINE COURSES:		
1.	https://www.coursera.org/specializations/software-design-architecture	
2.	https://www.udemy.com/courses/development/software-engineering/	

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	2	2		
CO2	3	2	2	2		
CO3	3	2	2	2		
CO4	3	2	2	2		
CO5	3	2	2	2		
Average	3	2	2	2		
1–Low, 2 –Medium, 3–High						

ME23CP308	MULTICORE ARCHITECTURE AND PROGRAMMING	Version: 1.0				
Programme& Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To understand the need for multi-core processors, and their architecture.
2	To understand the challenges in parallel land multithreaded programming.
3	To learn about the various parallel programming paradigms
4	To develop multicore programs and design parallel solutions

UNIT–I	MULTI-CORE PROCESSORS	9

Single core to Multi-core architectures(L2) – SIMD and MIMD systems(L2) – Interconnection networks(L2) – SymmetricandDistributedSharedMemoryArchitectures(L2)–Cachecoherence(L2)–PerformanceIssues(L2)–Parallel program design.(L3)

UNIT–II	PARALLEL PROGRAMCHALLENGES	9

Performance(L1) – Scalability(L1) – Synchronization and data sharing(L2) – Data races(L2) – Synchronization primitives(mutexes,locks,semaphores,barriers)(L2)–deadlocksandlivelocks(L2) – communication between threads(condition variables, signals, message queues and pipes).(L2)

UNIT–III	SHARED MEMORYPROGRAMMINGWITH OpenMP	9

OpenMP Execution Model(L2) – Memory Model(L2) – OpenMP Directives(L3) – Work-sharing Constructs(L3) –Library functions(L3) – Handling Data and Functional Parallelism(L3) – Handling Loops(L3) – Performance Considerations.(L3)

UNIT–IV	DISTRIBUTED MEMORYPROGRAMMINGWITH MPI	9

MPI program execution(L3) – MPI constructs(L3) – libraries(L3) – MPI send and receive(L3) – Point-to-point and Collective communication(L3) – MPI derived datatypes(L3) – Performance evaluation(L3)

UNIT–V	PARALLEL PROGRAMDEVELOPMENT	9

Case studies(L3) – n-Body solvers(L3) – Tree Search(L3) – OpenMP and MPI implementations and comparison.(L3)

Total:45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course Specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

Course Outcomes: Upon completion of this course the students will be able to:		BLOOMS Taxonomy
CO1	Describe multicore architectures and identify their characteristics and challenges.	L2 – Understand
CO2	Identify the issues in programming Parallel Processors.	L2 – Understand
CO3	Write programs using OpenMP and MPI.	L3 – Apply
CO4	Design parallel programming solutions to common problems	L3 – Apply
CO5	Compare and contrast programming for serial processors and programming for parallelprocessors.	L3 – Apply

REFERENCEBOOKS:	
1.	Peter S. Pacheco, "An Introduction to Parallel Programming, Morgan Kauffman/Elsevier,2021.
2.	DarrylGove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson 2011
3.	Michael J Quinn, "Parallel programming in C with MPI and OpenMP,TataMcGrawHill,2003.
4.	Victor A lessandrini, Shared Memory Application Programming, 1stEdition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
5.	YanSolihin, Fundamentals of Parallel Multicore Architecture, CRC Press,2015

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	1	1	2	1	2
CO2	2	1			2	2
CO3	1		2	1	1	2
CO4	2	1	1	1	2	2
CO5	3	1	2	1	2	3
Average	1.8	1	1.5	1.25	1.6	2.2
1–Low, 2 –Medium, 3–High						

ME23MC701	UNIVERSAL HUMAN VALUES AND ETHICS	Version: 1.0
(Common to ALL BRANCHES)		

Programme & Branch		CP	L	T	P	C
		3	2	1	0	3

Course Objectives:

1.	To understand the concept of Universal Human Values.
2.	To explain theoretical and practical implications of UHV.
3.	To discuss the use of harmony in the family and society.
4.	To classify the harmony in the nature methods.
5.	To describe effective human values in personal and professional in life.

UNIT–I	INTRODUCTION TO VALUE EDUCATION	9

Right Understanding (L2), Relationship and Physical Facility (L2) (Holistic Development and the Role of Education) (L2) - Understanding Value Education (L2) - Sharing about Oneself (L2) - Self-exploration as the Process for Value Education (L2) - Continuous Happiness and Prosperity (L2) – the Basic Human Aspirations (L1) - Exploring Human Consciousness (L2) - Happiness and Prosperity (L2) – Current Scenario (L2) - Method to Fulfil the Basic Human Aspirations (L2) - Exploring Natural Acceptance (L2).

UNIT–II	HARMONY IN THE HUMAN BEING	9

Understanding Human being as the Co-existence of the Self and the Body (L2) - Distinguishing between the Needs of the Self and the Body (L2)- Exploring the difference of Needs of Self and Body (L2) - The Body as an Instrument of the Self (L2)- Understanding Harmony in the Self (L2)- Exploring Sources of Imagination in the Self(L2) - Harmony of the Self with the Body (L2)- Programme to ensure self-regulation and Health (L2)- Exploring Harmony of Self with the Body (L2).

UNIT– III	HARMONY IN THE FAMILY AND SOCIETY	9

Harmony in the Family (L2) – the Basic Unit of Human Interaction (L2) - 'Trust' – the Foundational Value in Relationship (L2) - Exploring the Feeling of Trust (L2) - 'Respect' – as the Right Evaluation (L3) - Exploring the Feeling of Respect (L2) - Other Feelings (L2), Justice in Human-to-Human Relationship (L2) - Understanding Harmony in the Society (L2)- Vision for the Universal Human Order (L3) - Exploring Systems to fulfil Human Goal (L2).

UNIT – IV	HARMONY IN THE NATURE/EXISTENCE	9

Understanding Harmony in the Nature (L2) – Interconnectedness (L2), self-regulation and Mutual Fulfilment among the Four Orders of Nature (L3) - Exploring the Four Orders of Nature (L2) - Realizing Existence as Co-existence at All Levels (L2) - The Holistic Perception of Harmony in Existence (L2) - Exploring Co-existence in Existence (L2).

UNIT–V	IMPLICATIONS OF THE HOLISTIC UNDERSTANDING - A LOOK AT PROFESSIONAL ETHICS	9
Natural Acceptance of Human Values (L2) - Definitiveness of (Ethical) Human Conduct (L2) - Exploring Ethical Human Conduct (L2) - A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order (L2) - Competence in Professional Ethics (L2) - Exploring Humanistic Models in Education (L2) - Holistic Technologies, Production Systems and Management Models (L2) -Typical Case Studies (L2)- Strategies for Transition towards Value-based Life and Profession (L2) - Exploring Steps of Transition towards Universal Human Order (L2).		
	OPEN ENDED PROBLEMS / QUESTIONS	
Course specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as Assignments and evaluated as IA only and not for the End semester Examinations.		
		Total : 45 PERIODS

Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
1.	Recognize the concepts of Universal Human Values.	L2 – Understand
2.	Describe both theoretical and practical implications of Universal Human Values.	L2 – Understand
3.	Use the harmony in family and society.	L3 – Apply
4.	Incorporate harmony in all human existence.	L3 – Apply
5.	Use human values in both personal and professional life.	L2 – Understand

REFERENCE BOOKS:

1.	R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019.
2.	A.N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.
3.	R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi, 2010.
4.	B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted 2008.
5.	Frankl, Viktor E. Yes to Life In spite of Everything, Penguin Random House, London, 2019.
6.	Van Zomeren, M., & Dovidio, J. F. The Oxford Handbook of the Human Essence (Eds.), New York Oxford University Press, 2018.
7.	B P Banerjee, Foundations of Ethics and Management, Excel Books, 2005.

VIDEO REFERENCES:

Any relevant videos like

1.	https://www.youtube.com/c/UniversalHumanValues
2.	https://www.youtube.com/watch?v=OgdNx0X923I

WEB REFERENCES:

1.	Story of Stuff, http://www.storyofstuff.com
2.	https://fdp-si.aicte-india.org/UHVII.php

ONLINE COURSES:	
1.	https://nptel.ac.in/courses/109104068
2.	https://uhv.org.in/course

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1						
CO2						
CO3						
CO4						
CO5						
Average						
1–Low, 2 –Medium, 3–High						

ME23PT802	RESEARCH PAPER REVIEW AND PRESENTATION	Version : 1.0
(COMMON TO ALL BRANCHES)		

Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		2	0	0	2	1

Course Objectives:

1	To Learn scientific paper reading and wiring skills
2	To Learn the literature review and report wiring skills
3	To understand the research gap and formulation of the research problem

The work involves the following steps:

1. Assigning the faculty supervisor
2. Selecting a subject, narrowing the subject into a topic
3. Stating an objective.
4. Collecting the relevant bibliography (atleast 20 research papers)
5. Studying the papers understanding the authors contributions and critically analysing each paper.
6. Preparing a 20-25 page literature review report
7. Preparing conclusions based on the literature review report.
8. Writing the Final Review Paper
9. Final Presentation to the review committee

Evaluation method:

A faculty supervisors will be assigned to each student. The supervisor will assign a topic to the student. The student has to review the literature pertaining to the topic, prepare a 20-25 page report and make a presentation. Minimum 20 research papers have to be reviewed out of which 60% have to be in the recent 05 years. The format for the research paper report and guidelines for assessment will be issued by the Head of the Department before the commencement of the course. The evaluation will be carried out based on the research paper report and presentation, and is evaluated for 100 marks. Minimum 50 marks is essential to pass. In case a student fails, he or she has to redo the course in the forthcoming semesters. Assessment is by Internal Assessment mode only no End Semester Examination.

Total : 30 PERIODS

	Course Outcomes: At the end of this course, the students will demonstrate the ability to	**BLOOM'S Taxonomy**
CO1	**write** a scientific review paper in their field	L3 - Apply
CO2	**Identify** the research gap and formulate the research problem	L3 - Apply

Mapping of COs with POs

CO	PO1	PO2	PO3	PO4	PO5	PO6
1		3				
2		3				
Average		3				

1–Low, 2 –Medium, 3–High.

ME23CP309	SOFTWARE ENGINEERING LABORATORY	Version: 1.0				
Programme & Branch	M.E-COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		2	0	0	2	1

Course Objectives:

1.	To impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner through the Web.
2.	Present case studies to demonstrate practical applications of different concepts
3.	Provide a scope to students where they can solve small, real-life problems

List of Experiments / Exercises

1.	Write a Problem Statement to define a title of the project with bounded scope of project.
2.	Select relevant process model to define activities and related task set for assigned project
3.	Prepare broad SRS (Software Requirement Specification) for the above selected projects
4.	Prepare USE Cases and Draw Use Case Diagram using modelling Tool
5.	Develop the activity diagram to represent flow from one activity to another for software development
6.	Develop data Designs using DFD Decision Table & ER Diagram
7.	Draw class diagram, sequence diagram, Collaboration Diagram, State Transition Diagram for the assigned project
8.	Write Test Cases to Validate requirements of assigned project from SRS Document
9.	Evaluate Size of the project using function point metric for the assigned project
10.	Estimate cost of the project using COCOMO and COCOCMOII for the assigned project
11.	Use CPM/PERT for scheduling the assigned project
12.	Use timeline Charts or Gantt Charts to track progress of the assigned project

Total: 30 PERIODS

Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
1.	Can produce the requirements and use cases the client wants for the software being Produced.	L3 – Apply
2.	Participate in drawing up the project plan. The plan will include at least extent and work assessments of the project, the schedule, available resources, and risk management can model and specify the requirements of mid-range software and their architecture.	L3 – Apply
3.	Create and specify such a software design based on the requirement specification that the software can be implemented based on the design.	L3 – Apply
4.	Can assess the extent and costs of a project with the help of several different assessment methods	L3 – Apply

Mapping of COs with POs and PSOs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	3	3
CO2	2	3	3	3	2	2
CO3	3	1	2	2	1	2
CO4	2	3	1	2		
CO5	3	3	3	3	3	3
Average	2.6	2.6	2.4	2.6	2.25	2.5
1–Low, 2 –Medium, 3–High						

ME23CP401	CLOUD COMPUTING TECHNOLOGIES	Version: 1.0				
Programme& Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
2.	To understand the architecture, infrastructure and delivery models of cloud computing.
3.	To explore the roster of AWS services and illustrate the way to make applications in AWS
4.	To gain knowledge in the working of Windows Azure and Storage services offered by Windows Azure
5.	To develop the cloud application using various programming model of Hadoop and Aneka

UNIT–I	VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE	9

Basics of Virtual Machines(L1) - Process Virtual Machines (L2)– System Virtual Machines(L2) – Emulation(L2) – Interpretation(L2) – Binary Translation(L3) - Taxonomy of Virtual Machines(L2). Virtualization(L2) –Management Virtualization(L2) –– Hardware Maximization(L2) – Architectures (L2)– Virtualization Management(L2) – Storage Virtualization(L2) – Network Virtualization(L2)- Implementation levels of virtualization (L2)– virtualization structure (L2)– virtualization of CPU, Memory and I/O devices (L2)– virtual clusters and Resource(L2) Management(L2) – Virtualization for data center automation(L2)

UNIT–II	CLOUD PLATFORM ARCHITECTURE	9

Cloud Computing: Definition(L1), Characteristics (L2)- Cloud deployment models: public(L2), private(L2), hybrid(L2), community(L2) – Categories of cloud computing(L2): Everything as a service(L2): Infrastructure(L2), platform(L2), software(L2)- A Generic Cloud Architecture Design (L2)– Layered cloud Architectural Development(L2) – Architectural Design Challenges(L2)

UNIT–III	AWS CLOUD PLATFORM - IAAS	9

Amazon Web Services: AWS Infrastructure(L2)- AWS API(L2)- AWS Management Console(L2) - Setting up AWS Storage (L2)- Stretching out with Elastic Compute Cloud (L2)- Elastic Container Service for Kubernetes(L2)- AWS Developer Tools: AWS Code Commit(L2), AWS Code Build(L2), AWS Code Deploy(L2), AWS Code Pipeline(L2), AWS code Star(L2) - AWS Management Tools: Cloud Watch(L2), AWS Auto Scaling(L2), AWS control Tower(L2), Cloud Formation(L2), Cloud Trail(L2), AWS License Manager(L2)

UNIT–IV	PAAS CLOUD PLATFORM	9

Windows Azure: Origin of Windows Azure(L2), Features(L2), The Fabric Controller (L2)– First Cloud APP in Windows Azure(L2)- Service Model and Managing Services: Definition and Configuration(L2), Service runtime API(L2)- Windows Azure Developer Porta(L2)l- Service Management API(L2)- Windows Azure Storage Characteristics(L2)-Storage Services(L2)- REST API(L2)- Blops(L2)

UNIT–V	PROGRAMMING MODEL	9

Introduction to Hadoop Framework(L2) - Mapreduce(L2), Input splitting(L2), map and reduce functions(L3), specifying input and output parameters(L2), configuring and running a job (L2)– Developing Map Reduce Applications (L2)- Design of Hadoop file system(L3)–Setting up Hadoop Cluster(L2)- Aneka: Cloud Application Platform(L2),Thread Programming(L3), Task Programming and Map-Reduce Programming in Aneka(L2).

Total: PERIODS: 45

OPEN ENDED PROBLEMS / QUESTIONS		
Course Specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOMS Taxonomy**
CO1	Employ the concepts of virtualization in the cloud computing	L3- Apply
CO2	Identify the architecture, infrastructure and delivery models of cloud computing	L2- Understand
CO3	Develop the Cloud Application in AWS platform	L3- Apply
CO4	Apply the concepts of Windows Azure to design Cloud Application	L3- Apply
CO5	Develop services using various Cloud computing programming models	L3- Apply
TEXT BOOKS:		
1.	Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.	
2.	Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019.	
REFERENCE BOOKS:		
1.	Sriram Krishnan, Programming: Windows Azure, O'Reilly,2010.	
2.	Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing , MCGraw Hill Education (India) Pvt. Ltd., 2013.	
3.	Danielle Ruest, Nelson Ruest, —Virtualization: A Beginner"s Guide‖, McGraw-Hill Osborne Media, 2009.	
4	Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.	
5.	John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.	

Mapping of COs with POs and PSOs						
COs	**POs**					
CO1				2	2	1
CO2	2	3	1			1
CO3	3		3		1	3
CO4				2		3
CO5	3	2				
Average	2.7	2.5	2	2	1.5	2
1–Low, 2 –Medium, 3–High						

ME23CP402	FOUNDATIONS OF DATA SCIENCE	Version 1.0				
Programme& Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To apply fundamental algorithms to process data.
2.	Learn to apply hypotheses and data into actionable predictions.
3.	Document and transfer the results and effectively communicate the findings using visualization techniques.
4.	To learn statistical methods and machine learning algorithms required for Data Science.
5	To develop the fundamental knowledge and understand concepts to become a data science professional.

UNIT–I	INTRODUCTION TO DATA SCIENCE	9

Data science process(L2) – roles, stages in data science project(L2) – working with data from files(L2) – working with relational databases(L2) – exploring data(L2) – managing data(L2) – cleaning and sampling for modeling and validation(L2) – introduction to NoSQL(L1).

UNIT–II	MODELING METHODS	9

Choosing and evaluating models(L3) – mapping problems to machine learning(L2), evaluating clustering models(L3), validating models(L3) – cluster analysis(L3) – K-means algorithm(L3), Naïve Bayes(L3) – Memorization Methods(L3) – Linear and logistic regression(L3) – unsupervised methods(L3).

UNIT–III	INTRODUCTION TO R	9

Reading and getting data into R(L2) – ordered and unordered factors(L2) – arrays and matrices(L2) – lists and data frames (L2)– reading data from files(L2) – probability distributions(L2) – statistical models in R(L3) - manipulating objects(L3)– data distribution(L2).

UNIT–IV	MAP REDUCE	9

Introduction(L1) – distributed file system(L2) – algorithms using map reduce(L3), Matrix-Vector Multiplication by Map Reduce(L2) – Hadoop - Understanding the Map Reduce architecture(L2) - Writing Hadoop MapReduce Programs(L3) - Loading data into HDFS(L2) - Executing the Map phase(L3) - Shuffling and sorting(L2) - Reducing phase execution(L2).

UNIT–V	DATA VISUALIZATION	9

Documentation and deployment(L 2)– producing effective presentations(L2) – Introduction to graphical analysis(L1) – plot () function(L2) – displaying multivariate data(L2) – matrix plots(L2) – multiple plots in one window(L2) - exporting graph using graphics parameters(L2) - Case studies(L3).

Total: PERIODS: 45

OPEN ENDED PROBLEMS / QUESTIONS

Course Specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations

Course Outcomes: Upon completion of this course the students will be able to:		BLOOMS Taxonomy
CO1	Obtain, clean/process and transform data.	L2- Understand
CO2	Analyze and interpret data using an ethically responsible approach.	L2- Understand
CO3	Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues.	L2- Understand
CO4	Apply computing theory, languages and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses	L3 - Apply
CO5	Formulate and use appropriate models of data analysis to solve business-related challenges.	L3 - Apply

TEXT BOOKS:

1.	Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.
2.	Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.

REFERENCE BOOKS:

1.	W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013.
2.	Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd., 2014.
3.	Nathan Yau, "Visualize This: The FlowingData Guide to Design, Visualization, and Statistics", Wiley, 2011.

Mapping of COs with POs and PSOs

COs	POs					
CO1	3	2	2	2		
CO2	3	2	2	2		
CO3	3	2	2	2		
CO4	3	2	2	2		
CO5	3	2	2	2		
Average	3	2	2	2		
1–Low, 2 –Medium, 3–High						

ME23CP403	AGILE METHODOLOGIES					
Programme & Branch	M.E. COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To learn the fundamental principles and practices associated with each of the agile development methods.
2	To apply the principles and practices of agile software development on a project of interest and relevance to the student.
3	To provide a good understanding of software design and a set of software technologies and APIs.
4	To do a detailed examination and demonstration of Agile development& testing techniques.
5	To understand Agile development and testing.

UNIT–I	AGILE SOFTWARE DEVELOPMENT	9

Basics and Fundamentals of Agile Process Methods(L1), Values of Agile(L2), Principles of Agile(L2), stakeholders(L2), Challenges(L2) . Lean Approach: Waste Management, Kaizen and Kanban(L3), add process and products add value(L3). Roles related to the lifecycle(L1), differences between Agile and traditional plans(L2), differences between Agile plans at different lifecycle phases(L2). Testing plan links between testing(L2), roles and key techniques, principles(L2), understand as a means of assessing the initial status of a project/ How Agile helps to build quality(L3)

UNIT–II	AGILE AND SCRUM PRINCIPLES	9

Agile Manifesto (L2), Twelve Practices of XP(L1), Scrum Practices(L1), Applying Scrum(L3). Need of scrum(L2), working of scrum(L2), advanced Scrum Applications(L4), Scrum and the Organization(L2), scrum values(L2)

UNIT–III	AGILE PRODUCT MANAGEMENT	9

Communication (L2), Planning (L3), Estimation Managing the Agile approach Monitoring progress (L3), Targeting and motivating the team (L3), Managing business involvement (L3), Escalating issue (L3). Quality(L3), Risk, Metrics and Measurements(L3), Managing the Agile approach Monitoring progress(L2), Targeting and motivating the team(L3), Managing business involvement and Escalating issue(L3)

UNIT–IV	AGILE REQUIREMENTS AND AGILE TESTING	9

User Stories (L2), Backlog Management (L3). Agile Architecture (L3): Feature Driven Development (L3). Agile Risk Management (L3): Risk and Quality Assurance (L2), Agile Tools (L3). Agile Testing Techniques(L3), Test-Driven Development(L3), User Acceptance Test(L3)

UNIT–V	AGILE REVIEW AND SCALING AGILE FOR LARGE PROJECTS	9

Agile Metrics and Measurements (L2), The Agile approach to estimating and project variables (L3), Agile Measurement (L3), Agile Control: the 7 control parameters (L3). Agile approach to Risk(L3), The Agile approach to Configuration Management(L3), The Atern Principles(L2), Atern Philosophy(L2), The rationale for using Atern(L3), Refactoring(L3), Continuous integration(L3), Automated Build Tools(L3). Scrum of Scrums(L3), Team collaborations(L3), Scrum, Estimate a Scrum Project(L3), Track Scrum Projects(L3), Communication in Scrum Projects(L3), Best Practices to Manage Scrum(L3).

Total: 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS		
Course Specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOMS Taxonomy**
CO1	Analyze existing problems with the team, development process and wider organization	L3- Apply
CO2	Apply a thorough understanding of Agile principles and specific practices	L3- Apply
CO3	Select the most appropriate way to improve results for a specific circumstance or need	L3- Apply
CO4	Judge and craft appropriate adaptations to existing practices or processes depending upon analysis of typical problems	L3- Apply
CO5	Evaluate likely successes and formulate plans to manage likely risks or problems	L3- Apply
TEXTBOOKS:		
1.	Robert C. Martin ,Agile Software Development, Principles, Patterns, and Practices Alan Apt Series (2011)	
2.	Succeeding with Agile : Software Development Using Scrum, Pearson (2010)	
REFERENCEBOOKS:		
1.	David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.	
2.	Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.	
3.	Craig Larman, "Agile and Iterative Development: A Managers Guide, Addison-Wesley, 2004.	
4.	Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.	

Mapping of COs with POs and PSOs						
COs	**POs**					
CO1	3	1	3	-	2	3
CO2	2	-	3	3	1	3
CO3	3	-	-	-	3	3
CO4	2	-	1	2	3	3
CO5	1	-	1	1	2	3
Average	2.2	1	2	2	2.2	3
1–Low, 2 –Medium, 3–High						

ME23CP404	DIGITAL IMAGE PROCESSING	Version 1.0				
Programme & Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To study fundamental concepts of digital image processing.
2.	To understand and learn image processing operations and restoration.
3.	To use the concepts of Feature Extraction
4.	To study the concepts of Image Compression.
5.	To expose students to current trends in the field of image segmentation.

UNIT–I	INTRODUCTION	9

Examples of fields that use digital image processing(L2), fundamental steps in digital image processing(L2), components of image processing system(L2). Digital Image Fundamentals: A simple image formation model(L1), image sampling and quantization(L2), basic relationships between pixels(L2). Image enhancement in the spatial domain: Basic gray-level transformation(L2), histogram processing(L2), enhancement using arithmetic and logic operators(L3), basic spatial filtering(L3), smoothing(L3), and sharpening spatial filters(L3), combining the spatial enhancement methods(L3).

UNIT–II	IMAGE RESTORATION	9

A model of the image degradation/restoration process(L2), noise models(L2), restoration in the presence of noise–only spatial filtering(L2), Weiner filtering(L2), constrained least squares filtering(L2), geometric transforms(L2); Introduction to the Fourier transform and the frequency domain(L2), estimating the degradation function(L3). Color Image Processing: Color fundamentals(L2), color models(L2), pseudo color image processing(L2), basics of full–color image processing(L2), color transforms(L2), smoothing and sharpening(L2), color segmentation(L2)

UNIT–III	FEATURE EXTRACTION	9

Detection of discontinuities(L1) – Edge linking and Boundary detection(L2)- Thresholding(L2) -Edge based segmentation(L2)-Region based Segmentation(L2)- Matching(L2)-Advanced optimal border and surface detection(L3)- Use of motion in segmentation(L3). Image Morphology(L3) – Boundary descriptors(L3)- Regional descriptors(L3)**.**

UNIT–IV	IMAGE COMPRESSION	9

Fundamentals(L1), image compression models(L2), error-free compression(L2), lossy predictive coding(L2), image compression standards Morphological Image Processing: Preliminaries(L2), dilation(L2), erosion(L2), open and closing(L2), hit or miss transformation(L3), basic morphological algorithms(L3)

UNIT–V	IMAGE SEGMENTATION	9

Detection of discontinuous(L1), edge linking and boundary detection(L2), thresholding(L2), region–based segmentation(L2). Object Recognition: Patterns and patterns classes(L2), recognition based on decision(L2)– theoretic methods(L2), matching(L3), optimum statistical classifiers(L3), neural networks(L2), structural methods(L2) – matching shape numbers(L3), string matching(L3).

Total:-- 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS		
Course Specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations		
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOMS Taxonomy**
CO1	Apply knowledge of Mathematics for image processing operations	L3 - Apply
CO2	Apply techniques for image restoration.	L3 - Apply
CO3	Identify and extract salient features of images	L3 - Apply
CO4	Apply the appropriate tools (Contemporary) for image compression and analysis.	L3 - Apply
CO5	Apply segmentation techniques and do object recognition	L3 - Apply
TEXTBOOKS:		
1.	Digital Image Processing, Rafeal C.Gonzalez, Richard E.Woods, Second Edition, Pearson Education/PHI., 2002	
2.	Digital Image Processing, Sridhar S, Second Edition, Oxford University Press, 2016	
REFERENCE BOOKS:		
1.	Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology, .Brooks/Cole 2004.	
2.	Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis and Machine Vision", Second Edition, Thompson Learning, 2007.	
3.	Digital Image Processing using Matlab, Rafeal C.Gonzalez, Richard E.Woods, Steven L. Eddins, Pearson Education.Second Edition, 2017.	

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**		
CO1	1					1
CO2	1		1		1	2
CO3	1	1			1	2
CO4		2	1	1	2	2
CO5	1	2	1		2	3
Average	1	1.7	1	1	1.5	2
1–Low, 2 –Medium, 3–High						

ME23CP405	MACHINE LEARNING	Version 1.0				
Programme & Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To understand the concepts and mathematical foundations of machine learning and types of problem stackled by machine learning
2.	To explore the different supervised learning techniques including ensemble methods
3.	To learn different aspects of unsupervised learning and reinforcement learning
4.	To learn the role of probabilistic methods for machine learning
5.	To understand the basic concepts of neural networks and deep learning

UNIT–I	INTRODUCTION AND MATHEMATICAL FOUNDATIONS	9

What is Machine Learning? (L1) Need–History(L1)–Definitions(L1)–Applications(L1) Advantages, Disadvantages& Challenges (L1)-Types of Machine Learning Problems(L2) – Mathematical Foundations (L3)-Linear Algebra &Analytical Geometry(L3) -Probability and Statistics(L3)- Bayesian Conditional Probability(L3)-Vector Calculus &Optimization(L3) –Decision Theory(L3)-Information theory(L3)

UNIT–II	SUPERVISED LEARNING	9

Introduction(L1)-Discriminative and Generative Models(L2)-Linear Regression(L2)-Least Squares(L2)-Under-fitting/ Over-fitting (L2)-Cross-Validation(L2) – Lasso Regression(L2)-Classification(L2) -Logistic Regression(L2)-Gradient Linear Models(L2) -Support Vector Machines(L3) –Kernel Methods (L2)-Instance based Methods(L2) - K-Nearest Neighbors (L2)- Tree based Methods (L2)–Decision Trees(L2) –ID3 (L2)–CART(L2) - Ensemble Methods(L2) –Random Forest(L2)-Evaluation of Classification Algorithms(L3)

UNIT–III	UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING	9

Introduction(L1)-ClusteringAlgorithms(L2)-K–Means(L3)–HierarchicalClustering(L3)-Cluster Validity (L2) Dimensionality Reduction(L2)–Principal Component Analysis(L3)–Recommendation Systems(L2)-EMa Algorithm(L2). Reinforcement Learning(L2)–Elements(L2)-Model based Learning(L2)–Temporal Difference Learning(L2)

UNIT–IV	PROBABILISTIC METHODS FOR LEARNING	9

Introduction(L1)-Naïve Bayes Algorithm(L3)-Maximum Likelihood(L2)-Maximum Apriori(L2)- Bayesian Belief Networks (L3)-Probabilistic Modelling of Problems (L3)-Inference in Bayesian Belief Networks(L4) – Probability Density Estimation(L3)-Sequence Models(L3) – Markov Models(L3)– Hidden Markov Models(L3)

UNIT–V	NEURAL NETWORKS AND DEEP LEARNING	9

Neural Networks(L2)–Biological Motivation(L1)-Perceptron(L2)–Multi-layer Perceptron(L2)– Feed Forward Network(L3) – Back Propagation(L3)-Activation and Loss Functions(L3)-Limitations of Machine Learning (L1)– Deep Learning(L2)–Convolution Neural Networks(L2)–Recurrent Neural Networks(L3)–Use cases(L4)

Total:45 PERIODS

List of Experiments:

1.	Implement a Linear Regression with a Real Dataset (https://www.kaggle.com/harrywang/housing). Experiment with different features in building amodel. Tune the model's hyper parameters.

2.	Implement a binary classification model. That is, answers a binary question such as "Are houses in this neighborhood above a certain price?"(use data from exercise 1). Modify the classification threshold and determine how that modification influences the model. Experiment with different classification metrics to determine your model's effectiveness.
3.	Classification with Nearest Neighbors. In this question, you will use the scikit-learn's KNN classifier to classify real vs. fake news headlines. The aim of this question is for you to read the scikit-learn API and get comfortable with training/validation splits. Use California Housing Dataset.
4.	In this exercise, you'll experiment with validation sets and test sets using the dataset. Splita training set into a smaller training set and a validation set. Analyze deltas between training set and validation set results. Test the trained model with a test set to determine whether your trained model is over fitting. Detect and fix a common training problem.
5.	Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset.
6.	Project - (in Pairs) Your project must implement one or more machine learning algorithms and apply them to some data.

OPEN ENDED PROBLEMS / QUESTIONS

Course Specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations

Course Outcomes: Upon completion of this course the students will be able to:		**BLOOMS Taxonomy**
CO1	Understand and outline problems for each type of machine learning	L3 – Apply
CO2	Design Decision tree and Random forest for and application	L3 – Apply
CO3	Implement Probabilistic Discriminative and Generative algorithms for an application and analyze the results.	L3 – Apply
CO4	Use a tool to implement typical Clustering algorithms for different types of applications.	L3 – Apply
CO5	Design and implement an HMM for a Sequence Model type of application and identify applications suitable for different types of Machine Learning with suitable justification.	L3 – Apply

TEXTBOOKS:

1.	Stephen Marsland,"Machine Learning: An Algorithmic Perspective", Chapman &Hall/CRC, 2ndEdition, 2014.
2.	KevinMurphy,"MachineLearning:AProbabilisticPerspective",MITPress,2012.

REFERENCEBOOKS:

1.	Ethem Alpaydin,"Introduction to Machine Learning", Third Edition ,Adaptive Computation and Machine Learning Series ,MIT Press,2014
2.	TomMMitchell,"MachineLearning",McGrawHillEducation,2013.
3.	Peter Flach,"Machine Learning:The Art and Science of Algorithms that Make Sense of Data",First Edition,Cambridge University Press,2012.
4.	ShaiShalev-Shwartz and ShaiBen-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2015
5.	Christopher Bishop,"Pattern Recognition and Machine Learning", Springer,2007.

Mapping of COs with POs and PSOs

	POs					
COs	**PO1**	**PO2**	**PO3**	**PO4**		
CO1	1	1	1	2	1	2
CO2	2	1	-	-	2	2
CO3	1		2	1	1	2
CO4	2	1	1	1	2	2
CO5	3	1	2	1	2	3
Average	1.8	1	1.5	1.25	1.6	2.2

1–Low, 2 –Medium, 3–High

ME23CP406	SOFTWARE QUALITY ASSURANCE	Version 1.0				
Programme& Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	Be exposed to the software quality factors, Quality Assurance (SQA) architecture and SQA components.
2.	Understand the integration of SQA components into the project life cycle.
3.	Be familiar with the software quality infrastructure.
4.	Be exposed to the management components of software quality.
5.	Be familiar with the Quality standards, certifications and assessments

UNIT–I	INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE	9

Need for Software quality (L1)– Software quality assurance (SQA) (L2) – Software quality factors(L2) - McCall's quality model (L2) – SQA system components (L2) – Pre project quality components(L2) – Development and quality plans(L3).

UNIT–II	SQA COMPONENTS AND PROJECT LIFE CYCLE	9

Integrating quality activities in the project life cycle(L2) – Reviews(L2) – Software Testing (L2) – Quality of software maintenance components (L2) – Quality assurance for external participant's contribution (L3) – CASE tools for software quality Management(L3).

UNIT–III	SOFTWARE QUALITY INFRASTRUCTURE	9

Procedures and work instructions (L2) – Supporting quality devices(L3) - Staff training and certification(L3) -Corrective and preventive actions(L3) – Configuration management (L3)– Software change control (L2) –Configuration management audit(L2) -Documentation control(L2).

UNIT–IV	SOFTWARE QUALITY MANAGEMENT & METRICS	9

Project process control (L2) – Software quality metrics (L2) – Cost of software quality (L2) – Classical quality cost model (L2) – Extended model (L2) – Application and Problems in application of Cost model(L3)

UNIT–V	STANDARDS, CERTIFICATIONS & ASSESSMENTS	9

Quality management standards (L2) – ISO 9001 and ISO 9000-3 (L2) –Capability Maturity Models(L2) – CMM and CMMI assessment methodologies(L2) - Bootstrap methodology (L3) – SPICE Project(L3) – SQA project process standards(L3) – Organization of Quality Assurance (L2) – Role of management in SQA (L2) – SQA units and other actors in SQA systems(L2).

Total: 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course Specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations

Course Outcomes: Upon completion of this course the students will be able to:		BLOOMS Taxonomy
CO1	Utilize the concepts of SQA in software development life cycle	L3 – Apply
CO2	Demonstrate their capability to adopt quality standards.	L3 – Apply
CO3	Assess the quality of software products.	L3 – Apply
CO4	Apply the concepts in preparing the quality plan & documents.	L3 – Apply
CO5	Ensure whether the product meets company's quality standards and client's expectations and demands	L3 – Apply
TEXT BOOKS:		
1.	Daniel Galin, "Software Quality Assurance", Pearson Publication, 2009.	
2.	Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 2011.	
REFERENCE BOOKS:		
1.	Kshirasagar Naim and Priyadarshi Tripathy," Software Testing and Quality Assurance Theory and Practice", John Wiley & Sons Inc., 2008	
2.	Mordechai Ben-Menachem "Software Quality: Producing Practical Consistent Software",International Thompson Computer Press, 2014	

Mapping of COs with POs and PSOs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	P06
CO1	3	3	3	3	2	3
CO2	2	2	2	3	2	3
CO3	3	1	1	2	1	3
CO4	2	2	2	3	2	1
CO5	1	1	1	3	1	2
Average	2.2	1.8	1.8	2.8	1.6	2.4
1–Low, 2 –Medium, 3–High						

ME23CP407	AUTONOMOUS SYSTEMS	Version 1.0				
Programme& Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To impart knowledge on the functional architecture of autonomous vehicles
2.	To impart knowledge on Localization and mapping fundamentals
3.	To impart knowledge on process end effectors and robotic controls
4.	To learn Robot cell design, Robot Transformation and Sensors
5.	To learn Micro/Nano Robotic Systems

UNIT–I	INTRODUCTION AND FUNCTIONAL ARCHITECTURE	9

Functional architecture(L1) - Major functions in an autonomous vehicle system, Motion Modeling(L2) - Coordinate frames and transforms, point mass model, Vehicle modeling (kinematic and dynamic bicycle model (L2) - two-track models), Sensor Modeling - encoders, inertial sensors, GPS (L3).

UNIT–II	PERCEPTION FOR AUTONOMOUS SYSTEMS	9

SLAM (L2) - Localization and mapping fundamentals, LIDAR and visual SLAM, Navigation (L2) – Global path planning, Local path planning, Vehicle control (L3) - Control structures, PID control, Linear quadratic regulator, Sample controllers (L3).

UNIT–III	ROBOTICS INTRODUCTION, END EFFECTORS AND CONTROL	9

Robot anatomy (L2) -Definition, law of robotics, Simple problems Specifications of Robot (L2) -Speed of Robot (L2) -Robot joints and links-Robot classifications (L2) -Architecture of robotic systems, Mechanical grippers (L2) -Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers (L2) - Air operated grippers (L2) - Gripper force analysis (L2) - Gripper design (L2) - Simple problems (L3) - Robot controls (L2) -Point to point control, Continuous path control, Intelligent robot Control system for robot joint (L2) -Control actions (L2) - Feedback devices (2) - Encoder, Resolver, LVDT Motion Interpolations (L2) - Adaptive control (L2).

UNIT–IV	ROBOT TRANSFORMATIONS, SENSORS AND ROBOT CELLDESIGN	9

Robot kinematics (L1) -Types (L1) - 2D, 3D Transformation (L3) -Scaling, Rotation, Translation (L3) - Homogeneous coordinates, multiple transformation (L3) -Simple problems (L3). Sensors in robot (L2) – Touch sensors (L2) -Tactile, Robot work cell design and control (L2) -Sequence control, Operator interface, Safety monitoring devices in Robot (L3) - Mobile robot working principle, actuation using MATLAB, NXT Software (L3).

UNIT–V	MICRO/NANO ROBOTICS SYSTEM	9

Micro/Nano robotics system overview (L1) - Scaling effect (L3) - Top down and bottom up approach Actuators of Micro/Nano robotics system (L3) - Nano robot communication techniques (L3) - Fabrication of micro/nano grippers (L2) - Wall climbing micro robot working principles (L2) - Biomimetic robot (L3) - Swarm robot (L3) -Nano robot in targeted drug delivery system (L3).

Total: 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course Specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.

Course Outcomes: Upon completion of this course the students will be able to:		BLOOMS Taxonomy
CO1	Understand architecture and modeling of autonomous systems.	L3 - Apply
CO2	Employ localization mapping techniques for autonomous systems	L3 - Apply
CO3	Design solutions for autonomous systems control.	L3 - Apply
CO4	Analyze Robot Transformations, Sensors and Cell Design	L3 - Apply
CO5	Explain the working principles of Micro/Nano Robotic system	L3 - Apply

TEXT BOOKS:

1.	S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education.,2009
2.	Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.

REFERENCE BOOKS:

1.	Karsten Berns, Ewald Puttkamer, Springer, Autonomous Land Vehicles: Steps towards Service Robots, 2009
2.	Sebastian Thrun, Wolfram Burgard, Dieter Fox., Probabilistic robotics. MIT Press, 2005
3.	Steven M. LaValle., Planning algorithms, Cambridge University Press, 2006
4.	Daniel Watzenig and Martin Horn (Eds.), Automated Driving: Safer and More Efficient Future Driving, Springer, 2017
5.	Markus Maurer, Autonomous driving: technical, legal and social aspects. Springer, 2016
6.	Jha, Theory, Design and Applications of Unmanned Aerial Vehicles, CRC Press, 2016
7.	Adriano Cavalcanti, Tad Hogg, Bijan Shirinzadeh "**Nanorobot Communication Techniques: A Comprehensive Tutorial**", 9th International Conference on Control, Automation, Robotics and Vision, 2006.

Mapping of COs with POs and PSOs

Cos	Pos					
CO1	3	2	2	2		
CO2	3	2	2	2		
CO3	3	2	2	2		
CO4	3	2	2	2		
CO5	3	2	2	2		
Average	3	2	2	2		

1–Low, 2 –Medium, 3–High

ME23CP408	BIG DATA MINING AND ANALYTICS	Version 1.0				
Programme& Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To understand the computational approaches to Modeling, Feature Extraction.
2.	To understand the need and application of Map Reduce.
3.	To understand the various search algorithms applicable to Big Data.
4.	To analyze and interpret streaming data.
5.	To learn how to handle large data sets in main memory and learn the various clustering techniques applicable to Big Data.

UNIT–I	DATA MINING AND LARGE SCALE FILES	9

Introduction to Statistical modeling (L2) – Machine Learning (L2) – Computational approaches to modeling (L2) – Summarization (L2) – Feature Extraction (L3) – Statistical Limits on Data Mining (L3) - Distributed File Systems (L3) – Map-reduce (L3) – Algorithms using Map Reduce (L3) – Efficiency of Cluster Computing Techniques (L3) .

UNIT–II	SIMILAR ITEMS	9

Nearest Neighbor Search (L2) – Shingling of Documents (L2) – Similarity preserving summaries (L3) – Locality sensitive hashing for documents (L3) – Distance Measures (L3) – Theory of Locality Sensitive Functions (L2) – LSH Families (L2) – Methods for High Degree of Similarities (L3).

UNIT–III	MINING DATA STREAMS	9

Stream Data Model (L2) – Sampling Data in the Stream (L3) – Filtering Streams (L3) – Counting Distance Elements in a Stream (L3) – Estimating Moments (L3) – Counting Ones in Window (L3) – Decaying Windows (L3).

UNIT–IV	LINK ANALYSIS AND FREQUENT ITEMSETS	9

Page Rank (L2) – Efficient Computation (L4) - Topic Sensitive Page Rank (L3) – Link Spam (L3) – Market Basket Model (L3) – A-priori algorithm (L4) – Handling Larger Datasets in Main Memory (L4) – Limited Pass Algorithm (L3) – Counting Frequent Item sets (L3)

UNIT–V	CLUSTERING	9

Introduction to Clustering Techniques(L2) – Hierarchical Clustering (L2) – Algorithms (L2) – K-Means (L3) – CURE (L3) – Clustering in Non-Euclidean Spaces (L3) – Streams and Parallelism (L3) – Case Study: Advertising on the Web – Recommendation Systems (L3)

Total: 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course Specific Open Ended Problems will be solved during the class room teaching. Such problems can be given as Assignments and evaluated as Internal Assessment only and not for the End semester Examinations.

Course Outcomes: Upon completion of this course the students will be able to:		BLOOMS Taxonomy
CO1	Design algorithms by employing Map Reduce technique for solving Big Data problems	L3 - Apply
CO2	Design algorithms for Big Data by deciding on the apt Features set	L3 - Apply
CO3	Design algorithms for handling petabytes of datasets	L3 - Apply
CO4	Design algorithms and propose solutions for Big Data by optimizing main memory consumption	L3 - Apply
CO5	Design solutions for problems in Big Data by suggesting appropriate clustering techniques.	L3 - Apply

REFERENCE BOOKS:

1	Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 3rd Edition, 2020.
2	Jiawei Han, MichelineKamber, Jian Pei, "Data Mining Concepts and Techniques", Morgan Kaufman Publications, Third Edition, 2012.
3	Ian H.Witten, Eibe Frank "Data Mining – Practical Machine Learning Tools and Techniques", Morgan Kaufman Publications, Third Edition, 2011.
4	David Hand, HeikkiMannila and Padhraic Smyth, "Principles of Data Mining", MIT PRESS, 2001.

VIDEO REFERENCES:

1	https://www.youtube.com/playlist?list=PLuAADu3OvBt4OoH3LpZRbfvptzmJuzKxu
2	https://www.youtube.com/watch?v=1vbXmCrkT3Y
3	https://www.youtube.com/playlist?list=PLm_MSClsnwm8vZFOpvRth3wgVMxEm6jvY
4	https://www.youtube.com/playlist?list=PL4gu8xQu0_5I_UtjmsGnjfhAEzcXoas1O

WEB REFERENCES:

1	https://examupdates.in/big-data-analytics/
2	https://www.tutorialspoint.com/big_data_analytics/index.htm
3	https://www.tutorialspoint.com/data_mining/index.htm
4	https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106104189/lec1.pdf

ONLINE COURSES:

1	Nptel: https://swayam.gov.in/nd2_arp19_ap60/preview
2	Coursera: https://www.coursera.org/learn/big-data-analysis-deep-dive
3	GreatLearning: https://www.mygreatlearning.com/academy/learn-for-free/courses/mastering-big-data-analytics

Mapping of COs with POs and PSOs

COs	POs					
CO1				2	3	3
CO2					2	2
CO3				2	3	3
CO4	1		2	2	3	3
CO5	2	3	2	2	3	3
Average	1.5	3	2	2	2.8	2.8

1–Low, 2 –Medium, 3–High

ME23CP501	SECURITY PRACTICES	Version: 1.0
(COMMON TO M.E. VLSI, M.E. ISE, M.E. EMBEDDED)		

Programme & Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To learn the core fundamentals of system and web security concepts
2.	To have through understanding in the security concepts related to networks
3.	To deploy the security essentials in IT Sector
4.	To be exposed to the concepts of Cyber Security and cloud security
5.	To perform a detailed study of Privacy and Storage security and related Issues

UNIT -I	SYSTEM SECURITY	9

Model of network security (L1)– Security attacks, services and mechanisms(L1) – OSI security architecture A Cryptography primer- Intrusion detection system(L1)- Intrusion Prevention system (L1)- Security web applications- Case study: OWASP(L3) - Top 10 Web Application Security Risks(L2)

UNIT -II	NETWORK SECURITY	9

Internet Security - Intranet security(L2)- Local Area Network Security - Wireless Network Security(L2) - Wireless Sensor Network Security(L1)- Cellular Network Security - Mobile security(L2) - IOT security - Case Study - Kali Linux(L3).

UNIT –III	SECURITY MANAGEMENT	9

Information security essentials for IT Managers- Security Management System (L2)- Policy Driven System Management- IT Security(L3) - Online Identity and User Management System. Case study: Metasploit(L3)

UNIT –IV	CYBER SECURITY AND CLOUD SECURITY	9

Cyber Forensics- Disk Forensics – Network Forensics (L2)– Wireless Forensics – Database Forensics(L2) – Malware Forensics – Mobile Forensics (L2)– Email Forensics(L3)- Best security practices for automate Cloud infrastructure management (L2)– Establishing trust in IaaS, PaaS, and SaaS Cloud types. Case study: DVWA(L2)

UNIT –V	PRIVACY AND STORAGE SECURITY	9

Privacy on the Internet(L2) - Privacy Enhancing Technologies (L3)- Personal privacy Policies - Detection of Conflicts in security policies(L2)- privacy and security in environment monitoring systems(L2). Storage Area Network Security(L3) - Storage Area Network Security Devices (L2)- Risk management - Physical Security Essentials(L3)

Total:- 45 PERIODS

OPEN ENDED PROBLEMS /QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

Course Outcomes: Upon completion of this course the students will be able to:		BLOOMS Taxonomy
CO1	Understand the core fundamentals of system security	L3 – Apply
CO2	Apply the security concepts to wired and wireless networks	L3 – Apply
CO3	Implement and Manage the security essentials in IT Sector	L2 – Understand
CO4	Explain the concepts of Cyber Security and Cyber forensics	L3 – Apply
CO5	Be aware of Privacy and Storage security Issues	L3 – Apply

REFERENCEBOOKS:

1.	John R. Vacca, Computer and Information Security Handbook, Third Edition, Elsevier 2017
2.	Michael E. Whitman, Herbert J. Mattord, Principles of Information Security, Seventh Edition, Cengage Learning, 2022
3.	Richard E. Smith, Elementary Information Security, Third Edition, Jones and Bartlett Learning, 2019
4.	Mayor, K.K.Mookhey, Jacopo Cervini, Fairuzan Roslan, Kevin Beaver, Metasploit Toolkit for Penetration Testing,Exploit Development and Vulnerability Research,Syngress publications, Elsevier, 2007. ISBN : 978-1-59749-074-0
5.	John Sammons, "The Basics of Digital Forensics- The Primer for Getting Started in Digital Forensics", Syngress, 2012
6.	Siani Pearson, George Yee "Privacy and Security for Cloud Computing" Computer Communications and Networks, Springer, 2013.

Mapping of COs with POs and PSOs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	1	1	2	1
CO2	2	1	3	1	1	2
CO3			2	3	3	3
CO4	2	2	1	2	1	3
CO5	1		1	1	2	3
Average	1.5	1.7	1.6	1.6	1.8	2.4

1–Low, 2 –Medium, 3–High

ME23CP502	CLOUD COMPUTING TECHNOLOGIES	Version: 1.0
(COMMON TO M.E. VLSI, M.E. ISE, M.E. EMBEDDED)		

Programme & Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
2.	To understand the architecture, infrastructure and delivery models of cloud computing
3.	To explore the roster of AWS services and illustrate the way to make applications in AWS
4.	To gain knowledge in the working of Windows Azure and Storage services offered by Windows Azure
5.	To develop the cloud application using various programming model of Hadoop and Aneka

UNIT -I	VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE	9

Basics of Virtual Machines(L1) - Process Virtual Machines (L1)– System Virtual Machines (L1)–Emulation (L1)– Interpretation(L1) – Binary Translation - Taxonomy of Virtual Machines. Virtualization (L1)– Management Virtualization – Hardware Maximization – Architectures (L1)– Virtualization Management – Storage Virtualization (L1)– Network Virtualization- Implementation levels of virtualization(L1) – virtualization structure(L1) – virtualization of CPU, Memory and I/O devices (L1)– virtual clusters and Resource Management (L1)– Virtualization for data center automation(L1)

UNIT -II	CLOUD PLATFORM ARCHITECTURE	9

Cloud Computing: Definition, Characteristics (L1)- Cloud deployment models: public, private, hybrid, community(L1) – Categories of cloud computing(L1): Everything as a service: Infrastructure(L1), platform, software- A Generic Cloud Architecture Design(L1) – Layered cloud Architectural Development(L1) – Architectural Design Challenges(L1)

UNIT –III	AWS CLOUD PLATFORM - IAAS	9

Amazon Web Services: AWS Infrastructure(L1)- AWS API- AWS Management Console - Setting up AWS Storage (L1)- Stretching out with Elastic Compute Cloud - Elastic Container Service for Kubernetes(L1)- AWS Developer Tools: AWS Code Commit, AWS Code Build, AWS Code Deploy(L1), AWS Code Pipeline(L1), AWS code Star - AWS Management Tools: Cloud Watch, AWS Auto Scaling(L1), AWS control Tower, Cloud Formation(L1), Cloud Trail, AWS License Manager(L1)

UNIT –IV	PAAS CLOUD PLATFORM	9

Windows Azure: Origin of Windows Azure(L1), Features, The Fabric Controller – First Cloud APP in Windows Azure(L1)- Service Model and Managing Services: Definition and Configuration(L1), Service runtime API(L1)- Windows Azure Developer Portal(L1)- Service Management API(L1)- Windows Azure Storage Characteristics- Storage Services(L1)- REST API(L1)- Blops(L1)

UNIT –V	PROGRAMMING MODEL	9

Introduction to Hadoop Framework - Map reduce, Input splitting, map and reduce functions, specifying input and output parameters(L1), configuring and running a job(L1) –Developing Map Reduce Applications(L1)- Design of Hadoop file system(L1) –Setting up Hadoop Cluster(L1)- Aneka: Cloud Application Platform, Thread Programming, Task Programming and Map(L1)-Reduce Programming in Aneka(L1)

Total:- 45 PERIODS

OPEN ENDED PROBLEMS /QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOMS Taxonomy**
CO1	Employ the concepts of virtualization in the cloud computing	L3 – Apply
CO2	Identify the architecture, infrastructure and delivery models of cloud computing	L3 – Apply
CO3	Develop the Cloud Application in AWS platform	L2 – Understand
CO4	Apply the concepts of Windows Azure to design Cloud Application	L3 – Apply
CO5	Develop services using various Cloud computing programming models	L3 – Apply
REFERENCEBOOKS:		
1.	Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.	
2.	Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019.	
3.	Sriram Krishnan, Programming: Windows Azure, O'Reilly,2010.	
4.	Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing , MCGraw Hill Education (India) Pvt. Ltd., 2013	
5.	Danielle Ruest, Nelson Ruest, —Virtualization: A Beginner"s Guide‖, McGraw-Hill Osborne Media, 2009.	
6.	Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005	

Mapping of COs with POs and PSOs						
COs	**POs**					
CO1	-	-	-	2	2	1
CO2	2	3	1	-	-	1
CO3	3	-	3	-	1	3
CO4	-	-	-	2	-	3
CO5	3	2	-	-	-	-
Average	2.7	2.5	2	2	1.5	2
1–Low, 2 –Medium, 3–High						

ME23CP503	BLOCKCHAIN TECHNOLOGIES	Version: 1.0				
(COMMON TO M.E. VLSI, M.E. ISE, M.E. EMBEDDED)						
Programme & Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	This course is intended to study the basics of Block chain technology.
2.	During this course the learner will explore various aspects of Block chain technology like application in various domains
3.	By implementing, learners will have idea about private and public Block chain, and smart contract.

UNIT -I	INTRODUCTION OF CRYPTOGRAPHY AND BLOCKCHAIN	9

Introduction to Blockchain(L1), Blockchain Technology Mechanisms & Networks (L1), Blockchain Origins, Objective of Blockchain, Blockchain Challenges(L1), Transactions and Blocks, P2P Systems(L1), Keys as Identity, Digital Signatures(L1), Hashing, and public key cryptosystems(L1), private vs. public Blockchain(L1).

UNIT -II	BITCOIN AND CRYPTOCURRENCY	9

Introduction to Bitcoin(L1), The Bitcoin Network, The Bitcoin Mining Process(L1), Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks(L1), Ethereum Virtual Machine (EVM), Merkle Tree(L2), Double-Spend Problem(L1), Blockchain and Digital Currency, Transactional Blocks(L1), Impact of Block chain Technology on Cryptocurrency(L1)

UNIT –III	INTRODUCTION TO ETHEREUM	9

Introduction to Ethereum(L1), Consensus Mechanisms(L1), Metamask Setup(L1), Ethereum Accounts(L1) , Transactions, Receiving Ethers, Smart Contracts(L1).

UNIT –IV	INTRODUCTION TO HYPERLEDGER AND SOLIDITY PROGRAMMING	9

Introduction to Hyperledger(L1), Distributed Ledger Technology & its Challenges(L1), Hyperledger & Distributed Ledger Technology(L2), Hyperledger Fabric(L2), Hyperledger Composer(L2). Solidity (L2)-Language of Smart Contracts(L1), Installing Solidity & Ethereum Wallet(L1), Basics of Solidity(L1), Layout of a Solidity Source File & Structure of Smart Contracts(L2), General Value Types(L2).

UNIT –V	BLOCKCHAIN APPLICATIONS	9

Internet of Things(L2), Medical Record Management System(L3), Domain Name Service and Future of Blockchain(L3), Alt Coins(L2)

Total:- 45 PERIODS

OPEN ENDED PROBLEMS /QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

Course Outcomes: Upon completion of this course the students will be able to:		BLOOMS Taxonomy
CO1	Understand and explore the working of Block chain technology	L3 – Apply
CO2	Analyze the working of Smart Contracts	L3 – Apply
CO3	Understand and analyze the working of Hyper ledger	L2 – Understand
CO4	Apply the learning of solidity to build de-centralized apps on Ethereum	L3 – Apply
CO5	Develop applications on Block chain	L3 – Apply

REFERENCEBOOKS:

1.	Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained", Second Edition, Packt Publishing, 2018
2.	Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2016
3.	Antonopoulos, Mastering Bitcoin, O'Reilly Publishing, 2014. .
4.	Antonopoulos and G. Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", O'Reilly Publishing, 2018.
5.	D. Drescher, Blockchain Basics. Apress, 2017.

Mapping of COs with POs and PSOs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	3	2	2	3
CO2	2	1	2	3	2	2
CO3	2	1	3	1	2	1
CO4	2	1	2	3	2	2
CO5		1		2		
Average	2	1	2.5	2.2	2	2
1–Low, 2 –Medium, 3–High						

ME23CP504	DEEP LEARNING	Version: 1.0
(COMMON TO M.E. VLSI, M.E. ISE, M.E. EMBEDDED)		

Programme & Branch	M.E. – COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	Develop and Train Deep Neural Networks
2	Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition
3	Build and train RNNs, work with NLP and Word Embeddings
4	The internal structure of LSTM and GRU and the differences between them
5	The Auto Encoders for Image Processing

UNIT–I	DEEP LEARNING CONCEPTS	6

Fundamentals about Deep Learning (L2) Perception Learning Algorithms (L2) Probabilistic modelling (L2) Early Neural Networks (L2) How Deep Learning different from Machine Learning (L2) Scalars (L2) Vectors (L2) Matrixes(L2) Higher Dimensional Tensor (L2). Manipulating Tensors (L2) Vector Data (L2) Time Series Data (L2) Image Data (L2) Video Data (L2)

UNIT–II	NEURAL NETWORKS	9

About Neural Networ (l2) Building Blocks of Neural Network (L2) Optimizers (L2) Activation Functions (L3) Loss Functions (L3) Data Pre-processing for neural networks()L3 Feature Engineering (L2) Overfitting and Underfitting(L2) Hyper parameters(L2)

UNIT– III	CONVOLUTIONAL NEURAL NETWORK	10

About CNN (L2) Linear Time Invariant (L2) Image Processing Filtering (L2) Building a convolutional neural network (L2) Input Layers (L2) Convolution Layers (L2) Pooling Layers (L2) Dense Layers(L2) Backpropagation Through the Convolutional Layer(L2) Filters and Feature Map (L2). Backpropagation Through the Pooling Layers(L3) Dropout Layers and Regularization(L3) Batch Normalization (L3) Various Activation Functions (L2) Various Optimizers(L2) LeNet (L2), AlexNet(L2), VGG16 (L2), ResNet (L2) Transfer Learning with Image Data(L3) Transfer Learning using Inception Oxford VGG Model(L3), Google Inception Model(L3), Microsoft ResNet Model(L2). R-CNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO(L2)

UNIT – IV	NATURAL LANGUAGE PROCESSING USING RNN	10

About NLP & its Toolkits(L2) Language Modeling(L2) Vector Space Model (VSM)(L2) Continuous Bag of Words (CBOW) (L2) Skip-Gram Model for Word Embedding(L3) Part of Speech (PoS) Global Co-occurrence Statistics–based Word Vectors (L3). Transfer Learning (L2) Word2Vec(L2) Global Vectors for Word Representation GloVe (L3) Backpropagation Through Time (L2) Bidirectional RNNs (BRNN)(L2) .Long Short Term Memory (LSTM)(L2) Bi-directional LSTM(L2) Sequence-to-Sequence Models (Seq2Seq). Gated recurrent unit GRU(L2)

UNIT–V	DEEP REINFORCEMENT & UNSUPERVISED LEARNING	10

About Deep Reinforcement Learning(L2) Q-Learning(L2) Deep Q-Network (DQN)(L2). Policy Gradient Methods(L2). Actor-Critic Algorithm(L3) About Auto encoding(L2) Convolutional Auto Encoding(L2) Variational Auto Encoding(L3) Generative Adversarial Networks (L2) Auto encoders for Feature Extraction(L2) Auto Encoders for Classification (L3). Denoising Auto encoders(L2) Sparse Auto encoders(L2)

TOTAL : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS		
Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment (IA) only and not for the End semester Examinations.		
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Feature Extraction from Image and Video Data	L2 - Understand
CO2	Implement Image Segmentation and Instance Segmentation in Images	L3 - Apply
CO3	Implement image recognition and image classification using a pretrained network (Transfer Learning)	L3 - Apply
CO4	Traffic Information analysis using Twitter Data.	L3 - Apply
CO5	Autoencoder for Classification & Feature Extraction.	L3 - Apply
REFERENCE BOOKS:		
1.	Josh Patterson and Adam Gibson," Deep Learning A Practitioner's Approach", O'Reilly Media, Inc.2017	
2.	Jojo Moolayil," Learn Keras for Deep Neural Networks", Apress,2018	
3.	Vinita Silaparasetty," Deep Learning Projects Using TensorFlow 2", Apress, 2020	
4.	François Chollet," Deep Learning with Python", Manning Shelter Island,2017	
5.	Santanu Pattanayak," Pro Deep Learning with TensorFlow", Apress,2017	
VIDEO REFERENCES:		
1.	https://onlinecourses.nptel.ac.in/noc20_cs62/preview	
2.	https://onlinecourses.nptel.ac.in/noc20_cs50/preview	
WEB REFERENCES:		
1.	https://www.kaggle.com/learn/intro-to-deep-learning	
2.	https://www.datacamp.com/tutorial/tutorial-deep-learning-tutorial	
ONLINE COURSES:		
1.	https://www.udemy.com/course/deeplearning	
2.	https://in.mathworks.com/solutions/deep-learning	

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2	2		3	3	3
CO2	2	2	2	3	3	2
CO3	2	2	2	3	2	3
CO4	2	2	1	3	3	3
CO5	2	2		3	2	2
Average	2	2	1.7	3	2.6	2.6
1–Low, 2 –Medium, 3–High						

ME23CP505	DESIGN THINKING	Version: 1.0
(COMMON TO M.E. VLSI, M.E. ISE, M.E. EMBEDDED)		

Programme & Branch	M.E. – COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To provide a sound knowledge in UI & UX
2.	To understand the need for UI and UX
3.	Research Methods used in Design
4.	Tools used in UI & UX
5.	Creating a wireframe and prototype

UNIT–I	UX LIFECYCLE TEMPLATE	8

Introduction(L1) A UX process lifecycle template (L2) Choosing a process instance for your project (L2). The system complexity space (L2) Meet the user interface team (L2) Scope of UX presence within the team (L2) More about UX lifecycles(L2) Business Strategy (L2) Value Innovation (L2) Validated User Research (L2) Killer UX Design (L2) The Blockbuster Value Proposition(L2) What Is a Value Proposition? (L2)

UNIT–II	CONTEXTUAL INQUIRY	10

The system concept statement (L2) User work activity data gathering (L3) Look for emotional aspects of work practice (L3) Abridged contextual inquiry process (L3) Data-driven vs. model-driven inquiry(L2) Organizing concepts: work roles and flow model(L2) Creating and managing work activity notes (L3) Constructing your work activity affinity diagram (WAAD) (L3). Abridged contextual analysis process (L3) History of affinity diagrams(L2)

UNIT– III	DESIGN THINKING, IDEATION, AND SKETCHING	9

Design-informing models: second span of the bridge(L2) Some general "how to" suggestions(L2) A New example domain: slideshow presentations (L3) User models (L2) Usage models(L2) Work environment models(L2) Barrier summaries(L2) Model consolidation(L3) Protecting your sources(L2) Abridged methods for design-informing models extraction(L3) Design paradigms(L2) Design thinking(L2) Design perspectives(L2) User personas(L3) Ideation(L3) Sketching(L3)

UNIT – IV	UX GOALS, METRICS, AND TARGETS	8

Introduction (L1) UX goals (L2) UX target tables(L2) Work roles (L2) user classes(L2) and UX goals(L2) UX measures (L2) Measuring instruments. UX metric(L3) Baseline level(L3) Target level(L3) Setting levels(L3) Observed results(L2) Practical tips and cautions for creating UX targets(L3) How UX targets help manage the user experience engineering process(L2).

UNIT–V	ANALYSING USER EXPERIENCE	10

Sharpening Your Thinking Tools (L2) UX Research and Strength of Evidence (L2) Agile Personas(L2) How to Prioritize Usability Problems(L2). Creating Insights(L2), Hypotheses and Testable Design Ideas(L2). How to Manage Design Projects with User Experience Metrics(L2) Two Measures that Will Justify Any Design Change(L2). Evangelizing UX Research(L2). How to Create a User Journey Map(L3). Generating Solutions to Usability Problems(L3). Building UX Research into the Design Studio Methodology(L3). Dealing with Common objections to UX Research(L3). The User Experience Debrief Meeting(L3). Creating a User Experience Dashboard(L3).

TOTAL : 45 PERIODS

	OPEN ENDED PROBLEMS / QUESTIONS	

Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment (IA) only and not for the End semeste Examinations.

TOTAL: 45 PERIODS

Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Build UI for user Applications.	L2 - Understand
CO2	Use the UI Interaction behaviors and principles	L3 - Apply
CO3	Evaluate UX design of any product or application.	L3 - Apply
CO4	Demonstrate UX Skills in product development.	L3 – Apply
CO5	Implement Sketching principles.	L3 – Apply

REFERENCE BOOKS:

1.	Westley Knight," UX for Developers: How to Integrate User-Centered Design Principles Into Your Day-toDay Development Work", Apress, 2018
2.	Rex Hartson, Pardha Pyla. Morgan Kaufmann," The UX Book: Process and Guidelines for Ensuring a Quality User Experience", 2012
3.	Edward Stull," UX Fundamentals for Non-UX Professionals: User Experience Principles for Managers, Writers, Designers, and Developers". Apress, 2018
4.	Gothelf, Jeff, Seiden, and Josh," Lean UX: Designing Great Products with Agile Team", O'Reilly Media, 2016
5.	Ben Coleman, and Dan Goodwin," Designing UX: Prototyping: Because Modern Design is Never Static", SitePoint, 2017

VIDEO REFERENCES:

1.	https://onlinecourses.nptel.ac.in/noc22_mg32/preview
2.	https://elearn.nptel.ac.in/shop/iit-workshops/completed/introduction-to-design-thinking-its-creative-tools/

WEB REFERENCES:

1.	https://www.ibm.com/design/thinking/
2.	https://designthinking.ideo.com/

ONLINE COURSES:

1.	https://www.edx.org/learn/design-thinking
2.	https://www.udemy.com/topic/design-thinking

Mapping of COs with POs and PSOs

COs	POs PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	1		
CO2	2	2	1	1		
CO3	2	2	1	1		
CO4	2	2	1	1		
CO5	2	2	1	1		
Average	2	2	1	1		

1–Low, 2 –Medium, 3–High

ME23CP506	PRINCIPLES OF MULTIMEDIA	Version: 1.0
(COMMON TO M.E. VLSI, M.E. ISE, M.E. EMBEDDED)		

Programme & Branch	M.E. – COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1.	To get familiarity with gamut of multimedia and its significance
2.	To acquire knowledge in multimedia components
3.	To acquire knowledge about multimedia tools and authoring
4.	To acquire knowledge in the development of multimedia applications
5.	To explore the latest trends and technologies in multimedia

UNIT–I	INTRODUCTION	9

Introduction to Multimedia (L2) – Characteristics of Multimedia Presentation (L2) – Multimedia Components (L2) – Promotion of Multimedia Based Components (L2) – Digital Representation (L2) – Media and Data Streams (L2) – Multimedia Architecture (L2) – Multimedia Documents (L2), Multimedia Tasks and Concerns (L2), Production (L2), sharing and distribution (L2), Hypermedia (L2), WWW and Internet (L2), Authoring (L2), Multimedia over wireless and mobile networks(L2)

Suggested Activities:

1. Flipped classroom on media Components (L3).
2. External learning – Interactive presentation (L3).

Suggested Evaluation Methods:

1. Tutorial – Handling media components
2. Quizzes on different types of data presentation.

UNIT–II	ELEMENTS OF MULTIMEDIA	9

Text-Types (L2), Font, Unicode Standard, File Formats (L2), Graphics and Image data representations (L2) – data types, file formats, color models(L2); video – color models in video (L2), analog video (L2), digital video, file formats, video display interfaces (L2), 3D video and TV: Audio – Digitization (L2), SNR, SQNR, quantization, audio quality, file formats, MIDI (L2); Animation- Key Frames and Tweening, other Techniques, 2D and 3D Animation (L2)

Suggested Activities:

1. Flipped classroom on different file formats of various media elements (L3).
2. External learning – Adobe after effects, Adobe Media Encoder, Adobe Audition(L3).

Suggested Evaluation Methods:

1. Demonstration on after effects animations.
2. Quizzes on file formats and color models

UNIT– III	MULTIMEDIA TOOLS	9

Authoring Tools (L2) – Features and Types (L2) – Card and Page Based Tools(L2) – Icon and Object Based Tools (L2) – Time Based Tools (L2) – Cross Platform Authoring To(L2)ols – Editing Tools (L2)– Painting and Drawing Tools (L2) – 3D Modeling and Animation Tools (L2) – Image Editing Tools (L2)– Sound Editing Tools (L2)– Digital Movie Tools (L2).

Suggested Activities:

1. Flipped classroom on multimedia tools (L3).
2. External learning – Comparison of various authoring tools (L3).

Suggested Evaluation Methods:

1. Tutorial – Audio editing tool.
2. Quizzes on animation tools.

UNIT – IV	MULTIMEDIA SYSTEMS	9

Compression Types and Techniques: CODEC (L2), Text Compression: GIF Coding Standards, JPEG standard (L2) – JPEG 2000 (L2), basic audio compression (L2) – ADPCM, MPEG Psychoacoustics (L2), basic Video compression techniques (L2) – MPEG, H.26X – Multimedia Database System (L2) – User Interfaces – OS Multimedia Support (L2) – Hardware Support (L2)– Real Time Protocols (L2) – Play Back Architectures (L2) – Synchronization (L2) – Document Architecture (L2) – Hypermedia Concepts: Hypermedia Design – Digital Copyrights, Content analysis(L2).

Suggested Activities:

1. Flipped classroom on concepts of multimedia hardware architectures(L3).
2. External learning – Digital repositories and hypermedia design (L3).

Suggested Evaluation Methods:

1. Quizzes on multimedia hardware and compression techniques.
2. Tutorial – Hypermedia design.

UNIT–V	MULTIMEDIA APPLICATIONS FOR THE WEB AND MOBILE PLATFORMS	9

ADDIE Model (L2)– Conceptualization – Content Collection – Storyboard–Script Authoring Metaphors (L2) – Testing – Report Writing – Documentation (L2). Multimedia for the web and mobile platforms(L2) Virtual Reality, Internet multimedia content distribution (L2), Multimedia Information sharing (L2) – social media sharing, cloud computing for multimedia services, interactive cloud gaming(L2). Multimedia information retrieval (L2).

Suggested Activities:

1. External learning – Game consoles (L3).
2. External learning – VRML scripting languages (L3).

Suggested Evaluation Methods:

1. Demonstration of simple interactive games.
2. Tutorial – Simple VRML program.

TOTAL : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific Open Ended Problems will be solved during the classroom teaching. Such problems can be given as Assignments and evaluated as Internal Assessment (IA) only and not for the End semester Examinations.

TOTAL: 45 PERIODS

	Course Outcomes: **Upon completion of this course the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Handle the multimedia elements effectively.	L3 - Apply
CO2	Articulate the concepts and techniques used in multimedia applications	L3 - Apply
CO3	Develop effective strategies to deliver Quality of Experience in multimedia applications	L3 - Apply
CO4	Design and implement algorithms and techniques applied to multimedia objects.	L3 - Apply
CO5	Design and develop multimedia applications following software engineering models.	L3 - Apply

REFERENCE BOOKS:	
1.	Li, Ze-Nian, Drew, Mark, Liu, Jiangchuan, "Fundamentals of Multimedia", Springer, Third Edition, 2021
2.	Prabhat K.Andleigh, Kiran Thakrar, "MULTIMEDIA SYSTEMS DESIGN", Pearson Education, 2015
3.	Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018. (digital book)
4.	Ranjan Parekh, "Principles of Multimedia", Second Edition, McGraw-Hill Education, 2017
5.	Santanu Pattanayak," Pro Deep Learning with TensorFlow", Apress,2017
VIDEO REFERENCES:	
1.	https://nptel.ac.in/courses/117105083
2.	https://www.classcentral.com/course/swayam-cit-003-web-based-technologies-and-multimedia-applications-20229
WEB REFERENCES:	
1.	https://ctl.wiley.com/principles-of-multimedia-learning/
2.	https://pressbooks.pub/elearning2020/chapter/a-quick-overview-of-the-multimedia-principle/
ONLINE COURSES:	
1.	https://www.skillshare.com/browse/multimedia
2.	https://leverageedu.com/blog/multimedia-courses/

Mapping of COs with POs and PSOs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1				1	3	2
CO2				1	3	2
CO3				1	3	2
CO4				1	3	2
CO5				1	3	2
Average				1	3	2

1–Low, 2 –Medium, 3–High

ME23IS501 / ME23IS302	ENVIRONMENTAL SAFETY	Version: 1.0

(EXCEPT FOR M.E. INDUSTRIAL SAFETY ENGINEERING)

Programme & Branch	M.E INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To provide in depth knowledge in Principles of Environmental safety and its applications in various fields.
2	To give understanding of air and water pollution and their control.
3	To expose the students to the basis in hazardous waste management.
4	To provide knowledge on pollution monitoring and control devices.
5	To design emission measurement devices.

UNIT–I	AIR POLLUTION	9

Classification and properties of air pollutants (L1)-Pollution sources (L1)-Effects of air pollutants on human beings(L2), Animals, Plants, and Materials (L2)-Automobile pollution (L1)-Hazards of air pollution (L2)-Concept of clean coal combustion technology (L2)-Ultra violet radiation (L1), infrared radiation(L1), radiation from the sun (L1)-Hazards due to depletion of ozone (L2)-Deforestation (L2), ozone holes (L2), automobile exhausts, chemical factory stack emissions, CFC (L2).

UNIT–II	WATER POLLUTION	9

Classification of water pollutants (L1)-Health hazards (L2)-Sampling and analysis of water (L2)-Water treatment (L3)-Different industrial effluents and their treatment and disposal (L2)-Advanced wastewater treatment (L3)-Effluent quality standards and laws (L3)-Chemical industries, tannery, textile effluents (L2)-Common treatment (L2).

UNIT– III	HAZARDOUS WASTE MANAGEMENT	9

Hazardous waste management in India (L1)-Waste identification, characterization, and classification (L2)-Technological options for collection, treatment, and disposal of hazardous waste (L2)Selection charts for the treatment of different hazardous wastes (L2)-Methods of collection and disposal of solid wastes (L2)-Health hazards - (L2)-Toxic and radioactive wastes (L2)-Incineration and vitrification (L1)-Hazards due to bio-process(L1)-, dilution, standards, and restrictions (L1)-Recycling and reuse (L2).

UNIT – IV	ENVIRONMENTAL MEASUREMENT AND CONTROL	9

Sampling and analysis (L2)-Dust monitor (L2)-Gas analyzer(L1)-, particle size analyzer (L2)-Lux meter(L1)-, pH meter (L1)-Gas chromatograph (L1)-Atomic absorption spectrometer (L1)-Gravitational settling chambers(L1), cyclone separators(L1), scrubbers (L1)-Electrostatic precipitator(L1), bag filter(L1), maintenance (L2)-Control of gaseous emission by adsorption(L2), absorption(L2), and combustion methods (L2)-Pollution Control Board, laws (L1).

UNIT–V	POLLUTION CONTROL IN PROCESS INDUSTRIES	9

Pollution control in process industries (L2)-Cement, paper, petroleum, petroleum products, textile (L2)-Tanneries, thermal power plants (L2)-Dyeing and pigment industries (L2)-Eco-friendly energy (L2).

Total : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

Course Outcomes: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Illustrate and familiarize the basic concepts scope of environmental safety.	L2 - Understand
CO2	Interpret the standards of professional conduct that are published by professional safety organizations and/or certification bodies.	L2 - Understand
CO3	Explain the ways in which environmental health problems have arisen due to air and water pollution.	L2 - Understand
CO4	Examine the role of hazardous waste management and use of critical thinking to identify and assess environmental health risks.	L4 - Analyze
CO5	Apply concepts of emission measurement and design emission measurement devices.	L3 - Apply

REFERENCE BOOKS:

1.	E. C Wolfe, Race to Save to Save Planet, Wadsworth Publishing Co., Belmont, CA 2006.
2.	G. T Miller, Environmental Science: Working with the Earth, 11th Edition, Wadsworth Publishing Co., Belmont, CA, 2006
3.	M.J Hammer,., and M.J Hammer,., Jr., Water and Wastewater Technology, Pearson Prentice Hall, 2006
4.	Rao, CS, "Environmental pollution engineering:, Wiley Eastern Limited, New Delhi, 1 st January 2018.
5.	S. P. Mahajan, "Pollution control in process industries", Tata McGraw Hill Publishing Company, New Delhi, 2006.
6.	Varma and Braner, "Air pollution equipment", Springer Publishers, Second Edition.

VIDEO REFERENCES:	
1.	https://www.youtube.com/watch?v=DAQapF-F4Vw&list=PL9108F6C4E154885A
2.	https://www.youtube.com/watch?v=5dukz1UOtkA&list=PLLy_2iUCG87BwOQUbS7WSdMVWHDXByk-w
WEB REFERENCES:	
1.	https://tifac.org.in/index.php/programmes/activities/8-publication/145-industrial-air-pollution-control-technologies?showall=1
2.	https://www.unep.org/beatpollution/global-response-pollution
ONLINE COURSES:	
1.	https://onlinecourses.nptel.ac.in/noc23_ce14/preview
2.	https://onlinecourses.nptel.ac.in/noc23_ch72/preview

Mapping of COs with POs and PSOs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1		1	2			1
CO2		1	3	1		1
CO3		2	2		1	2
CO4	1	3	3	1	3	
CO5	1	1	3	3		
Average	1	1.6	2.75	1.66	2	1.33

1–Low, 2 –Medium, 3–High.

ME23IS502 / ME23IS309	ELECTRICAL SAFETY	Version: 1.0
(EXCEPT FOR M.E. INDUSTRIAL SAFETY ENGINEERING)		

Programme & Branch	M.E INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To impart knowledge on fundamental electrical concepts, equipment principles, and comply with safety regulations, including basic first aid.
2	To familiarize students with primary electrical hazards, insulation, and lightning protection measures.
3	To provide an in depth knowledge on functioning of fuses, circuit breakers, and safety measures against electrical faults.
4	To provide knowledge on equipment selection, safety features, and maintenance for electrical tools.
5	To familiarize students with hazardous zone classification, safe equipment, and safety measures in different environments.

UNIT–I	CONCEPTS AND STATUTORY REQUIREMENTS	9

Introduction – electrostatics (L1), electro magnetism(L1), stored energy(L1), energy radiation and electromagnetic interference(L1) – Working principles of electrical equipment(L2)-Indian electricity act and rules(L1)-statutory requirements from electrical inspectorate(L1)-international standards on electrical safety (L1)– first aid-cardio pulmonary resuscitation(CPR) (L1).

UNIT–II	ELECTRICAL HAZARDS	9

Primary and secondary hazards (L2)-shocks(L1), burns(L1), scalds(L1), falls-human safety in the use of electricity(L1).Energy leakage(L2)-clearances and insulation(L2)-classes of insulation(L2)-voltage classifications(L2)-excess energycurrent surges(L2)-Safety in handling of war equipments(L2)-over current and short circuit current(L2)-heating effects of current(L2)-electromagnetic forces(L1)-corona effect(L2)-static electricity(L1) –definition, sources, hazardous conditions(L2), control(L2), electrical causes of fire and explosion(L2)-ionization, spark and arcignition energy(L2)-national electrical safety code ANSI(L2).Lightning (L2), hazards (L2), lightning arrestor (L2), installation – earthing(L2), specifications(L2), earth resistance(L2), earth pit maintenance(L2).

UNIT– III	PROTECTION SYSTEMS	9

Fuse(L1), circuit breakers and overload relays(L1) – protection against over voltage and under voltage (L2)– safe limits of amperage – voltage –safe distance from lines(L2)-capacity and protection of conductor-joints-and connections(L2), overload and short circuit protection(L2)-no load protection(L2)-earth fault protection(L2). FRLS insulation(L2)-insulation and continuity test(L2)-system grounding(L2)-equipment grounding(L2)-earth leakage circuit breaker (ELCB) (L2)-cable wires(L2)-maintenance of ground-ground fault circuit interrupter(L2)-use of low voltage(L2)-electrical guards(L2)-Personal protective equipment(L2) – safety in handling hand held electrical appliances tools and medical equipments(L2).

UNIT – IV	SELECTION, INSTALLATION, OPERATION AND MAINTENANCE	9

Role of environment in selection(L2)-safety aspects in application(L2) - protection and interlock(L2)-self diagnostic features and fail safe concepts(L2)-lock out and work permit system(L2)-discharge rod and earthing devices safety in the use of portable tools(L2)-cabling and cable joints(L2)-preventive maintenance(L2).

UNIT–V	HAZARDOUS ZONES	9

Classification of hazardous zones(L2)-intrinsically safe and explosion proof electrical apparatus(L2)-increase safe equipment(L2)-their selection for different zones(L2)-temperature classification(L2)-grouping of gases(L2)-use of barriers and isolators(L2)-equipment certifying agencies(L2).

Total : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

COURSE OUTCOMES: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Demonstrate understanding of electrical concepts and legal compliance for safe operation, within regulatory constraints.	L2 - Understand
CO2	Identify and mitigate electrical hazards, ensuring safety adherence to protocols and guidelines.	L3 - Apply
CO3	Utilize protection systems effectively, ensuring electrical safety within specified standards.	L3 - Apply
CO4	Apply a safe and efficient process for selecting, installing, operating, and maintaining electrical equipment, adhering to industry regulations.	L3 - Apply
CO5	Develop expertise in managing hazardous zones safely, within the constraints of applicable safety standards.	L3 - Apply

REFERENCE BOOKS:

1.	"Accident prevention manual for industrial operations", N.S.C., Chicago, 1982.
2.	Indian Electricity Act and Rules, Government of India.
3.	Power Engineers – Handbook of TNEB, Chennai, 1989.
4.	Martin Glov Electrostatic Hazards in powder handling, Research Studies Pvt. Ltd., England, 1988.
5.	Fordham Cooper, W., "Electrical Safety Engineering" Butterworth and Company, London, 1986.

VIDEO REFERENCES:

1.	https://www.youtube.com/watch?v=zRHtJLFJf78
2.	https://www.youtube.com/watch?v=7N9chOXO8TU

WEB REFERENCES:

1.	https://www.osha.gov/sites/default/files/2019-03/electrical_safety_manual.pdf
2.	https://www.ilo.org/global/topics/labour-administration-inspection/resources-library/publications/guide-for-labour-inspectors/electrical-safety/lang--en/index.htm

ONLINE COURSES:	
1.	https://onlinecourses.swayam2.ac.in/nou20_cs08/preview
2.	https://learning.tcsionhub.in/courses/ve/safety/siemens/electrical-safety-online-course-and-training/

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	1	3		1	1
CO2		1	3	1	2	2
CO3		2	3	2	2	2
CO4	1	1	3	1	1	1
CO5		2	3		2	
Average	1	1.4	3	1.33	1.6	1.5
1–Low, 2 –Medium, 3–High.						

ME23IS503/ ME23IS 413	SAFETY IN ENGINEERING INDUSTRY	Version: 1.0
(EXCEPT FOR M.E. INDUSTRIAL SAFETY ENGINEERING)		

Programme & Branch	M.E INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To know the safety rules and regulations, standards and codes
2	To study various mechanical machines and their safety importance
3	To understand the principles of machine guarding and operation of protective devices.
4	To know the working principle of mechanical engineering processes such as metal forming and joining process and their safety risks.
5	To impart knowledge on finishing, inspection and testing operations in engineering industry

UNIT–I	SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES	9

General safety rules(L1), principles(L1), maintenance(L1), Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines (L3), CNC machines(L1),Wood working machinery(L1), types(L1),, safety principles(L1),, electrical guards(L2),, work area(L1), material handling(L1), inspection(L3),, standards and codes(L1),- saws(L1), types(L1),hazards(L2).

UNIT–II	PRINCIPLES OF MACHINE GUARDING	9

Guarding during maintenance(L2),, Zero Mechanical State (ZMS) (L2),, Definition(L1),, Policy for ZMS(L1), – guarding of hazards(L2), - point of operation protective devices(L2), machine guarding(L2), types, fixed guard(L2), interlock guard(L2), automatic guard(L2), trip guard(L2), electron eye(L2), positional control guard(L2), fixed guard fencing(L2), - guard construction(L2), - guard opening(L1).Selection and suitability: lathe-drilling-boring-milling-grinding-shaping-sawing-shearing-presses-forge hammer(L1) -flywheels(L1) -shafts(L1)-couplings(L1)-gears(L1)-sprockets wheels and chains(L1)-pulleys and belts(L1)-authorized entry to hazardous installations(L3)-benefits of good guarding systems(L1).

UNIT– III	SAFETY IN WELDING AND GAS CUTTING	9

Gas welding and oxygen cutting(L2), resistances welding(L2), arc welding and cutting(L2), common hazards(L1), personal protective equipment(L1), training(L1), safety precautions in brazing, soldering and metalizing(L2) – explosive welding(L1), selection, care and maintenance of the associated equipment and instruments(L2) – safety in generation, distribution and handling of industrial gases(L2) -colour coding(L2) – flashback arrestor (L2)– leak detection(L1)-pipe line safety(L1)-storage and handling of gas cylinders(L2).

UNIT – IV	SAFETY IN COLD FARMING AND HOT WORKING OF METALS	9

Cold working(L1), power presses(L1), point of operation safe guarding(L2), auxiliary mechanisms(L1), feeding and cutting mechanism(L1),, hand or foot-operated presses(L1),, power press electric controls(L1),, power press set up and die removal(L2), inspection and maintenance(L3), -metal sheers-press brakes(L2).Hot working safety in forging(L2),, hot rolling mill operation(L2), safe guards in hot rolling mills(L2), – hot bending of pipes(L2), hazards and control measures(L1). Safety in gas furnace operation, cupola, crucibles, ovens (L2)- foundry health hazards(L2), work environment(L1), material handling in foundries(L1), foundry production cleaning and finishing foundry processes(L2).

UNIT–V	SAFETY IN FINISHING, INSPECTION AND TESTING	9

Heat treatment operations(L2), electro plating(L2), paint shops(L1), sand and shot blasting(L1), safety in inspection and testing(L3), dynamic balancing(L2), hydro testing(L2), valves(L1), boiler drums and headers(L1), pressure vessels(L1), air leak test(L2), steam testing(L2), safety in radiography(L2), personal monitoring devices(L2), radiation hazards(L2), engineering and administrative controls(L2), Indian Boilers Regulation(L1).Health and welfare measures in engineering industry(L2),-pollution control in engineering industry(L2) - industrial waste disposal(L2) .

Total : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

COURSE OUTCOMES: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Apply safety rules for maintaining and inspecting metal and wood working machines, ensuring industry standards.	L3 - Apply
CO2	Apply effective design strategies for machine guarding systems, emphasizing zero mechanical state (ZMS) during maintenance.	L3 - Apply
CO3	Demonstrate proficiency in safe welding and cutting, ensuring proper equipment selection, care, and maintenance.	L2 - Understand
CO4	Make use of safety measures in cold and hot metalworking, ensuring proper equipment setup, inspection, and maintenance.	L3 - Apply
CO5	Apply safety protocols in finishing, inspection, and testing, adhering to regulations and considering health and pollution control in engineering.	L3 - Apply

REFERENCE BOOKS:

1.	"Accident Prevention Manual" – NSC, Chicago, 1982.
2.	"Occupational safety Manual" BHEL, Trichy, 1988.
3.	"Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989.
4.	"Safety in Industry" N.V. Krishnan Jaico Publishery House, 1996.
5.	Indian Boiler acts and Regulations, Government of India.
6.	Safety in the use of wood working machines, HMSO, UK 1992.
7.	Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.

VIDEO REFERENCES:	
1.	https://www.youtube.com/watch?v=7ZjDk92zE1Y
2.	https://www.youtube.com/watch?v=3VReVbsmjKI
WEB REFERENCES:	
1.	https://www.nsc.org/getmedia/238460ca-6df0-411d-914a-54d36282fc36/apm_et_answers_q_cs_ch25.pdf
2.	https://www.osha.gov/sites/default/files/2019-03/sheetmetal.pdf
ONLINE COURSES:	
1.	https://www.nfpa.org/for-professionals/training-for-me/industrial-hazards-training/hot-work-safety-certificate-online-training
2.	https://www.nsc.org/safety-training/workplace/advanced-safety-certificate/safety-inspections

Mapping of COs with POs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		1	3		2	
CO2		1	3		3	1
CO3	1	1	3		3	
CO4	1	1	3		3	1
CO5	2	1	3	1	3	
Average	1.33	1	3	1	2.8	1
1–Low, 2 –Medium, 3–High.						

ME23IS504	DESIGN OF EXPERIMENTS	Version: 1.0
(EXCEPT FOR M.E. INDUSTRIAL SAFETY ENGINEERING)		

Programme & Branch	M.E INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To impart knowledge on principles and steps in designing a statistically designed experiment.
2	To build foundation in analysing the data in single factor experiments and to perform post hoc tests.
3	To provide knowledge on analysing the data in factorial experiments.
4	To educate on analysing the data analysis in special experimental designs and Response Surface Methods.
5	To impart knowledge in designing and analysing the data in Taguchi's Design of Experiments to improve Process/Product quality.

UNIT–I	EXPERIMENTAL DESIGN FUNDAMENTALS	9

Importance of experiments(L2), experimental strategies(L2), basic principles of design(L2), terminology, ANOVA(L3), steps in experimentation(L2), sample size(L3), normal probability plot(L3), linear regression models(L3).

UNIT–II	SINGLE FACTOR EXPERIMENTS	9

Completely randomized design(L2), Randomized block design(L2), Latin square design(L2). Statistical analysis(L3), estimation of model parameters(L3), model adequacy checking(L3), pair wise comparison tests(L4).

UNIT– III	MULTIFACTOR EXPERIMENTS	9

Two and three factor full factorial experiments(L2), Randomized block factorial design(L3), Experiments with random factors(L3), rules for expected mean squares(L3), approximate F-tests(L4). 2^K factorial Experiments(L4).

UNIT – IV	SPECIAL EXPERIMENTAL DESIGNS	9

Blocking and confounding in 2^K designs(L2). Two level Fractional factorial design(L3), nested designs(L3), Split plot design(L3), Introduction to Response Surface Methods(L3).

UNIT–V	TAGUCHI METHODS	9

Steps in experimentation(L2), design using Orthogonal Arrays(L3), data analysis(L3), Robust design(L2),- control and noise factors(L3), S/N ratios(L3), parameter design(L3), Multi-level experiments(L2), Multi-response optimization(L2), Introduction to Shainin DOE(L2).

Total : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

COURSE OUTCOMES: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Interpret the Design of Experiments principles, strategizing experiment design within practical resource considerations and goals.	L2 - Understand
CO2	Analyze single-factor experiment data, focusing on randomization and pair-wise comparison tests.	L4 - Analyze
CO3	Analyze multifactor experiment data, applying rules for expected mean squares and approximate F-tests.	L4 - Analyze
CO4	Apply special experimental designs, minimize confounding effects, optimize data collection, and introduce Response Surface Methods with practical considerations.	L3 - Apply
CO5	Apply Taguchi-based approaches for quality evaluation, emphasizing practical experimentation with orthogonal arrays and multi-response optimization.	L3 - Apply

REFERENCE BOOKS:	
1.	Krishnaiah, K. and Shahabudeen, P. Applied Design of Experiments and Taguchi Methods, PHI learning private Ltd., 2012.
2.	Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, Eighth edition, 2012.
3.	NicoloBelavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.
4.	Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.
5.	Montgomery, D.C., Design and Analysis of Experiment, Minitab Manual, John Wiley and Sons, Seventh edition, 2010.
VIDEO REFERENCES:	
1.	https://www.youtube.com/watch?v=k3lUo0XYG3E
2.	https://www.youtube.com/watch?v=IEUTRhyoHNc&list=PLPjSqITyvDeWS9Lxp4jreGJ7eNsxHxJA8
WEB REFERENCES:	
1.	https://www.itl.nist.gov/div898/handbook/pmd/section3/pmd31.htm
2.	https://www.sartorius.com/en/knowledge/science-snippets/what-is-doe-design-of-experiments-basics-for-beginners-507170
ONLINE COURSES:	
1.	https://onlinecourses.nptel.ac.in/noc21_mg48/preview
2.	https://www.coursera.org/specializations/design-experiments

Mapping of COs with POs and PSOs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	1			
CO2	2	2	1		1	
CO3	2	2	1		1	
CO4	3	2	1		1	
CO5	3	2	1	3	1	
Average	2.2	2	1	3	1	
1–Low, 2 –Medium, 3–High.						

ME23IS505	CIRCULAR ECONOMY	Version: 1.0
(EXCEPT FOR M.E. INDUSTRIAL SAFETY ENGINEERING)		

Programme & Branch	M.E INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To equip graduates with circularity expertise for diverse national and international job opportunities.
2	To develop skilled manpower and foster entrepreneurship in Circular Economy.
3	To facilitate student-professional interactions for real-world exposure in technology, research, innovation, and circular business models.
4	To inspire students to address circularity business needs and pursue Research and Development (R&D) and entrepreneurship.
5	To cultivate environmentally conscious entrepreneurs through core competencies in environmental education and collaborative university-industry partnerships.

UNIT–I	INTRODUCTION TO CIRCULAR ECONOMY	9

Linear Economy and its emergence(L2), Economic and Ecological disadvantages of linear economy(L3), Replacing Linear economy by Circular Economy(L3), Development of Concept of Circular Economy(L2), A differential - Linear Vs Circular Economy(L2).

UNIT–II	CHARACTERISTICS OF CIRCULAR ECONOMY	9

Material recovery(L2), Waste Reduction(L2), reducing negative externalities(L3), Explaining Butterfly diagram(L2), Concept of Loops(L2).

UNIT– III	CIRCULAR DESIGN, INNOVATION AND ASSESSMENT	9

Zero waste: Waste Management in context of Circular Economy(L3), Circular design(L3), Research and innovation(L4), LCA(L2), Circular Business(L2)

UNIT – IV	CASE STUDIES	9

Business models(L2), Solid Waste Management / Wastewater, Plastics: A case study(L4), EPR: polluters pay principle(L3), Industrial symbiosis/ Eco-parks(L2)

UNIT–V	LEGAL AND POLICY FRAMEWORK	9

Role of governments and networks(L2), Sharing best practices(L2), Universal circular economy policy goals(L2), India and CE strategy(L2), ESG(L2).

Total : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

COURSE OUTCOMES: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Differentiate Circular Economy from Linear Economy and showcase its practical application.	L2 - Understand
CO2	Apply Circular Economy principles, incorporating material recovery and waste reduction to illustrate the Butterfly diagram and emphasize the loops within the circular system.	L3 - Apply
CO3	Apply circular design and innovation principles, assess sustainability in Circular Economy, and examine circular business models	L3 - Apply
CO4	Analyze case studies on circular economy from different fields and connect these cases to Circular Economy concepts professionally.	L4 - Analyze
CO5	Infer government roles, share best practices, and articulate Circular Economy policy goals, demonstrating expertise in legal frameworks with an ESG focus, especially in India.	L2 - Understand
REFERENCE BOOKS:		
1.	Towards Zero Waste: Circular Economy Boost, Waste to Resources María-Laura Franco-García, Jorge Carlos Carpio-Aguilar, Hans Bressers. Springer International Publishing 2019	
2.	Strategic Management and the Circular Economy Marcello Tonelli, Nicolo Cristoni, Routledge 2018.	
3.	Circular Economy: Global Perspective Sadhan Kumar Ghosh, Springer, 2020	
4.	The Circular Economy: A User's Guide Stahel, Walter R. Routledge 2019	
5.	An Introduction to Circular Economy Lerwen Liu, Seeram Ramakrishna, Springer Singapore 2021	
VIDEO REFERENCES:		
1.	https://www.youtube.com/watch?v=ETxYCzS7xlg	
2.	https://www.youtube.com/watch?v=2KdTYaCSBCs	
WEB REFERENCES:		
1.	https://www.oecd.org/cfe/regionaldevelopment/Ekins-2019-Circular-Economy-What-Why-How-Where.pdf	
2.	https://ic-ce.com/product/principles-of-circular-economy/	
ONLINE COURSES:		
1.	https://online-learning.harvard.edu/course/introduction-circular-economy?delta=0	
2.	https://www.coursera.org/learn/circular-economy	

Mapping of COs with POs and PSOs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1						
CO2	1					
CO3	1	2			1	
CO4	2					
CO5						
Average	1.33	2			1	
1–Low, 2 –Medium, 3–High.						

ME23ET501 / ME23ET310	IOT FOR SMART SYSTEMS	Version : 1.0

EXCEPT FOR M.E. EMBEDDED SYSTEM TECHNOLOGIES

Programme &Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To study about Internet of Things technologies and its role in real time applications.
2	To introduce the infrastructure required for IoT
3	To familiarize the accessories and communication techniques for IoT.
4	To provide insight about the embedded processor and sensors required for IoT
5	To familiarize the different platforms and Attributes for IoT

UNIT–I	INTRODUCTION TO INTERNET OF THINGS	9

Overview(L2), Hardware and software requirements for IOT(L2), Sensor and actuators, Technology driver(L2)s, Business drivers(L2), Typical IoT applications(L3), Trends and implications(L3).

UNIT–II	IOT ARCHITECTURE	9

IoT reference model and architecture (L2)-Node Structure(L2) - Sensing, Processing, Communication, Powering, Networking(L2) - Topologies(L2), Layer/Stack architecture(L2)**,** IoT standards(L2), Cloud computing for IoT(L2), Bluetooth(L2), Bluetooth Low Energy beacons(L2).

UNIT– III	PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT PROTOCOLS	9

NFC, SCADA and RFID, Zigbee, MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe, GSM, CDMA, LTE, GPRS, small cell(L2). **Wireless technologies for IoT:** WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems-Recent trends. (L2).

UNIT – IV	IOT PROCESSORS	9

Services/Attributes: Big-Data Analytics for IOT, Dependability, Interoperability, Security, Maintainability (L2).

Embedded processors for IOT :Introduction to Python programming(L2) -Building IOT with RASPERRY PI and Arduino (L3).

UNIT–V	CASE STUDIES	9

Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense(L3).

Total : 45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

COURSE OUTCOMES: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Analyze the concepts of IoT and its present developments.	L3 - Apply
CO2	Compare and contrast different platforms and infrastructures available for IoT	L2 - Understand
CO3	Explain different protocols and communication technologies used in IoT	L2 - Understand
CO4	Analyze the big data analytic and programming of IoT	L3 - Apply
CO5	Implement IoT solutions for smart applications	L3 - Apply

REFERENCE BOOKS:	
1.	ArshdeepBahga and VijaiMadisetti : A Hands-on Approach "Internet of Things",Universities Press 2015.
2.	Oliver Hersent , David Boswarthick and Omar Elloumi " The Internet of Things", Wiley,2016.
3.	Samuel Greengard, " The Internet of Things", The MIT press, 2015.
4.	Adrian McEwen and Hakim Cassimally"Designing the Internet of Things "Wiley,2014.
5.	Jean- Philippe Vasseur, Adam Dunkels, "Interconnecting Smart Objects with IP: The Next Internet" Morgan Kuffmann Publishers, 2010.
6.	Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", John Wiley and sons, 2014.
7.	Lingyang Song/DusitNiyato/ Zhu Han/Ekram Hossain,"Wireless Device-to-Device Communications and Networks, CAMBRIDGE UNIVERSITY PRESS,2015.
8.	OvidiuVermesan and Peter Friess (Editors), "Internet of Things: Converging Technologies for Smart Environments and I ntegrated Ecosystems", River Publishers Series in Communication, 2013.
9.	Vijay Madisetti , ArshdeepBahga, "Internet of Things (A Hands on-Approach)", 2014.
10.	Lars T.Berger and Krzysztof Iniewski, "Smart Grid applications, communications and security", Wiley, 2015.
11.	JanakaEkanayake, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama and Nick Jenkins, " Smart Grid Technology and Applications", Wiley, 2015.
12.	UpenaDalal,"Wireless Communications & Networks,Oxford,2015.
WEB REFERENCES:	
1.	https://archive.nptel.ac.in/courses/106/105/106105166/
2.	https://www.geeksforgeeks.org/architecture-of-internet-of-things-iot/
ONLINE COURSES:	
1.	https://onlinecourses.nptel.ac.in/noc22_cs53/
2.	https://www.udemy.com/course/internet-of-things-iot-fundamentals
VIDEO REFERENCES:	
1.	https://www.youtube.com/watch?v=WUYAjxnwjU4&list=PLE7VH8RC_N3bpVn-e8QzOAHziEgmjQ2qE
2.	https://www.youtube.com/watch?v=urUBLmXFKl0&list=PLgMDNELGJ1CaBrefq-0eYatfOnoncW0y-
3.	https://www.youtube.com/watch?v=hdZzNOQV5vU

Mapping of COs with POs						
COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	2	1			
CO2		2				
CO3	1	2		1	3	
CO4	2		3	3	3	
CO5	3	2	3	3	3	
Average	1.75	2	2.33	2.33	3	
1–Low, 2 –Medium, 3–High.						

ME23ET502 / ME23ET408	MACHINE LEARNING AND DEEP LEARNING	Version : 1.0

EXCEPT FOR M.E. EMBEDDED SYSTEM TECHNOLOGIES

Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	Understanding about the learning problem and algorithms
2	Providing insight about neural networks
3	Introducing the machine learning fundamentals and significance
4	Enabling the students to acquire knowledge about pattern recognition
5	Motivating the students to apply deep learning algorithms for solving real life problems. metering infrastructure.

UNIT–I	LEARNING PROBLEMS AND ALGORITHMS	9

Various paradigms of learning problems(L2), Supervised, Semi-supervised and Unsupervised algorithms(L2).

UNIT–II	NEURAL NETWORKS	9

Differences between Biological and Artificial Neural Networks(L2) - Typical Architecture, Common Activation Functions, Multi-layer neural network, Linear Separability, Hebb Net, Perceptron, Adaline, Standard Back propagation Training Algorithms for Pattern Association (L2)- Hebb rule and Delta rule, Hetero associative, Auto associative, Kohonen Self Organising Maps, Examples of Feature Maps, Learning Vector Quantization, Gradient descent, Boltzmann Machine Learning (L2).

UNIT– III	MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS	9

Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1(L2)- Score, the curse of dimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, early stopping, regularization, bias and variance. Feature Selection, normalization, dimensionality reduction, Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification, clustering (L2).

UNIT – IV	DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS	9

Feed forward networks(L2), Activation functions(L2), back propagation in CNN(L2), optimizers(L2), batch normalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs(L2).

UNIT–V	DEEP LEARNING: RNNS, AUTOENCODERS AND GANS	9

State, Structure of RNN Cell, LSTM and GRU(L2), Time distributed layers, Generating Text, Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders(L2), GANs: The discriminator, generator, DCGANs(L2).

Total : 45 PERIODS

Course Outcomes: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Illustrate the categorization of machine learning algorithms.	L2 – Understand
CO2	Compare and contrast the types of neural network architectures, activation functions	L2 – Understand
CO3	Acquaint with the pattern association using neural networks	L2 – Understand
CO4	Elaborate various terminologies related with pattern recognition and architectures of convolutional neural networks	L2 – Understand
CO5	Construct different feature selection and classification techniques and advanced neural network architectures such as RNN, Autoencoders, and GANs	L2 – Understand

REFERENCE BOOKS:	
1.	J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro Fuzzy and Soft Computing - A Computational Approach to Learning and Machine Intelligence, 2015, PHI learning.
2.	Deep Learning, Ian Good fellow, YoshuaBengio and Aaron Courville, MIT Press, ISBN: 9780262035613, 2016.
3.	The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Second Edition. 2019.
4.	Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2016
5.	Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.
WEB REFERENCES:	
1.	https://archive.nptel.ac.in/courses/106/106/106106139/
2.	https://archive.nptel.ac.in/courses/106/106/106106202/
ONLINE COURSES:	
1.	https://nptel.ac.in/courses/117105084
2.	https://onlinecourses.nptel.ac.in/noc23_ee87/
VIDEO REFERENCES:	
1.	https://www.youtube.com/watch?v=KshIEHQn5ZM
2.	https://www.youtube.com/watch?v=TIFFfLejkcA
3.	https://www.youtube.com/watch?v=4TC5s_xNKSs&list=PLyqSpQzTE6M9gCgajvQbc68Hk_JKGBAYT&index=2

Mapping of COs with POs						
COs	**POs**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	3	1			
CO2	2	3	2			
CO3	3		3		3	
CO4	2	3	3			
CO5	3	3	3		3	
Average	2.42	3	2.57		3	
1–Low, 2 –Medium, 3–High.						

ME23ET503	RENEWABLE ENERGY TECHNOLOGY	Version : 1.0

EXCEPT FOR M.E. EMBEDDED SYSTEM TECHNOLOGIES

Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To provide knowledge about the different types of renewable energy technologies
2	To provide knowledge on standalone operation of solar energy systems
3	To provide knowledge on grid connected operation of solar energy systems
4	To analyze the various operating modes of wind energy generating systems
5	To provide knowledge about other renewable energy systems.

UNIT–I	INTRODUCTION	9

Classification of energy sources(L2) – Co2 Emission (L2)- Features of Renewable energy(L2) - Renewable energy scenario in India(L2) -Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment Per Capital Consumption - CO2 Emission(L2) - importance of renewable energy sources, Potentials – Achievements– Applications(L2)

UNIT–II	SOLAR PHOTOVOLTAICS	9

Solar Energy: Sun and Earth(L1)-Basic Characteristics of solar radiation(L2)- angle of sunrays on solar collector(L2)-Estimating Solar Radiation Empirically (L2)- Equivalent circuit of PV Cell(L2)-Photovoltaic cell characteristics: P-V and I-V curve of cell-Impact of Temperature and Insolation on I-V characteristics(L2), Shading Impacts on I-V characteristics(L2)-Bypass diode -Blocking diode(L2).

UNIT– III	PHOTOVOLTAIC SYSTEM DESIGN	9

Block diagram of solar photo voltaic system: Line commutated converters (inversion mode) - Boost and buck-boost converters(L2) - selection of inverter, battery sizing, array sizing (L2)- PV systems classification(L2)- standalone PV systems(L2) - Grid tied and grid interactive inverters(L2)- grid connection issues(L2).

UNIT – IV	WIND ENERGY CONVERSION SYSTEMS	9

Origin of Winds: Global and Local Winds(L2)- Aerodynamics of Wind turbine(L3)-Derivation of Betz's limit Power available in wind(L2)-Classification of wind turbine: Horizontal Axis wind turbine and Vertical axis wind turbine(L2)- Aerodynamic Efficiency(L3)-Tip Speed(L2)-Tip Speed Ratio(L3)-Solidity-Blade Count-Power curve of wind turbine (L2)- Configurations of wind energy conversion systems: Type A, Type B, Type C and Type D Configurations(L2)- Grid connection Issues(L2) - Grid integrated SCIG and PMSG based WECS(L3).

UNIT–V	OTHER RENEWABLE ENERGY SOURCES	9

Qualitative study of different renewable energy resources: ocean(L2), Biomass, Hydrogen energy systems, Fuel cells, Ocean Thermal Energy Conversion (OTEC)(L2), Tidal and wave energy, Geothermal Energy Resources(L2).

Total : 45 PERIODS

C**ourse Outcomes:** **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Demonstrate the need for renewable energy sources.	L2 – Understand
CO2	Develop a stand-alone photo voltaic system and implement a maximum power point tracking in the PV system	L2 – Understand
CO3	Design a stand-alone and Grid connected PV system	L2 – Understand
CO4	Analyze the different configurations of the wind energy conversion systems.	L3 - Apply
CO5	Realize the basic of various available renewable energy sources	L2 – Understand

REFERENCE BOOKS:	
1.	S.N.Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford UniversityPress, 2019.
3.	Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
4.	Rai. G.D," Solar energy utilization", Khanna publishes, 1993.
5.	Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI Learning Private Limited, 2012
6.	John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2016.
WEB REFERENCES:	
1.	https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA-ETSAP_Tech_Brief_Power_Grid_Integration_2015.pdf
2.	https://www.nrel.gov/docs/fy15osti/63033.pdf
ONLINE COURSES:	
1.	https://www.coursera.org/learn/renewable-power-electricity-systems
2.	https://nptel.ac.in/courses/103103206
VIDEO REFERENCES:	
1.	https://www.youtube.com/watch?v=mh51mAUexK4&list=PLwdnzlV3ogoXUifhvYB65lLJCZ74o_fAk
2.	https://www.youtube.com/watch?v=cGHlV0EavaQ

Mapping of COs with POs						
CO	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3		2			
CO2	3		2			
CO3	3		2			
CO4	3		2			
CO5	3		2			
Average	3		2			
1–Low, 2 –Medium, 3–High.						

ME23ET504 / ME23ET423	SMART GRID	Version : 1.0
EXCEPT FOR M.E. EMBEDDED SYSTEM TECHNOLOGIES		

Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
2	To know about the function of smart grid
3	To familiarize the power quality management issues in Smart Grid
4	To familiarize the high performance computing for Smart Grid applications
5	To get familiarized with the communication networks for Smart Grid applications

UNIT–I	INTRODUCTION TO SMART GRID	9

Evolution of Electric Grid(l2), Concept, Definitions and Need for Smart Grid(l2), Smart grid drivers, functions, opportunities, challenges and benefits(l2), Difference between conventional & Smart Grid(L2), Comparison of Micro grid and Smart grid(l2), Present development & International policies in Smart Grid, Smart Grid Initiative for Power Distribution Utility in India(l2) – Case Study(L2).

UNIT–II	SMART GRID TECHNOLOGIES	9

Technology Drivers, Smart Integration of energy resources(L2), Smart substations(L2), Substation Automation(L2), Feeder Automation(L2), Transmission systems: EMS, FACTS and HVDC(L2), Wide area monitoring(L2), Protection and control, Distribution systems: DMS(L2), Volt/Var control, Fault Detection(L2), Isolation and service restoration(L2), Outage management(L2), High-Efficiency Distribution Transformers(L2), Phase Shifting Transformers(L2), Plug in Hybrid Electric Vehicles (PHEV(L2)) (L2) – Grid to Vehicle and Vehicle to Grid charging concepts(L2).

UNIT– III	SMART METERS AND ADVANCED METERING INFRASTRUCTURE	9

Introduction to Smart Meters(L1), Advanced Metering infrastructure (AMI) drivers and benefits(L2), AMI protocols, standards and initiatives(L2), AMI needs in the smart grid(L2), Phasor Measurement Unit(PMU) & their application for monitoring & protection(L2). Demand side management and demand response programs(L2), Demand pricing and Time of Use, Real Time Pricing(L2), Peak Time Pricing(L2).

UNIT – IV	POWER QUALITY MANAGEMENT IN SMART GRID	9

Power Quality & EMC in Smart Grid(L2), Power Quality issues of Grid connected Renewable Energy Sources(L2), Power Quality Conditioners for Smart Grid(L2), Web based Power Quality monitoring(L2), Power Quality Audit (L2).

UNIT–V	HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS	9

Architecture and Standards(L2) -Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), PLC, Zigbee, GSM, IP based Protocols(L2), Basics of Web Service and CLOUD Computing(L2), Cyber Security for Smart Grid(L2).

Total : 45 PERIODS

Course Outcomes: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Relate with the smart resources, smart meters and other smart devices.	L2 – Understand
CO2	Explain the function of Smart Grid	L2 – Understand
CO3	Experiment the issues of Power Quality in Smart Grid.	L2 – Understand
CO4	Analyze the performance of Smart Grid	L2 – Understand
CO5	Recommend suitable communication networks for smart grid applications	L2 – Understand

REFERENCE BOOKS:

1.	Stuart Borlase 'Smart Grid: Infrastructure, Technology and Solutions', CRC Press 2012.
2.	JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, 'Smart Grid: Technology and Applications', Wiley, 2012
3.	Mini S. Thomas, John D McDonald, 'Power System SCADA and Smart Grids', CRC Press, 2015
4.	Kenneth C.Budka, Jayant G. Deshpande, Marina Thottan, 'Communication Networks for Smart Grids', Springer, 2014
5.	SMART GRID Fundamentals of Design and Analysis, James Momoh, IEEE press, A John Wiley & Sons, Inc., Publication. 2018

WEB REFERENCES:

1.	https://www.researchgate.net/publication/224078022_Power_Quality_and_EMC_in_Smart_Grid
2.	https://amity.edu/icactm/Proceeding/Paper%20Index%20Content/24%20T4%20P9%20ID%209.pdf

ONLINE COURSES:

1.	https://onlinecourses.nptel.ac.in/noc21_ee68
2.	https://onlinecourses.nptel.ac.in/noc23_ee124/

VIDEO REFERENCES:

1.	https://www.youtube.com/watch?v=KgVFJnmJvKk&list=PLSJzHGpGe6lP5biCvZrtQdHf80tnSXRBr
2.	https://archive.nptel.ac.in/noc/courses/noc20/SEM2/noc20-ee65/

Mapping of COs with POs

CO	PO					
	1	2	3	4	5	6
CO1	3	2		2	2	2
CO2	3		2	2		2
CO3	2		1			2
CO4	1			3	3	1
CO5		2	2	2	2	3
Average	2.25	2	1.66	2.25	2.3	2
1–Low, 2 –Medium, 3–High.						

ME23VL501	BIG DATA ANALYTICS	Version: 1.0
EXCEPT FOR M.E. VLSI DESIGN		

Programme & Branch	M.E. VLSI DESIGN	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To understand the basics of big data analytics
2	To understand the search methods and visualization
3	To learn mining data streams
4	To learn frameworks
5	To gain knowledge on R language

UNIT–I	INTRODUCTION TO BIG DATA	9

Introduction to Big Data Platform (L2)– Challenges of Conventional Systems (L2)- Intelligent data analysis –Nature of Data (L2)- Analytic Processes and Tools (L2)- Analysis Vs Reporting (L2)- Modern Data Analytic Tools (L2)- Statistical Concepts: Sampling Distributions (L2)- Re-Sampling (L2)– Statistical Inference - Prediction Error (L2).

UNIT–II	SEARCH METHODS AND VISUALIZATION	9

Search by simulated Annealing (L2)– Stochastic, Adaptive search by Evaluation (L2)– Evaluation Strategies (L3) – Genetic Algorithm – Genetic Programming (L2) – Visualization – Classification of Visual Data Analysis Techniques (L3) – Data Types – Visualization Techniques (L3) – Interaction techniques – Specific Visual data analysis Techniques (L3)

UNIT– III	MINING DATA STREAMS	9

Introduction To Streams Concepts (L2)– Stream Data Model and Architecture (L2)- Stream Computing - Sampling Data in a Stream (L2)– Filtering Streams – Counting Distinct Elements in a Stream (L3)– Estimating Moments – Counting Oneness in a Window (L3)– Decaying Window (L3) - Real time Analytics Platform(RTAP) Applications (L3) - Case Studies - Real Time Sentiment Analysis (L3), Stock Market Predictions (L3)

UNIT – IV	FRAMEWORKS	9

MapReduce – Hadoop (L2) , Hive, MapR – Sharding – NoSQL Databases (L2) - S3 - Hadoop Distributed File Systems (L2) – Case Study- Preventing Private Information Inference Attacks on Social Networks (L2) - Grand Challenge: Applying Regulatory Science (L2) and Big Data to Improve Medical Device Innovation(L2)

UNIT–V	R LANGUAGE	9

Overview, Programming structures: Control statements (L3) - Operators – Functions (L3) – Environment and scope issues (L3)- Recursion - Replacement functions (L3), R data structures: Vectors -Matrices and arrays (L3)- Lists -Data frames -Classes, Input/output, String manipulations (L3)

45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Out comes: Upon completion of this course the students will be able to:		**BLOOM'S Taxonomy**
CO1	Understand the basics of big data analytics	L2 – Understand
CO2	Ability to use Hadoop, Map Reduce Framework	L3 – Apply
CO3	Apply big data analytics for increasing the business outcome	L3 – Apply
CO4	Understand the concepts of R language	L2 – Understand
CO5	Use R language to integrate and analyse large amounts of information	L3 – Apply
REFERENCE BOOKS:		
1.	Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007	
2.	Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 3rd edition 2020	
3.	Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, USA, 2011.	
4.	Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons, 2012	
5.	Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007	
VIDEO REFERENCES:		
1.	https://onlinecourses.nptel.ac.in/noc20_cs92/preview	
2.	https://onlinecourses.swayam2.ac.in/arp19_ap60/preview	
WEB REFERENCES:		
1.	https://www.ibm.com/analytics/big-data-analytics	
2.	https://www.tableau.com/learn/articles/big-data-analytics	
ONLINE COURSES:		
1.	https://www.edx.org/learn/big-data/university-of-adelaide-big-data-analytics	
2.	http://moocs.anuonline.ac.in/advance-diploma-in-big-data-analytics.html	

Mapping of COs with POs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2		2	3	3	1
CO2	2		2	2	3	1
CO3	1		2	2	3	1
CO4	1		2	3	2	1
CO5	2		2	2	1	1
Average	1.6		2	2.4	2.4	1
1–Low, 2 –Medium, 3–High.						

ME23VL502	INTERNET OF THINGS AND CLOUD	Version: 1.0
EXCEPT FOR M.E. VLSI DESIGN		

Programme & Branch	M.E. VLSI DESIGN	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To understand Smart Objects and IoT Architectures
2	To learn about various IOT-related protocols
3	To build simple IoT Systems using Arduino and Raspberry Pi.
4	To understand data analytics and cloud in the context of IoT
5	To develop IoT infrastructure for popular applications

UNIT–I	FUNDAMENTALS OF IoT	9

Introduction to IoT (L2)– IoT definition – Characteristics (L2)– IoT Complete Architectural Stack (L2)– IoT enabling Technologies – IoT Challenges (L2). Sensors and Hardware for IoT (L2)– Hardware Platforms – Arduino, Raspberry Pi, Node MCU (L2). A Case study with any one of the boards and data acquisition from sensors (L3).

UNIT–II	PROTOCOLS FOR IoT	9

Infrastructure protocol (IPV4/V6/RPL) (L2), Identification (URIs) (L2), Transport (Wifi, Lifi, BLE), Discovery (L3), Data Protocols, Device Management Protocols (L3). – A Case Study with MQTT/CoAP usage-IoT privacy (L3), security and vulnerability solutions (L3).

UNIT– III	CASE STUDIES/INDUSTRIAL APPLICATIONS	9

Case studies with architectural analysis (L2): IoT applications – Smart City – Smart Water (L3)– Smart Agriculture (L2)– Smart Energy – Smart Healthcare (L3)– Smart Transportation – Smart Retail (L3)– Smart waste management (L3).

UNIT – IV	CLOUD COMPUTING INTRODUCTION	9

Introduction to Cloud Computing (L2)- Service Model (L2)– Deployment Model (L2)- Virtualization Concepts – Cloud Platforms (L2)– Amazon AWS (L2)– Microsoft Azure – Google APIs (L2).

UNIT–V	IoT AND CLOUD	9

IoT and the Cloud (L2)- Role of Cloud Computing in IoT (L2)- AWS Components (L2)- S3 – Lambda – AWS IoT Core (L2)- Connecting a web application to AWS IoT using MQTT (L3)- AWS IoT Examples (L3). Security Concerns, Risk Issues (L2), and Legal Aspects of Cloud Computing (L2)- Cloud Data Security (L2)

Total:-45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

Course Out comes: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Understand the various concept of the IoT and their technologies.	L2 – Understand
CO2	Develop IoT application using different hardware platforms.	L3 – Apply
CO3	Implement the various IoT Protocols.	L3 – Apply
CO4	Understand the basic principles of cloud computing.	L2 – Understand
CO5	Develop and deploy the IoT application into cloud environment.	L2 – Understand
REFERENCE BOOKS:		
1.	"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman ,CRC Press, 2017	
2.	Adrian McEwen, Designing the Internet of Things, Wiley,2013.	
3.	EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.	
4.	Simon Walkowiak, "Big Data Analytics with R" PackT Publishers, 2016	
5.	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.	
VIDEO REFERENCES:		
1.	https://onlinecourses.nptel.ac.in/noc22_cs53/preview	
2.	https://www.oracle.com/in/internet-of-things/what-is-iot/	
WEB REFERENCES:		
1.	https://innovationatwork.ieee.org/internet-of-things/	
2.	https://www.ibm.com/topics/internet-of-things	
ONLINE COURSES:		
1.	https://onlinecourses.nptel.ac.in/noc23_cs82/preview	
2.	https://onlinecourses.nptel.ac.in/noc22_cs53/preview	

Mapping of COs with POs						
COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2		2	3	3	1
CO2	2		2	2	3	1
CO3	1			2	3	1
CO4			2	3	2	1
CO5	2		2	2	1	1
Average	1.7		2	2.4	2.4	1
1–Low, 2 –Medium, 3–High.						

ME23VL503	MEDICAL ROBOTICS	Version: 1.0
EXCEPT FOR M.E. VLSI DESIGN		

Programme & Branch	M.E. VLSI DESIGN	CP	L	T	P	C
		3	3	0	0	3

Instructions if any

Course Objectives:

1	To explain the basic concepts of robots and types of robots
2	To discuss the designing procedure of manipulators, actuators and grippers
3	To impart knowledge on various types of sensors and power sources
4	To explore various applications of Robots in Medicine
5	To impart knowledge on wearable robots

UNIT–I	INTRODUCTION TO ROBOTICS	9

Introduction to Robotics (L2), Overview of robot subsystems, Degrees of freedom, configurations and concept of workspace, Dynamic Stabilization (L2).

Sensors and Actuators: Sensors and controllers (L2), Internal and external sensors, position, velocity and acceleration sensors (L2), Proximity sensors, force sensors Pneumatic and hydraulic actuators (L2), Stepper motor control circuits (L2), End effectors (L2), Various types of Grippers (L2), PD and PID feedback actuator models (L2)

UNIT–II	MANIPULATORS & BASIC KINEMATICS	9

Construction of Manipulators (L2), Manipulator Dynamic and Force Control (L2), Electronic and pneumatic manipulator (L2), Forward Kinematic Problems, Inverse Kinematic Problems (L2), Solutions of Inverse Kinematic problems (L2)

Navigation and Treatment Planning: Variable speed arrangements (L2), Path determination – Machinery vision (L2), Ranging – Laser – Acoustic, Magnetic, fiber optic and Tactile sensor (L2)

UNIT– III	SURGICAL ROBOTS	9

Da Vinci Surgical System (L2), Image guided robotic systems for focal ultrasound based surgical applications (L2), System concept for robotic Tele-surgical system for off-pump (L2), CABG surgery, Urologic applications (L2), Cardiac surgery, Neuro-surgery (L2), Pediatric and General Surgery, Gynecologic Surgery (L2), General Surgery and Nanorobotics. Case Study (L2)

UNIT – IV	REHABILITATION AND ASSISTIVE ROBOTS	9

Pediatric Rehabilitation, Robotic Therapy for the Upper Extremity and Walking (L2), Clinical-Based Gait Rehabilitation Robots, Motion Correlation and Tracking (L2), Motion Prediction, Motion Replication (L2). Portable Robot for Tele rehabilitation (L2), Robotic Exoskeletons – Design considerations (L3), Hybrid assistive limb. Case Study (L3)

UNIT–V	WEARABLE ROBOTS	9

Augmented Reality (L2), Kinematics and Dynamics for Wearable Robots (L2), Wearable Robot technology, Sensors, Actuators, Portable Energy Storage (L2), Human–robot cognitive interaction (cHRI) (L2), Human–robot physical interaction (pHRI) (L2), Wearable Robotic Communication - Case Study (L3)

Total:-45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Out comes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Describe the configuration, applications of robots and the concept of grippers and actuators	L2 – Understand
CO2	Explain the functions of manipulators and basic kinematics	L2 – Understand
CO3	Describe the application of robots in various surgeries	L2 – Understand
CO4	Design and analyze the robotic systems for rehabilitation	L3 – Apply
CO5	Design the wearable robots	L3 – Apply

REFERENCE BOOKS:

1.	Nagrath and Mittal, "Robotics and Control", Tata McGraw Hill, First edition, 2003
2.	Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and Sons, First edition, 2008
4.	Fu.K.S, Gonzalez. R.C., Lee, C.S.G, "Robotics, control", sensing, Vision and Intelligence, Tata McGraw Hill International, First edition, 2008
5.	Bruno Siciliano, Oussama Khatib, Springer Handbook of Robotics, 1st Edition, Springer, 2008
6.	Shane (S.Q.) Xie, Advanced Robotics for Medical Rehabilitation - Current State of the Art and Recent Advances, Springer, 2016
7.	Sashi S Kommu, Rehabilitation Robotics, I-Tech Education and Publishing, 2007
8.	Jose L. Pons, Wearable Robots: Biomechatronic Exoskeletons, John Wiley & Sons Ltd, UK, 2008
9.	Howie Choset, Kevin Lynch, Seth Hutchinson, "Principles of Robot Motion: Theory, Algorithms, and Implementations", Prentice Hall of India, First edition, 2005
10	Philippe Coiffet, Michel Chirouze, "An Introduction to Robot Technology", Tata McGraw Hill, First Edition, 1983
11	Jacob Rosen, Blake Hannaford & Richard M Satava, "Surgical Robotics: System Applications & Visions", Springer 2011
12	Jocelyn Troccaz, Medical Robotics, Wiley, 2012
13	Achim Schweikard, Floris Ernst, Medical Robotics, Springer, 2015

VIDEO REFERENCES:

1.	https://nptel.ac.in/courses/107106090
2.	https://onlinecourses.nptel.ac.in/noc22_me05/preview

WEB REFERENCES:

1.	https://web.stanford.edu/class/me328/
2.	https://robotnik.eu/applications-of-robotics-in-medicine/

ONLINE COURSES:

1.	https://web.stanford.edu/class/me328/#lectures
2.	https://nptel.ac.in/courses/112106298

Mapping of COs with POs

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1				1		
CO2				2		
CO3	2		2	2	2	2
CO4	2		2	2	3	2
CO5	2		2	2	3	3
Average	2		2	1.8	2.6	2.3

1–Low, 2 –Medium, 3–High.

ME23VL504	EMBEDDED AUTOMATION	Version: 1.0
EXCEPT FOR M.E. VLSI DESIGN		

Programme & Branch	M.E. VLSI DESIGN	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To learn about the process involved in the design and development of real-time embedded system
2	To develop the embedded C programming skills on 8-bit microcontroller
3	To study about the interfacing mechanism of peripheral devices with 8-bit microcontrollers
4	To learn about the tools, firmware related to microcontroller programming
5	To build a home automation system

UNIT–I	INTRODUCTION TO EMBEDDED C PROGRAMMING	9

C Overview and Program Structure (L2) - C Types, Operators and Expressions (L2) - C Control Flow – C Functions and Program Structures (L3) - C Pointers And Arrays (L3) - FIFO and LIFO (L3) - C Structures (L3) - Development Tools (L2)

UNIT–II	AVR MICROCONTROLLER	9

ATMEGA 16 Architecture (L2) - Nonvolatile and Data Memories (L2) - Port System (L2) - Peripheral Features : Time Base, Timing Subsystem, Pulse Width Modulation (L2), USART, SPI, Two Wire Serial Interface (L2) , ADC, Interrupts - Physical and Operating Parameters (L2)

UNIT– III	HARDWARE AND SOFTWARE INTERFACING WITH 8-BIT SERIES CONTROLLERS	9

Lights and Switches (L3) - Stack Operation - Implementing Combinational Logic (L3) - Expanding I/O - Interfacing Analog To Digital Convertors (L3) - Interfacing Digital To Analog Convertors (L3) - LED Displays : Seven Segment Displays, Dot Matrix Displays - LCD Displays - Driving Relays - Stepper Motor Interface (L3) - Serial EEPROM - Real Time Clock (L3) - Accessing Constants Table - Arbitrary Waveform Generation (L3) - Communication Links - System Development Tools (L3)

UNIT – IV	VISION SYSTEM	9

Fundamentals of Image Processing (L2) – Filtering (L2) - Morphological Operations (L3) - Feature Detection and Matching (L3) - Blurring and Sharpening (L3) - Segmentation - Thresholding (L3) - Contours - Advanced Contour Properties (L3) - Gradient - Canny Edge Detector (L3) - Object Detection (L3) - Background Subtraction (L3)

UNIT–V	HOME AUTOMATION	9

Home Automation (L2) - Requirements - Water Level Notifier (L2) - Electric Guard Dog (L2) - Tweeting Bird Feeder (L2) - Package Delivery Detector (L2) - Web Enabled Light Switch (L2) - Curtain Automation (L3) - Android Door Lock - Voice Controlled Home Automation (L3) - Smart Lighting - Smart Mailbox (L3) - Electricity Usage Monitor (L3) - Proximity Garage Door Opener (L3) - Vision Based Authentic Entry System (L3)

45 PERIODS

OPEN ENDED PROBLEMS / QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

Course Out comes: **Upon completion of this course the students will be able to:**		**BLOOM'S Taxonomy**
CO1	Write embedded C programs for embedded system application	L2 – Understand
CO2	Describe internal subsystems of AVR microcontrollers	L2 – Understand
CO3	Analyze the 8-bit series microcontroller architecture, features and pin details	L3 – Apply
CO4	Develop the systems based on vision mechanism	L3 – Apply
CO5	Develop a real time home automation system	L3 – Apply

REFERENCE BOOKS:

1.	Dhananjay V. Gadre, "Programming and Customizing the AVR Microcontroller", McGraw-Hill, 2001
2.	Joe Pardue, "C Programming for Microcontrollers ", Smiley Micros, 2005
3.	Steven F. Barrett, Daniel J. Pack, "ATMEL AVR Microcontroller Primer : Programming and Interfacing", Morgan & Claypool Publishers, 2012
4.	Mike Riley, "Programming Your Home - Automate With Arduino, Android and Your Computer", the Pragmatic Programmers, Llc, 2012
5.	Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2011
6.	Kevin P. Murphy, "Machine Learning - a Probabilistic Perspective", the MIT Press Cambridge, Massachusetts, London, 2012

VIDEO REFERENCES:

1.	https://archive.nptel.ac.in/courses/106/105/106105193/
2.	https://archive.nptel.ac.in/courses/106/105/106105159/

WEB REFERENCES:

1.	https://community.arm.com/arm-community-blogs/b/embedded-blog
2.	https://www.embeddedrelated.com/blogs.php

ONLINE COURSES:

1.	https://nptel.ac.in/courses/106103182
2.	https://nptel.ac.in/courses/117106112

Mapping of COs with POs

COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1					
CO2	1	3	1			3
CO3	1	3	2	1	2	3
CO4	1	3	2	2	3	3
CO5	1	3	1	2	3	3
Average	1	3	1.5	1.6	2.6	3
1–Low, 2 –Medium, 3–High.						

ME23PT801	TECHNICAL SEMINAR / CASE STUDY PRESENTATION	Version : 1.0
(COMMON TO ALL BRANCHES)		

Programme & Branch	M.E. COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		2	0	0	2	0

Course Objectives:

1	To encourage the students to study advanced engineering developments
2	To prepare and present the technical and case study reports

Method of Evaluation:

The students need to identify an area of interest or topic in their programme of study or case study and prepare a 5-10 page report and a presentation. Based on the report and presentation, the course is evaluated for 100 marks. Minimum 50 marks is essential to pass. In case a student fails, he / she has to make such presentation in the subsequent semesters. The evaluation guidelines will be issued by the Head of the Department before the commencements of the course. The objectives are improving literature searching capabilities, comprehension and ability to write reports and to make presentations. It is assessed in Internal Assessment mode only and no End Semester Examination.

Total : 30 PERIODS

Course Outcomes: Upon completion of this course the students will be able to:		BLOOM'S Taxonomy
CO1	Perform the review and present technological developments in their field	L3 - Apply
CO2	Interpret the case study report and make a decision	L3 - Apply

Mapping of COs with POs

COs	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
1		3				
2		3				
Average		3				

1–Low, 2 –Medium, 3–High.

ME23AC701	ENGLISH FOR RESEARCH PAPER WRITING	Version: 1.0
(COMMON TO ALL BRANCHES)		

Programme& Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		2	2	0	0	0

Course Objectives:

1.	To teach how to improve writing skills and level of readability
2.	To tell about what to write in each section
3.	To summarize the skills needed when writing a Title
4.	To infer the skills needed when writing the Conclusion
5.	To ensure the quality of paper at very first-time submission

UNIT–I	INTRODUCTION TO RESEARCH PAPER WRITING	6

Planning and Preparation (L2), Word Order (L1), Breaking up long sentences (L2), Structuring Paragraphs and Sentences (L1), Being Concise and Removing Redundancy (L1), Avoiding Ambiguity and Vagueness (L2).

UNIT–II	PRESENTATION SKILLS	6

Clarifying Who Did What (L2), Highlighting Your Findings (L1), Hedging and Criticizing (L1), Paraphrasing and Plagiarism (L1), Sections of a Paper (L1), Abstracts, Introduction (L1).

UNIT–III	TITLE WRITING SKILLS	6

Key skills are needed when writing a Title (L1), key skills are needed when writing an Abstract (L1), key skills are needed when writing an Introduction (L1), skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check (L1)

UNIT–IV	RESULT WRITING SKILLS	6

Skills are needed when writing the Methods (L1), skills needed when writing the Results (L2), skills are needed when writing the Discussion (L2), skills are needed when writing the Conclusions (L2).

UNIT–V	VERIFICATION SKILLS	6

Useful phrases (L1), checking Plagiarism (L1), how to ensure paper is as good as it could possibly be the first- time submission (L1).

Total: 30 PERIODS

OPEN ENDED PROBLEMS /QUESTIONS

Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination

Course Outcomes: Upon completion of this course the students will be able to:		BLOOMS Taxonomy
CO1	Understand that how to improve your writing skills and level of readability	L2 – Understand
CO2	Learn about what to write in each section	L1 – Remember
CO3	Understand the skills needed when writing a Title	L2 – Understand
CO4	Understand the skills needed when writing the Conclusion	L2 – Understand
CO5	Ensure the good quality of paper at very first-time submission	L2 – Understand

ME23AC702	DISASTER MANAGEMENT	Version: 1.0
(COMMON TO ALL BRANCHES)		

Programme& Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	CP	L	T	P	C
		2	2	0	0	0

Course Objectives:

1	Summarize basics of disaster
2	Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
3	Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
4	Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
5	Develop the strengths and weaknesses of disaster management approaches

UNIT–I	INTRODUCTION	6

Disaster: Definition (L1), Factors and Significance (L1); Difference between Hazard And Disaster (L2); Natural and Manmade Disasters: Difference, Nature, Types and Magnitude (L1).

UNIT–II	REPERCUSSIONS OF DISASTERS AND HAZARDS	6

Economic Damage (L1), Loss of Human and Animal Life (L1), Destruction Of Ecosystem (L1). Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches (L1), Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts (L1).

UNIT–III	DISASTER PRONE AREAS IN INDIA	6

Study of Seismic Zones (L1); Areas Prone To Floods and Droughts (L1), Landslides And Avalanches (L1); Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami (L1); Post-Disaster Diseases and Epidemics (L1)

UNIT–IV	DISASTER PREPAREDNESS AND MANAGEMENT	6

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard (L2); Evaluation of Risk: Application of Remote Sensing (L1), Data from Meteorological And Other Agencies (L1), Media Reports: Governmental and Community Preparedness (L1).

UNIT–V	RISK ASSESSMENT	6

Disaster Risk: Concept and Elements (L1), Disaster Risk Reduction (L1), Global and National Disaster Risk Situation (L1). Techniques of Risk Assessment (L1), Global Co-Operation in Risk Assessment and Warning (L1), People"s Participation in Risk Assessment. Strategies for Survival (L1)

Total:- 30 PERIODS

OPEN ENDED PROBLEMS /QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOMS Taxonomy**
CO1	Summarize basics of disaster	L1 – Remember
CO2	Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	L2 – Understand
CO3	Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives	L2 – Understand
CO4	Describe an understanding of standards of humanitarian response and	L2 – Understand
	practical relevance in specific types of disasters and conflict situations.	
CO5	Develop the strengths and weaknesses of disaster management approaches	L2 – Understand
TEXTBOOKS:		
1.	Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi,2009.	
2.	NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies ""New Royal book Company,2007.	
REFERENCE BOOKS:		
1.	Sahni, Pradeep Et.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall of India, New Delhi,2001.	

ME23AC703	CONSTITUTION OF INDIA	Version: 1.0
(COMMON TO ALL BRANCHES)		

Programme& Branch	M.E- COMPUTER SCIENCE AND ENGINEERING	L	T	P	C
		2	0	0	0

Course Objectives:

1	To understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2	To address the growth of Indian opinion regarding modern Indian intellectuals" constitutional
3	To role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
4	To address the role of socialism in India after the commencement of the Bolshevik Revolution 1917 And its impact on the initial drafting of the Indian Constitution

UNIT–I	HISTORY OF MAKING OF THE INDIAN CONSTITUTION	6

History(L1), Drafting Committee(L1), (Composition & Working)

UNIT–II	PHILOSOPHY OF THE INDIAN CONSTITUTION	6

Preamble(L1), Salient Features(L1).

UNIT–III	CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES	6

Fundamental Rights(L1), Right to Equality(L1), Right to Freedom(L1), Right against Exploitation(L1),

Right to Freedom of Religion(L1), Cultural and Educational Rights(L1), Right to Constitutional Remedies(L1), Directive Principles of State Policy(L1), Fundamental Duties(L1).

UNIT–IV	ORGANS OF GOVERNANCE	6

Parliament(L1), Composition(L1), Qualifications and Disqualifications(L1), Powers and Functions(L1), Executive(L1), President(L1), Governor(L1), Council of Ministers(L1), Judiciary, Appointment and Transfer of Judges(L1), Qualifications, Powers and Functions(L1).

UNIT–V	LOCAL ADMINISTRATION	6

District"s Administration head: Role and Importance(L1), Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation(L1). Pachayati raj: Introduction(L1), PRI: Zila Panchayat(L1). Elected officials and their roles(L1), CEO Zila Pachayat: Position and role(L1). Block level: Organizational Hierarchy(Different departments) (L1), Village level:Role of Elected and Appointed officials(L1), Importance of grass root democracy(L1).

UNIT–VI	ELECTION COMMISSION	6

Election Commission: Role and Functioning (L1). Chief Election Commissioner and Election Commissioners (L1) - Institute and Bodies for the welfare of SC/ST/OBC and women(L1).

Total:- 36 PERIODS

OPEN ENDED PROBLEMS /QUESTIONS		
Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination		
Course Outcomes:		**BLOOMS**
Upon completion of this course the students will be able to:		**Taxonomy**
CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	L2 – Understand
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	L2 – Understand
CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.	L2 – Understand
CO4	Discuss the passage of the Hindu Code Bill of 1956.	L2 – Understand
TEXTBOOKS:		
1.	The Constitution of India, 1950(Bare Act), Government Publication	
2.	Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution, 1st Edition, 2015.	
REFERENCE BOOKS:		
1.	M.P. Jain, Indian Constitution Law, 7th Edn., LexisNexis,2014.	
2.	D.D. Basu, Introduction to the Constitution of India, LexisNexis, 2015.	

ME23AC704	நற்றமிழ் இலக்கியம் (TAMIL VERSION)	Version: 1.0
(COMMON TO ALL BRANCHES)		

Programme & Branch	M.E INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		2	2	0	0	0

Course Objectives:

1	சங்க இலக்கியம் பற்றி மாணவரக் ளாகக்கு எடுத்Fரரத்தல்
2	நீதி நூலக்கள் வாயிலாக அறக்கருத்Fகரள எடுத்F கூறுதல்.
3	சிலப்பதிகாரம், மணிமகரல காப்பியங்கரள எடுத்Fரரத்தல்.
4	இலக்கியங்களில் காணப்படும் அருள்நநறிக் கரதகரளப் பற்றி விளக்குதல்.
5	தற்காலத் தமிழ் இலக்கியங்கரள மாணவரக் ளாகக்கு நதரியப்படுத்Fதல்.

UNIT–I	சங்க இலக்கியம்	6

1. தமிழின் Fவக்க நூலக் நதாலக்காப்பியம் - எழுத்F , நசால், நபாருள் (L1)
2. அகநானூறு (82) - இயற்ரக இன்னிரச அரங்கம் (L1)
3. கூறிஞ்சிப் பாட்டி னில் மலரக் க்காட்சி (L1)
4. பூறநானூறு (95, 195) – மபாரர நிறுதத்திய ஔரவயார் (L1)

UNIT–II	அறநநறித்தமிழ்	6

1. அறநநறி வகுத்த திருவள்ளுவர் - அறம் வலியுறுதத்தல், அன் புரடரம, ஒப்புறவு அறிதல், ஈரக, புகழ் (L2)
2. பிற அறநூலக்கள் – இலக்கிய மரபுநF - ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்மகாரவ

(□ய்ரமரய வலியுறுதFம் நூலல்) (L2)

UNIT–III	இரட்டக்காப்பியங்கள்	6

1. கண்ணகியின் பரடசி - சிலப்பதிகார வழக்குரர காரத (L1)
2. சமூக மசரல இலக்கியம் மணிமகரல – சிரறக்மகாட்டம் அறக்மகாட்மாகிய காரத

(L1)

UNIT–IV	அருள்நநறித்தமிழ்	6

1. சிறுபாணாறற்றுப்பரட – பாரி மலல்ரலக்கு மதரப் நகாடுத்தF, மபகன் மயிலகக்குப் மபாரர் வ நகாடுத்தF, அதியமானின் ஔரவகக்கு நநலல்லிக்கனி நகாடுத்தF, அரசர் பண் பகள். (L2)
2. நற்றிரண – அன்ரனக்குரிய புன்ரன சிறப்பு (L2)
3. திருமந்திரம் (617,618) இயமம் நியமம் விதிகள் (L2)
4. தரம் சாரலரய நிறுவிய வள்ளலார் (L2)
5. புறநானூறு – சிறுவமன வள்ளலானான் (L2)
6. அகநானூறு (4) – வண் டு (L2)
7. நறற்றிரண (11) – நண் டு (L2)
8. கலிதந் தாரக (11) – யாரன, பூறா (L2)
9. ஐநற்றிரண ஐம்பF (27) – மானின் (L2)

	a. ஆகியரவ பற்றிய நசய்திகள் (L2)	
UNIT–V	**நவீன தமிழ் இலக்கியம்**	**6**

1. உரரநரடத்தமிழ் (L1)
   – தமிழின் முதல் புதினம் (L1)
   – தமிழின் முதல் சிறுகரத (L1)
   – கடுரர இலகக்கியமக் (L1)
   – பயண இலகக்கியமக் (L1)
   – நாடகம் (L1)
2. நாடடு வடிமாதரல மபாராடடமாமக் தமிழக் இலகக்கியமாமக் (L1)
3. சமாதாய வடிமாதரலயுமக் தமிழக் இலகக்கியமாமக் (L1)
4. நபண் வடிமாதரலயுமக் வளிமபு நிரலயினரினக் மமமபாடடிலக் தமிழக் இலகக்கியமாமக் (L1)
5. அறிவியல் தமிழ் (L1)
6. இரணயதக்திலக் தமிழக் (L1)
7. சுறறாசசூழலக் மமமபாடடிலக் தமிழக் இலகக்கியமக் (L1)

Total: 30 PERIODS

	COURSE OUTCOMES: **Upon completion of this course the students will be able to:**	**BLOOMS Taxonomy**
CO1	சங்க இலகக்கியமக் மாணவரக் ளக் மாழுரமயாக அறிநக்F பயணக் நபறுதலக்.	L1 - நிரனவில் நகாள்ளுதல்
CO2	அறநநறி இலகக்கியமக் வாயிலாக வாழக்வியலாகக்காதக் மதரவயான □ய்ரமப் பணிகரள மமறநகாள்ளுதல்.	L2 - பாரிநக்F நகாள்ளுதல்
CO3	சிலபபதிகாரமக், மணிமமகரல காபபியஙகளிலக் உளள நீதிகக்குதF கரள மாணவரக் ளக் நதரிநக்Fநகாளளாதலக்.	L1 - நிரனவில் நகாள்ளுதல்
CO4	இலக்கியங்களில் காணப்படும் அருள்நநறிக் கரதகரளப் பற்றி விளக்குதல்.	L2 – பாரிநக்F நகாள்ளுதல்
CO5	தறகாலதக் தமிழக் இலகக்கியஙகரள மாணவரக் ளக் நதரிநக்F அவறறினக் வாயிலாக பயன் அரடதல்.	L1 – நிரனவில் நகாள்ளுதல்

TEXTBOOKS: தமிழ் இலக்கிய நெளியீடுகள் புத்தகங்கள்
தமிழ் இரணய கல்விக்கழகம் (Tamil Virtual University) - www.tamilvu.org.
தமிழ் விக்கிப்பீடியா (Tamil Wikipedia) -https://ta.wikipedia.org.
தரமபுர ஆதீன நவளியீடு.
வாழ்வியல் களஞ்சியம் – தமிழ்ப் பல்கரலக்கழகம், தஞ்சாவூர.்
தமிழக்கரலகக்களஞ்சியமக் - தமிழ் வளரச் சித்Fரற (thamilvalarchithurai.com).
அறிவியல் களஞ்சியம் - தமிழ்ப் பல்கரலக்கழகம், தஞ்சாவூர.்

ME23AC704	CLASSICAL TAMIL LITERATURE (ENGLISH VERSION)	Version: 1.0
(COMMON TO ALL BRANCHES)		

Programme & Branch	M.E INDUSTRIAL SAFETY ENGINEERING	CP	L	T	P	C
		2	2	0	0	0

Course Objectives:

1.	Providing guidance to students about Sangam literature.
2.	Analyzing legal texts to articulate opinions on justice literature.
3.	Discussing Silappathikaram, Manimekalai, and KAppiyankaḷ.
4.	Shedding light on narratives of grace found in literature.
5.	Familiarizing students with contemporary Tamil literature.

UNIT–I	SANGAM LITERATURE	6

1. Tolkappiyam - The Fundamental Text of Tamil - Writing, language, and meaning (L1)
2. Akananuru (82) - Natural Melodious Garden (L1)
3. Kurinchipattu's Flower Landscape (L1)
4. Purananuru (95, 195) - Avvaiyar Who Stopped the War (L1)

UNIT–II	JUSTICE & RIGHTEOUSNESS IN TAMIL	6

1. Thiruvalluvar who Expounded Virtue - Understanding justice, embracing love, avoiding falsehood, gratitude, and fame. (L2)
2. Other Legal Texts - Literary Medicine - Eladhi, Sirupanchamulam, Trigatukam, and Acharakkovai (A book emphasizing cleanliness). (L2)

UNIT–III	IRATTAI KAPPIYANKAL	6

1. Kannagi's Protest - Introduction to the Silappathikaram Legal Story (L1)
2. Social Structure Literature Manimekalai - Story of Siraikkottam turned into Arakkottam (L1)

UNIT–IV	SACRED TAMIL LITERATURE	6

1. Siruppanattrupadai - Pari Presented the chariot to Jasmine Creeper, Pegan Presented a blanket to Peacock, Gooseberry given to Avvai by Adhiyamaan, Royal honors. (L2)
2. Nattrinai - Special gift for Mother (L2)
3. Thirumandiram (617,618) - Rules of Conduct (L2)
4. Vallalar who founded Dharmasala (L2)
5. Purananuru - The young man becomes a warrior (L2)
6. Akananuru (4) - The Chariot (L2)
7. Nattrinai (11) - Bull (L2)
8. Kalittokai (11) - Elephant, Tiger (L2)
9. Aindiṉai Aimpatu (27) - Deer (L2)

   a. News about the above (L2)

UNIT–V	MODERN TAMIL LITERATURE	6

1. Literary Tamil (L1):
   - First Novel in Tamil (L1)
   - First Short Story in Tamil (L1)
   - Essay Literature (L1)
   - Travel Literature (L1)
   - Drama (L1)
2. National Liberation Struggle and Tamil Literature (L1)
3. Community Liberation and Tamil Literature (L1)
4. Women's Liberation and Tamil Literature in the Perspective of Feminist Criticism (L1)
5. Scientific Tamil (L1)
6. Tamil on the Internet (L1)
7. Tamil Literature in Environmental Conservation (L1)

Total: 30 PERIODS

COURSE OUTCOMES: **Upon completion of this course the students will be able to:**		**BLOOMS Taxonomy**
CO1	Students comprehensively understand and benefit from Sangam literature.	L1 – Remember
CO2	Emphasize cleanliness tasks needed for the vitality of literary life.	L2 – Understand
CO3	Familiarize students with ethical principles found in Silappathikaram and Manimekalai.	L1 – Remember
CO4	Illuminate stories of grace in literature.	L2 – Understand
CO5	Students acquire knowledge of contemporary Tamil literature and apply its insights.	L1 – Remember

TEXTBOOKS:

1.	Tamil Virtual University - www.tamilvu.org.
2.	Tamil Wikipedia - https://ta.wikipedia.org.
3.	Release of Dharmapuri Adheenam.
4.	Biotechnology Symposium - Tamil Nadu Agricultural University, Thanjavur.
5.	Tamil Arts Symposium - Department of Tamil Development (thamilvalarchithurai.com).
6.	Science Symposium - Tamil Nadu Agricultural University, Thanjavur.

Note:

Syllabus for the courses offered from 3rd Semester to 4th Semester, will be added after the approval of the Board of Studies (BoS) & Academic Council (AC) in due course.