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 – 637 504. Salem Dt., Tamil Nadu, India.

Beyond Knowledge

M.E. / M.Tech. Regulations 2023

M.E. – Embedded System Technologies

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

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M.E. / M.Tech. REGULATIONS 2023 (R 2023)
CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

M.E. – Embedded System Technologies

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 produce technically competent Electrical and Electronics Engineers having exemplary skills with ethical and social values.

MISSION OF THE DEPARTMENT

M1	To provide state-of-the art facilities in Electrical and Electronics Engineering for improving the learning environment and research activities
M2	To continuously enrich the knowledge and skill of students towards the employment and creation of innovative products for society
M3	To develop ethical, social-valued and entrepreneurship skilled Electrical and Electronics Engineers

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	To provide students good foundation in mathematical, scientific, engineering fundamentals and hardware-software programming intelligence.
PEO 2	To develop among students, the ability to develop embedded systems based smart solutions for purpose of system automation.
PEO 3	To promote student awareness, for life-long learning and introduce them to professional ethics and code of practice.

PROGRAM OUTCOMES (POs)	
PO 1	An ability to independently carry out research / investigation and development work to solve practical problems.
PO 2	An ability to write and present a substantial technical report / document.
PO 3	Student should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO 4	Be able to design and develop Embedded system automation based on dedicated ICs that have computation, networking and control capacity.
PO 5	Skill to work on professional software languages, standard modeling and analysis tools & commercial packages with communication protocols and computation platforms for analysis and design of system automation.
PO 6	To involve in research on an industrial problem or develop an innovative smart system with automation as a consumer product through project management and finance with due concerned for socio economic values

KNOWLEDGE INSTITUTE OF TECHNOLOGY (AUTONOMOUS), SALEM - 637504

KNOWLEDGE INSTITUTE OF TECHNOLOGY (AUTONOMOUS), SALEM - 637504

**M.E. EMBEDDED SYSTEM TECHNOLOGIES**	**Version: 1.0**
**Courses of Study and Scheme of Assessment (Regulations 2023)**	**Date: 9.9.2023**

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	ME23MA104	Applied Mathematics for Embedded Systems Technologists	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	ME23ET301	Design of Embedded Systems	PC	3	3	0	0	3	40	60	100
4	ME23ET302	Software for Embedded Systems	PC	3	3	0	0	3	40	60	100
5	ME23ET303	Microcontroller Based System Design	PC	3	3	0	0	3	40	60	100
6	ME23ET304	VLSI Design and Reconfigurable Architecture	PC	3	3	0	0	3	40	60	100
7	ME23AC7XX	Audit Course–I *	AC	2	2	0	0	0	100	-	100
PRACTICAL
8	ME23ET305	Embedded Systems-I Laboratory	PC	4	0	0	4	2	60	40	100
EMPLOYABILITY ENHANCEMENT
9	ME23PT801	Technical Seminar / Case study Presentation	EEC	2	0	0	2	0	100	-	100
**Total**		27	19	2	6	21	500	400	900

Sl. No.	Course Code	Course Title	CAT	CP	L	T	P	C	IA	ESE	Total
SEMESTER II
THEORY
1	ME23ET306	Real Time Operating System	PC	3	3	0	0	3	40	60	100
2	ME23ET307	Embedded System Networking	PC	3	3	0	0	3	40	60	100
3	ME23ET308	Embedded Control for Electric Drives	PC	3	3	0	0	3	40	60	100
4	ME23ET4XX	Professional Elective-I	PE	3	3	0	0	3	40	60	100
5	ME23ET4XX	Professional Elective-II	PE	3	3	0	0	3	40	60	100
6	ME23XX5XX	Open Elective-I	OE	3	3	0	0	3	40	60	100
7	ME23MC701	Universal Human Values and Ethics	MC	3	2	1	0	3	40	60	100
8	ME23AC7XX	Audit Course–II *	AC	2	2	0	0	0	100	-	100
PRACTICAL
9	ME23ET309	Embedded Systems-II Laboratory	PC	4	0	0	4	2	60	40	100
EMPLOYABILITY ENHANCEMENT
10	ME23PT802	Research Paper Review and presentation	EEC	2	0	0	2	1	100	-	100
**Total**		29	22	1	6	24	540	460	1000

 * Audit Course is optional

M.E. EMBEDDED SYSTEM TECHNOLOGIES

Courses of Study and Scheme of Assessment (Regulations 2023)

Sl. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
		SEMESTER III									
THEORY											
1	ME23ET310	IoT for Smart Systems	PC	3	3	0	0	3	40	60	100
2	ME23ET4XX	Professional Elective-III	PE	3	3	0	0	3	40	60	100
3	ME23ET4XX	Professional Elective-IV	PE	3	3	0	0	3	40	60	100
4	ME23XX5XX	Open Elective-II	OE	3	3	0	0	3	40	60	100
PRACTICAL											
5	ME23ET601	Project Work - Phase I	PW	12	0	0	12	6	60	40	100
		Total		**24**	**12**	**0**	**12**	**18**	**220**	**280**	**500**
		SEMESTER IV									
PRACTICAL											
1	ME23ET602	Project Work - Phase II	PW	24	0	0	24	12	60	40	100
		Total		**24**	**0**	**0**	**24**	**12**	**60**	**40**	**100**
								Total Number of Credits: 75			

M.E. EMBEDDED SYSTEM TECHNOLOGIES

Courses of Study and Scheme of Assessment (Regulations 2023)

Sl. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	IA	ESE	Total
PROFESSIONAL ELECTIVES											
SEMESTER II **(Professional Electives - I & II)**											
1	ME23ET401	Wireless And Mobile Communication	PE	3	3	0	0	3	40	60	100
2	ME23ET402	Virtual Instrumentation	PE	3	3	0	0	3	40	60	100
3	ME23ET403	Embedded Processor Development	PE	3	3	0	0	3	40	60	100
4	ME23ET404	Automotive Embedded System	PE	3	3	0	0	3	40	60	100
5	ME23ET405	Intelligent Control and Automation	PE	3	3	0	0	3	40	60	100
6	ME23ET406	Unmanned Aerial Vehicle	PE	3	3	0	0	3	40	60	100
7	ME23ET407	DSP Based System Design	PE	3	3	0	0	3	40	60	100
8	ME23ET408	Machine Learning and Deep Learning	PE	3	3	0	0	3	40	60	100
SEMESTER III **(Professional Electives - III & IV)**											
9	ME23ET409	Computer Vision	PE	3	3	0	0	3	40	60	100
10	ME23ET410	Multimedia Communications	PE	3	3	0	0	3	40	60	100
11	ME23ET411	Embedded Networking and Automation of Electrical System	PE	3	3	0	0	3	40	60	100
12	ME23ET412	Smart System Design	PE	3	3	0	0	3	40	60	100
13	ME23ET413	Embedded Computing	PE	3	3	0	0	3	40	60	100
14	ME23ET414	Embedded Systems Security	PE	3	3	0	0	3	40	60	100
15	ME23ET415	Robotics and Automation	PE	3	3	0	0	3	40	60	100
16	ME23ET416	Reconfigurable Processor and SoC Design	PE	3	3	0	0	3	40	60	100
17	ME23ET417	MEMS and NEMS Technology	PE	3	3	0	0	3	40	60	100
18	ME23ET418	Entrepreneurship and Embedded Product Development	PE	3	3	0	0	3	40	60	100
19	ME23ET419	Embedded System for Biomedical Applications	PE	3	3	0	0	3	40	60	100
20	ME23ET420	Python Programming for Machine Learning	PE	3	3	0	0	3	40	60	100
21	ME23ET421	Renewable Energy and Grid Integration	PE	3	3	0	0	3	40	60	100
22	ME23ET422	Electric Vehicles and Power Management	PE	3	3	0	0	3	40	60	100
23	ME23ET423	Smart Grid	PE	3	3	0	0	3	40	60	100

SI. No.	Course Code	Course Title	CAT	CP	L	T	P	C	IA	ESE	Total
		KNOWLEDGE INSTITUTE OF TECHNOLOGY (AUTONOMOUS), SALEM - 637504									
		M.E. EMBEDDED SYSTEM TECHNOLOGIES									
		Courses of Study and Scheme of Assessment (Regulations 2023)									
					Periods / Week				**Maximum Marks**		
			CAT	CP	L	T	P	C	IA	ESE	Total
		OPEN ELECTIVES									
		Except M.E. Computer Science and Engineering									
1	ME23CP501/ ME23CP310	Security Practices	OE	3	3	0	0	3	60	40	100
2	ME23CP502/ ME23CP401	Cloud Computing Technologies	OE	3	3	0	0	3	60	40	100
3	ME23CP503/ ME23CP415	Block chain Technologies	OE	3	3	0	0	3	60	40	100
4	ME23CP504/ ME23CP414	Deep Learning	OE	3	3	0	0	3	60	40	100
5	ME23CP505	Design Thinking	OE	3	3	0	0	3	60	40	100
6	ME23CP506	Principles of Multimedia	OE	3	3	0	0	3	60	40	100
		Except M.E. Industrial Safety Engineering									
7	ME23IS501/ ME23IS302	Environmental Safety	OE	3	3	0	0	3	60	40	100
8	ME23IS502/ ME23IS309	Electrical safety	OE	3	3	0	0	3	60	40	100
9	ME23IS503/ ME23IS413	Safety in Engineering Industry	OE	3	3	0	0	3	60	40	100
10	ME23IS504	Design of Experiments	OE	3	3	0	0	3	60	40	100
11	ME23IS505	Circular Economy	OE	3	3	0	0	3	60	40	100
		Except M.E. Embedded System Technologies									
12	ME23ET501/ ME23ET310	IoT for Smart Systems	OE	3	3	0	0	3	60	40	100
13	ME23ET502/ ME23ET408	Machine Learning and Deep Learning	OE	3	3	0	0	3	60	40	100
14	ME23ET503	Renewable Energy Technology	OE	3	3	0	0	3	60	40	100
15	ME23ET504/ ME23ET423	Smart Grid	OE	3	3	0	0	3	60	40	100
		Except M.E. VLSI Desig									
16	ME23VL501	Big Data Analytics	OE	3	3	0	0	3	60	40	100
17	ME23VL502	Internet of Things and Cloud	OE	3	3	0	0	3	60	40	100
18	ME23VL503	Medical Robotics	OE	3	3	0	0	3	60	40	100
19	ME23VL504	Embedded Automation	OE	3	3	0	0	3	60	40	100
		AUDIT COURSES (Optional Courses)									
1	ME23AC701	English for Research Paper Writing	AC	2	2	0	0	0	100	-	100
2	ME23AC702	Disaster Management	AC	2	2	0	0	0	100	-	100
3	ME23AC703	Constitution of India	AC	2	2	0	0	0	100	-	100
		MANDATORY COURSE									
1	ME23AC704	நற்றமிழ் இலக்கியம்	AC	2	2	0	0	0	100	-	100

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**	14	11	3	-	28	**38**
4	**PE**	-	6	6	-	12	**16**
5	**OE**	-	3	3	-	6	**8**
6	**PW**	-	-	6	12	18	**24**
7	**MC/AC**	✓	3	-	-	3	**4**
8	**EEC**	✓	1	-	-	1	**1**
	Total	**21**	**24**	**18**	**12**	**75**	**100**

NOMENCLATURE

CAT	Category of Course	**FC**	Foundation Courses	**MC/AC**	Mandatory Courses/ Audit Courses
CP	Contact Periods	**RM**	Research methodology and IPR courses	**EEC**	Employability Enhancement Courses
L	Lecture Hours	**PC**	Professional Core Courses	**IA**	Internal Assessment
T	Tutorial Hours	**PE**	Professional Elective Courses	**ESE**	Semester End Examination
P	Practical Hours	**OE**	Open Elective Courses	**PW**	Project Work Courses
C	Credits				

ME23MA104	APPLIED MATHEMATICS FOR EMBEDDED SYSTEMS TECHNOLOGISTS			Version: 1.0		
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		4	3	1	0	4

Course Objectives:

1	To understand the techniques of Fourier transform to solve partial differential equations.
2	To learn the graph theory concepts for modelling the system.
3	To learn the optimization techniques.
4	To learn the basic concepts of probability and Random Variables.
5	To introduce the basic concept of queuing theory.

UNIT−I	FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS	9+3

Fourier transform : Definitions(L1) – Properties(L2) – Transform of elementary functions(L2) - Dirac delta function(L2) – Convolution theorem(L3) – Parseval's identity(L3) – Solutions to partial differential equations: Heat equation Wave equation(L3) - Laplace and Poison's equations(L3).

UNIT−II	GRAPH THEORY	9+3

Introduction to paths(L1), trees, vector spaces(L2) - Matrix coloring and directed graphs(L3) - Some basic algorithms(L2) – Shortest path algorithms(L2) – Depth - First search on a graph(L2) – Isomorphism(L3) – Other Graph Theoretic algorithms(L2) – Performance of graph theoretic algorithms(L3) – Graph theoretic computer languages(L2).

UNIT− III	OPTIMIZATION TECHNIQUES	9+3

Linear programming(L2) - Basic concepts(L2) – Graphical and simplex methods(L3) – Big M method(L3) - Two phase simplex method(L3) - Revised simplex method(L3) - Transportation problems(L3) – Assignment problems(L3) .

UNIT – IV	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 – Moment generating functions(L2) and their properties)L2) – Binomial,Poisson, Exponential, Normal distributions(L3) – Two dimensional random variables(L2) - Poisson process(L3).

UNIT−V	QUEUEING THEORY	9+3

Single and multiple servers(L2) - Markovian queuing models(L3) - Finite and infinite capacity queues(L3) – Finitesource model(L3) — Queuing applications(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 Fourier transform techniques to solve PDE technology	L3 – Apply
CO2	Model the networks in embedded systems using graph theory.	L3 – Apply
CO3	Apply the optimization technique to solve the transportation and	L3 – Apply

	assignment related problems.	
CO4	Make use of the concepts of probability and random variables in solving engineering problems.	L3 – Apply
CO5	Apply the knowledge queuing theory in embedded system technologies.	L3 – Apply

REFERENCE BOOKS:

1.	Taha H .A., " Operations Research: An Introduction " , 9th Edition, Pearson Education Asia, New Delhi, 2016.
2.	Walpole R.E., Myer R.H., Myer S.L., and Ye, K., " Probability and Statistics for Engineers and Scientists ", 7th Edition, Pearson Education, Delhi, 2002.
3.	Sankara Rao, K., " Introduction to Partial Differential Equations ", Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
4.	Narasingh Deo, " Graph Theory with Applications to Engineering and Computer Science ", Prentice Hall India,1997.
5.	S. S. Rao, " Engineering Optimization, Theory and Practice ", 4th Edition, John Wiley and Sons, 2009.

VIDEO REFERENCES:

1.	https://www.youtube.com/watch?v=6RcRSli0YEI&list=PLEAYkSg4uSQ3NwwQtfSgnKPF5x4iI_XTb Prof Rajiv Misra IIT-Karagpur
2.	https://www.youtube.com/watch?v=vqJuFD0GdJA (Dr P N Agarwal IIT R)

WEB REFERENCES:

1.	http://stankova.net/book.pdf
2.	https://www.edanz.com/blog/anova-explained

ONLINE COURSES:

1.	https://nptel.ac.in/courses/110105087
2.	https://onlinecourses.nptel.ac.in/noc23_ge25/preview

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

ME23RM201	RESEARCH METHODOLOGY AND IPR				Version: 1.0	

(COMMON TO ALL BRANCHES)						

Programme &Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	2	1	0	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 (L2)-Measurement and Result Analysis (L3)-Investigation of Solutions for Research Problem (L2)-Interpretation (L2)-Research Limitations (L2)-Journals in Science/Engineering (L2)-Indexing and Impact factor of Journals (L3)-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(L1)- - Language and Style (L1)-Format of Project Report (L1) - Use of Quotations (L2)-Method of Transcription Special Elements (L3)-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:	BLOOM'S
Upon completion of this course the students will be able to:	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	Utilize research & analytic tools for enhancing the research publication	L2 - Understand
CO4	Apply knowledge to produce presentations and technical reports that effectively communicate research findings.	L3 - Apply
CO5	Explain types of intellectual property and comprehend patenting as essential for safeguarding innovation and creativity.	L2 - Understand

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.
5.	The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

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/
2.	https://www.wipo.int/about-ip/en/

ONLINE COURSES:

1.	https://onlinecourses.nptel.ac.in/noc23_ge36/preview
2.	https://onlinecourses.nptel.ac.in/noc22_hs59/preview

Mapping of COs with POs						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	1			1
CO2	3	3		2		
CO3	3			3	1	
CO4	3	3				
CO5	2	2		2		1
Average	**2.8**	**2.5**	**1**	**2.33**	**1**	**1**
1–Low, 2 –Medium, 3–High.						

ME23ET301	DESIGN OF EMBEDDED SYSTEMS			Version : 1.0		
Programme & Branch	**M.E. EMBEDDED SYSTEM TECHNOLOGIES**	**CP**	**L**	**T**	**P**	**C**
		3	3	0	0	3

Course Objectives:

1	To provide knowledge on the basics, building blocks of Embedded System.
2	To discuss Input/output Interfacing & Bus Communication with processors.
3	To teach automation using scheduling algorithms and Real time operating system.
4	To discuss on different Phases & Modeling of a new embedded product.
5	To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT−I	**INTRODUCTION TO EMBEDDED SYSTEMS**	**9**

Introduction to Embedded Systems(L1) –built in features for embedded Target Architecture(L2) - selection of Embedded processor (L2)– DMA(L2)- memory devices(L2) – Memory management methods(L2)-memory mapping(L2), cache replacement policies- Timer and Counting devices, Watchdog Timer, Real Time Clock(L2)- Software Development tools(L2)-IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging(L2)- Overview of functional safety standards for embedded systems(L2).

UNIT−II	**EMBEDDED NETWORKING BY PROCESSORS**	**9**

Embedded Networking: Introduction, I/O Device Ports & Buses(L2)- multiple interrupts and interrupt service mechanism(L2) – Serial Bus communication protocols -RS232 standard–RS485(L2)S–USB(L2)–Inter Integrated Circuits (I^{2}C) (L2)- CAN Bus(L2) –Wireless protocol based on Wifi , Bluetooth, Zigbee(L2) – Introduction to Device Drivers(L2).

UNIT− III	**RTOS BASED EMBEDDED SYSTEM DESIGN**	**9**

Introduction to basic concepts of RTOS(L1)- Need, Task, process & threads(L2), interrupt routines in RTOS(L2), Multiprocessing and Multitasking(L2), Preemptive and non-preemptive scheduling(L2), Task communication- context switching, interrupt latency and deadline shared memory(L2), message passing(L2)-, Interprocess Communication(L2) – synchronization between processes(L2)-semaphores, Mailbox, pipes, priority inversion, priority inheritance(L2), comparison of Real time Operating systems: VxWorks, uC/OS-II, RT Linux(L2).

UNIT – IV	**MODELLING WITH HARDWARE/SOFTWARE DESIGN APPROACHES**	**9**

Modelling embedded systems- embedded software development approach(L2) --Overview of UML modeling with UML, UML Diagrams(L3)-- Hardware/Software Partitioning(L2), Co-Design Approaches for System Specification and modeling(L2)- CoSynthesis(L2)- Features comparing Single-processor Architectures & Multi-Processor Architectures(L3)--Design approach on parallelism in uniprocessors & Multiprocessors(L3).

UNIT−V	**EMBEDDED SYSTEM APPLICATION DEVELOPMENT**	**9**

Objective, Need, different Phases & Modelling of the EDLC.choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems-Case studies on Digital Camera, Adaptive Cruise control in a Car, Mobile Phone software for key inputs.

	Total : 45 PERIODS

	OPEN ENDED PROBLEMS / QUESTIONS	

Objective, Need, different Phases & Modelling of the EDLC(L2)- choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems(L3)-Case studies on Digital Camera, Adaptive Cruise control in a Car, Mobile Phone software for key inputs(L3).

Course Outcomes: At the end of this course, the students will		BLOOM'S Taxonomy
CO1	Demonstrate the functionalities of processor internal blocks, with their requirement.	L2 - Understand
CO2	Analyze that Bus standards are chosen based on interface overheads without sacrificing processor performance	L2 - Understand
CO3	Explain the role and features of RT operating system, that makes multitask execution possible by processors.	L2 - Understand
CO4	Illustrate that using multiple CPU based on either hardcore or softcore helps data overhead management with processing-speed reduction for uC execution.	L3 - Apply
CO5	Recommend Embedded consumer product design based on phases of product development.	L3 - Apply

REFERENCE BOOKS:

1.	Rajkamal, 'Embedded System-Architecture, Programming, Design', TMH,2011.
2.	Peckol, "Embedded system Design", JohnWiley&Sons,2010
3.	Lyla B Das," Embedded Systems-An Integrated Approach", Pearson2013
4.	EliciaWhite," Making Embedded Systems", O'Reilly Series, SPD,2011
5.	Bruce Powel Douglass, "Real-Time UML Workshop for Embedded Systems, Elsevier,2011
6.	Advanced Computer architecture, By Rajiv Chopra, S Chand, 2010
7.	Jorgen Staunstrup, Wayne Wolf, Hardware / Software Co- Design Principles and Practice, Springer, 2009.
8.	Shibu.K.V, "Introduction to Embedded Systems", Tata McGraw Hill,2009
9.	Tammy Noergaard," Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier, 2006
10.	Giovanni De Micheli, Mariagiovanna Sami, Hardware / Software Co- Design, Kluwer Academic Publishers, 2002

WEB REFERENCES:

1.	https://www.ripublication.com/ijaer17/ijaerv12n18_113,
2.	https://www.embedded.com/serial-protocols-compared/

ONLINE COURSES:

1.	https://onlinecourses.nptel.ac.in/noc20_cs14/preview
2.	https://onlinecourses.nptel.ac.in/noc21_cs08/preview

VIDEO REFERENCES:

1.	https://www.youtube.com/watch?v=3RfqkVyvnnc
2.	https://www.youtube.com/watch?v=U5CDf4TNARE
3.	https://www.youtube.com/watch?v=Gkp753foAgE

Mapping of COs with POs						
CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
1			3	2	1	
2	2		1	2		
3		2	2	3		
4	2		3	3		
5	2		1	2		2
Avg	2	2	2	2.4	1	2
1–Low, 2 –Medium, 3–High.						

ME23ET302	SOFTWARE FOR EMBEDDED SYSTEMS			Version : 1.0		
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To expose the students to the fundamentals of embedded Programming
2	To Introduce the GNU C Programming Tool Chain in Linux.
3	To study the basic concepts of embedded C.
4	To teach the basics of Python Programming
5	To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

UNIT–I	BASIC C PROGRAMMING	9

Typical C Program Development Environment - Introduction to C Programming(L2) - Structured Program Development in C (L2)- Data Types and Operators(L1) - C Program Control(L2) - C Functions(L2) - Introduction to Arrays (L2).

UNIT–II	EMBEDDED C	9

Adding Structure to 'C' Code: Object oriented programming with C(L2), Header files for Project and Port(L2), Examples. Meeting Real-time constraints(L3): Creating hardware delays(L3) - Need for timeout mechanism(L2) - Creating loop timeouts(L3) - Creating hardware timeouts(L3).

UNIT– III	C PROGRAMMING TOOL-CHAIN IN LINUX	9

C preprocessor(L2) - Stages of Compilation(L2) - Introduction to GCC(L2) - Debugging with (L3) - The Make utility(L3) - GNU Configure and Build System(L3) - GNU Binary utilities(L3) – Profiling(L3) - using gprof(L3) - Introduction to GNU C Library(L2).

UNIT – IV	PYTHON PROGRAMMING	9

Introduction(L1) - Parts of Python Programming Language(L2) - Control Flow Statements(L3) - Functions (L3)– Strings Lists (L3)- Dictionaries (L3)- Tuples and Sets (L3).

UNIT–V	MODULES, PACKAGES AND LIBRARIES IN PYTHON	9

Python Modules and Packages(L2) - Creating Modules and Packages(L3) - Practical Example - Libraries for Python(L3) - Library for Mathematical functionalities and Tools(L3) - Numerical Plotting Library(L3) - GUI Libraries for Python - Imaging Libraries for Python (L3)- Networking Libraries(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: At the end of this course, the students will demonstrate the ability to		BLOOM'S Taxonomy
CO1	Demonstrate C programming and its salient features for embedded systems	L2 - Understand
CO2	Deliver insight into various programming languages/software compatible to embedded process development with improved design & programming skills.	L3 - Apply
CO3	Develop knowledge on C programming in Linux environment.	L2 - Understand
CO4	Possess ability to write python programming for Embedded applications.	L3 - Apply
CO5	Develop Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded programming skills.	L3 - Apply

REFERENCE BOOKS:	
1.	Paul Deitel and Harvey Deitel, "C How to Program", 8th Edition, Pearson Education Limited, 2016.
2.	Michael J Pont, "Embedded C", Addison-Wesley, An imprint of Pearson Education, 2002.
3.	William von Hagen, "The Definitive Guide to GCC", 2nd Edition, Apress Inc., 2006.
4.	Gowrishankar S and Veena A, "Introduction to Python Programming", CRC Press, Taylor & Francis Group, 2019.
5.	Noel Kalicharan, "Learn to Program with C", Apress Inc., 2015.
6.	Steve Oualline, "Practical C programming", O'Reilly Media, 1997.
7.	Fabrizio Romano, "Learn Python Programming", Second Edition, Packt Publishing, 2018.
8.	John Paul Mueller, "Beginning Programming with Python for Dummies", 2nd Edition, John Wiley & Sons Inc., 2018.
9.	Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media Inc., 2010.
WEB REFERENCES:	
1.	https://www.javatpoint.com/gcc-linux
2.	https://www.geeksforgeeks.org/python-set-3-strings-lists-tuples-iterations/
ONLINE COURSES:	
1.	https://onlinecourses.nptel.ac.in/noc19_cs41/preview
2.	https://onlinecourses.nptel.ac.in/noc19_cs41/preview
VIDEO REFERENCES:	
1.	https://www.youtube.com/watch?v=XTiIiILOY8&list=PLEAYkSg4uSQ2k6GwNhpgSHodGT8wfvgwu
2.	https://www.youtube.com/watch?v=c235EsGFcZs
3.	https://www.youtube.com/watch?v=c235EsGFcZs

Mapping of COs with POs						
CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
1			2		3	
2	1		1		2	
3		2			2	
4	1		1	1	1	
5			2	2	3	2
Avg	1	2	1.5	1.5	2.2	2
1–Low, 2 –Medium, 3–High.						

ME23ET303	MICROCONTROLLER BASED SYSTEM DESIGN		Version : 1.0		
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	**CP**	**L**	**T**	**P**	**C**
		3	**3**	**0**	**0**	**3**

Course Objectives:

1	To teach the architecture of PIC Microcontroller and RISC processor.
2	To compare the architecture and programming of 8, 16, 32 bit RISC processor.
3	To teach the implementation of DSP in ARM processor.
4	To discuss on memory management, application development in RISC processor.
5	To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

UNIT–I	PIC MICROCONTROLLER	9

Architecture(L2) – memory organization(L2) – addressing modes(L2) – instruction set (L3)– PIC programming in Assembly & C(L3) –I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, practice in MP-LAB(L3).

UNIT–II	ARM ARCHITECTURE	9

Architecture(L2) – memory organization(L2) – addressing modes(L2) –The ARM Programmer's model (L2)–Registers(L2) – Pipeline (L2)- Interrupts(L2) – Coprocessors (L2)– Interrupt Structure(L2)

UNIT– III	PERIPHERALS OF PIC AND ARM MICROCONTROLLER	9

PIC: ADC, DAC and Sensor Interfacing(L3) –Flash and EEPROM memories(L3). ARM: I/O Memory (L3)– EEPROM (L3)– I/O Ports (L3)– SRAM(L3) –Timer (L3)–UART (L3) - Serial Communication with PC – ADC/DAC Interfacing(L3).

UNIT – IV	ARM MICROCONTROLLER PROGRAMMING	9

ARM general Instruction set(L2) – Thumb instruction set (L2)–Introduction to DSP on ARM – Implementation example of Filters(L3)

UNIT–V	DESIGN WITH PIC AND ARM MICROCONTROLLERS	9

PIC implementation - Generation of Gate signals for converters and Inverters - Motor Control – Controlling DC/ AC appliances (L3)– Measurement of frequency(L3) - Standalone Data Acquisition System(L3) –ARM Implementation(L3)- Simple ASM/C programs- Loops –Look up table- Block copy- subroutines-Hamming Code.(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: At the end of this course, the students will have the ability to	**BLOOM'S Taxonomy**
CO1	Understand the basics and requirement of processor functional blocks.	L3 - Apply
CO2	Observe the specialty of RISC processor Architecture.	L2 - Understand
CO3	Incorporate I/O hardware interface of a processor based automation for consumer application with peripherals.	L3 - Apply
CO4	Incorporate I/O software interface of a processor with peripherals.	L3 - Apply

| CO5 | Apply Employability and entrepreneurship ability to knowledge up gradation on recent trends in commercial embedded processors | L3 - Apply |

REFERENCE BOOKS:

1.	Steve Furber, 'ARM system on chip architecture', Addision Wesley,2010.
2.	Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System Developer's Guide Designing and Optimizing System Software', Elsevier 2007.
3.	Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey 'PIC Microcontroller and Embedded Systems using Assembly and C for PIC18', Pearson Education 2008.
4.	John Iovine, 'PIC Microcontroller Project Book', McGraw Hill 2000
5.	William Hohl, 'ARM Assembly Language' Fundamentals and Techniques,2009.
6.	Rajkamal," Microcontrollers Architecture, Programming, Interfacing, & System Design, Pearson,2012
7.	ARM Architecture Reference Manual, LPC213x User Manual
8.	www.Nuvoton .com/websites on Advanced ARM Cortex Processors

WEB REFERENCES:

1.	https://piembsystech.com/arm-microcontroller/
2.	https://www.elprocus.com/introduction-to-pic-microcontrollers-and-its-architecture/

ONLINE COURSES:

1.	https://nptel.ac.in/courses/108102045
2.	https://archive.nptel.ac.in/courses/106/105/106105193/

VIDEO REFERENCES:

1.	https://www.youtube.com/watch?v=0xgvINDxXJI&list=PLbRMhDVUMngcJu5oUhgpgYqtOn7DmSfuU
2.	https://www.youtube.com/watch?v=y9RAhEfLfJs&list=PL419D0518A8E82285
3.	https://www.youtube.com/watch?v=3OmyM4-zuQw&t=1s

Mapping of COs with POs						
CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
1			2			
2	1		3	2		
3			1	3	1	
4	1			1	2	
5			2			
Avg	1		2	2	1.5	
1–Low, 2 –Medium, 3–High.						

ME23ET304	VLSI DESIGN AND RECONFIGURABLE ARCHITECTURE			Version : 1.0		
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To expose the students to the fundamentals of sequential system design, synchronous and Asynchronous circuits.
2	To understand the basic concepts of CMOS and to introduce the IC fabrication methods
3	To introduce the Reconfigurable Processor technologies, To provide an insight and architecture significance of SOC.
4	To introduce the basics of analog VLSI design and its importance.
5	To learn about the programming of Programmable device using Hardware description Language.

UNIT–I	INTRODUCTION TO ADVANCED DIGITAL SYSTEM DESIGN	9

Modeling of Clocked Synchronous Sequential Network (CSSN)(L2), Design of CSSN(L3), Design of Asynchronous Sequential Circuits (ASC)(L3), Designing Vending Machine Controller(L3), Races in ASC, Static and Dynamic Hazards, Essential Hazards, Designing Hazard free circuits(L3).

UNIT–II	CMOS BASICS & IC FABRICATION	9

Moore's Law-MOSFET Scaling(L2) - MOS Transistor Model-Determination of pull up / pull down ratios- CMOS based combinational logic & sequential design(L3)- Dynamic CMOS – Transmission Gates(L3)- BiCMOS- Low power VLSI – CMOS IC Fabrications(L2) - Stick Diagrams, Design Rules and Layout(L3).

UNIT– III	ASIC AND RECONFIGURABLE PROCESSOR AND SoC DESIGN	9

Introduction to ASIC(L2), ASIC design flow- programmable ASICs(L2)- Introduction to reconfigurable processor- Architecture(L2) -Reconfigurable Computing(L2), SoC Overview, recent trends in Reconfigurable Processor & SoC, Reconfigurable processor based DC motor control(L3).

UNIT – IV	ANALOG VLSI DESIGN	9

Introduction to analog VLSI(L2)- Design of CMOS 2stage(L3)-3 stage Op-Amp –High Speed and High frequency op-amps-Super MOS- Analog primitive cells(L3)- Introduction to FPAA(L2).

UNIT–V	DESIGN WITH PIC AND ARM MICROCONTROLLERS	9

Overview of digital design with VHDL, structural, data flow and behavioral modeling concepts(L2)- logic synthesis-simulation-Design examples, Ripple carry Adders, Carry Look ahead adders, Multiplier, ALU, Shift Registers, Test Bench(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: At the end of this course, the students will have the ability to		BLOOM'S Taxonomy
CO1	Incorporate synchronous and asynchronous switching logics, with clocked circuits design	L3 - Apply
CO2	Deliver insight into developing CMOS design techniques and IC fabrication methods.	L3 - Apply
CO3	Explain the need of reconfigurable computing, hardware-software co design and operation of SoC processor.	L3 - Apply

CO4	Design and development of reprogrammable analog devices and its usage for Embedded applications.	L3 - Apply
CO5	Illustrate and develop HDL computational processes with improved design strategies.	L3 - Apply

REFERENCE BOOKS:

1.	Donald G. Givone, "Digital principles and Design", Tata McGraw Hill 2002.
2.	Charles H. Roth Jr., "Fundamentals of Logic design", Thomson Learning, 2004.
3.	Nurmi, Jari (Ed.) "Processor Design System-On-Chip Computing for ASICs and FPGAs" Springer, 2007.
4.	Joao Cardoso, Michael Hübner, "Reconfigurable Computing: From FPGAs to Hardware/Software Codesign" Springer, 2011.
5.	Pierre-Emmanuel Gaillardon, Reconfigurable Logic: Architecture, Tools, and Applications, 1st Edition, CRC Press , 2015
6.	Mohamed Ismail ,TerriFiez, "Analog VLSI Signal and information Processing", McGraw Hill International Editions,1994.
7.	William J. Dally / Curtis Harting / Tor M. Aamodt," Digital Design Using VHDL:A Systems Approach, Cambridge University Press,2015.
8.	Zainalatsed in Navabi, 'VHDL Analysis and Modelling of Digital Systems', 2n Edition, Tata McGraw Hill, 1998.

WEB REFERENCES:

1.	https://archive.nptel.ac.in/courses/108/106/108106177/
2.	https://nptel.ac.in/courses/117101058

ONLINE COURSES:

1.	https://onlinecourses.nptel.ac.in/noc20_cs14/
2.	https://onlinecourses.nptel.ac.in/noc21_ee39/

VIDEO REFERENCES:

1.	https://www.youtube.com/watch?v=oL8SKNxEaHs&list=PLLy_2iUCG87Bdulp9brz9AcvW_TnFCUmM
2.	https://www.youtube.com/watch?v=BoIOLczVulQ&list=PLyqSpQzTE6M_dZdF7Bd-ncI5_L_1VkXF

Mapping of COs with POs						
CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
1				1		
2	2		2	2		
3			3	3	2	1
4	2		2	3	1	-
5		1	1	3	3	1
Avg	2	1	2	2.4	2	1
1–Low, 2 –Medium, 3–High.						

ME23ET305	EMBEDDED SYSTEMS- I LABORATORY	Version : 1.0				
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		4	0	0	4	2

Course Objectives:

1	To involve the students to Practice on Workbench /Software Tools/ Hardware Processor Boards with the supporting Peripherals.
2	To teach the concepts of algorithm development & programming on software tools and Digital processors with peripheral interfaces.
3	To encourage students to practice in open source software / packages /tools
4	To train though hands-on practices in commercial and licensed Hardware-software suites
5	Practicing through the subdivisions covered within experiments listed below to expose the students into the revising the concepts acquired from theory subjects.

List of Experiments / Exercises

1.	Programming in Embedded C / Higher Level Language
2.	Programming in 8 bit Microcontrollers
3.	I/O Programming in 8 bit Microcontrollers I/O & Serial Programming, Timers, Interrupts & Motor Control, ADC/DAC, LCD.
4.	Programming in 8 bit PIC Microcontrollers
5.	I/O Programming in AVR / PIC Microcontrollers Timers/ Interrupts/Serial port, programming/PWM Generation/Motor Control/ADC/DAC/ LCD/ RTC, Interfacing/ Sensor Interfacing
6.	Programming in Arduino Microcontrollers
7.	VHDL Programming in FPGA processors
8.	Verilog HDL Programming in FPGA processors
9.	Programming & Simulation in Simulators /Tools/others (Proteus / OrCAD)
10.	Programming & Simulation in simulators / Tools/others (LabVIEW / MatLAB)

Total : 60 PERIODS

Course Outcomes: At the end of this course, the students will have the ability to	**BLOOM'S Taxonomy**
CO1	Experiment insight into various embedded processors of CISC and RISC architecture / computational processors with peripheral interface.	L1 - Remember
CO2	Understand the fundamental concepts of how process can be controlled with uC.	L2 - Understand
CO3	Experimenting on programming logic of Processor based on software suites(simulators, emulators)	L2 - Understand
CO4	Incorporate I/O software interface of a processor with peripherals.	L3 - Apply
CO5	Design and development of reprogrammable analog devices and its usage for Embedded applications.	L3 - Apply

	REFERENCE BOOKS:
1.	Mohamammad Ali Mazidi&Mazidi ' 8051 Microcontroller and Embedded Systems', Pearson Education
2.	Mohammad Ali Mazidi, Rolind Mckinley and Danny Causey, 'PIC Microcontroller and Embedded Systems' Pearson Education
3.	Simon Monk," Make Action-with Arduino and Raspberry Pi,SPD ,2016.
4.	Wesley J.Chun,"Core Python Applications Programming,3rd ed,Pearson,2016
5.	Kraig Mitzner, 'Complete PCB Design using ORCAD Capture and Layout', Elsevier
6.	Vinay K.Ingle,John G.Proakis,"DSP-A Matlab Based Approach", Cengage Learning,2010.
7.	Taan S.Elali,"Discrete Systems and Digital Signal Processing with Matlab",CRC Press2009.
8.	JovithaJerome," Virtual Instrumentation using Labview" PHI,2010.
9.	Woon-Seng Gan, Sen M. Kuo, 'Embedded Signal Processing with the Micro Signal Architecture', John Wiley & Sons, Inc., Hoboken, New Jersey 2007
10.	Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008

Mapping of COs with POs						
CO	**PO**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	2	1	2	1		
2			1	1	2	1
3	2	3	1	2	3	
4	2		2	1	2	
5			1	1	3	2
Avg	**2**	**2**	**1.4**	**1.2**	**2.5**	**1.5**
1–Low, 2 –Medium, 3–High.						

ME23PT801	TECHNICAL SEMINAR / CASE STUDY PRESENTATION		Version : 1.0		
	(COMMON TO ALL BRANCHES)				
Programme & Branch	**M.E. EMBEDDED SYSTEM TECHNOLOGIES**	**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 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						
CO	**PO**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1		3				
2		3				
Avg		**3**				
1–Low, 2 –Medium, 3–High.						

ME23ET306	REAL TIME OPERATING SYSTEM		Version : 1.0		
Programme & Branch	**M.E. EMBEDDED SYSTEM TECHNOLOGIES**	**CP**	**L**	**T**	**P**	**C**
		3	**3**	**0**	**0**	**3**

Course Objectives:

1	To expose the students to the fundamentals of interaction of OS with a computer and User computation.
2	To teach the fundamental concepts of how process are created and controlled with OS.
3	To study on programming logic of modeling Process based on range of OS features
4	To compare types and Functionalities in commercial OS, application development using RTOS
5	To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

UNIT−I	**REVIEW OF OPERATING SYSTEMS**	**9**

Basic Principles (L1)- Operating System structures (L2)– System Calls(L2) – Files(L2) – Processes(L2) – Design and Implementation of processes – Communication between processes (L2)– Introduction to Distributed operating system – Embedded operating systems(L2)

UNIT−II	**OVERVIEW OF RTOS**	**9**

RTOS Task and Task state(L2) –Multithreaded Preemptive scheduler(L2)- Process Synchronization- Message queues(L2)– Mail boxes(L2) -pipes(L2) – Critical section(L2) – Semaphores(L2) – Classical synchronization problem(L2) – Deadlocks(L2).

UNIT− III	**REALTIME MODELS AND LANGUAGES**	**9**

Event Based – Process Based and Graph based Models(L2) – Real Time Languages(L2)– RTOS Tasks – RT scheduling(L2) - Interrupt processing(L2) – Synchronization (L2)– Control Blocks(L2) – Memory Requirements(L2).

UNIT – IV	**REALTIME KERNEL**	**9**

Principles (L2)– Design issues(L2) – Polled Loop Systems(L2) – RTOS Porting to a Target (L2)– Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive(L2).

UNIT−V	**APPLICATION DEVELOPMENT**	**9**

Discussions on Basics of Linux supportive RTOS(L2) – Ucos(L2)-C Executive for development of RTOS Application(L3) – Case study(L3)

	Total: 45 PERIODS

Course Outcomes: At the end of this course, the students will have the ability to	**BLOOM'S Taxonomy**
CO1	Outline Operating System structures and types.	L2 – Understand
CO2	Insight into scheduling, disciplining of various processes execution.	L2 – Understand
CO3	Illustrate knowledge on various RTOS support modelling	L2 – Understand
CO4	Demonstrate commercial RTOS Suite features to work on real time processes design.	L2 – Understand
CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in RTOS and embedded automation design.	L3 - Apply

REFERENCE BOOKS:

1.	Silberschatz,Galvin,Gagne" Operating System Concepts,6th ed,John Wiley,2003
2.	Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill,1997
3.	Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill,2006.
4.	Karim Yaghmour,Building Embedded Linux System",O'reilly Pub,2003
5.	MukeshSighal and N G Shi "Advanced Concepts in Operating System", McGraw Hill,2000

WEB REFERENCES:

https://nptel.ac.in/courses/106108101

https://docplayer.net/21051759-Real-time-operating-systems-lesson-10.html

ONLINE COURSES:

https://archive.nptel.ac.in/courses/106/105/106105172/

https://onlinecourses.nptel.ac.in/noc21_cs98/

VIDEO REFERENCES:

https://www.youtube.com/watch?v=a5n8TMNbyrg

https://www.youtube.com/watch?v=dHsHP9RrXBw&t=518s

https://www.youtube.com/watch?v=qfiSgisz6Ug

Mapping of COs with POs						
COs	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
1	2		1		2	
2			2		3	1
3	2		2	1	2	2
4	2	2	3	2	1	3
5			1		3	1
Avg.	**2**	**2**	**1.8**	**1.5**	**2.2**	**1.75**
1–Low, 2 –Medium, 3–High.						

ME23ET307	EMBEDDED SYSTEM NETWORKING			Version : 1.0		
Programme & Branch	**M.E. EMBEDDED SYSTEM TECHNOLOGIES**	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To expose the students to the fundamentals of wired embedded networking techniques.
2	To introduce the concepts of embedded ethernet.
3	To expose the students to the fundamentals of wireless embedded networking.
4	To discuss the fundamental building blocks of digital instrumentation.
5	To introduce design of Programmable measurement & control of electrical Device.

UNIT–I	EMBEDDED PROCESS COMMUNICATION WITH INSTRUMENT BUS	9

Embedded networking: Introduction(L1) – Cluster of instruments in System(L2): Introduction to bus protocols (L2)– comparison of bus protocols – RS 232C, RS 422, RS 485 and USB standards (L2)– embedded ethernet (L2)– MOD bus, LIN bus and CAN bus(L2).

UNIT–II	EMBEDDED ETHERNET	9

Elements of a network(L2) – Inside Ethernet – Building a Network : Hardware options – Cables, Connections and network speed – Ethernet controllers(L2) – Inside the internet protocol – Exchanging messages using UDP and TCP(L2) – Email for Embedded systems using FTP (L2)– Keeping devices and network secure(L2)

UNIT– III	WIRELESS EMBEDDED NETWORKING	9

Wireless sensor networks – Introduction (L2)– Node architecture (L2)– Network topology(L2) - Localization (L2)– Time synchronization (L2)– Energy efficient MAC protocols(L2) – SMAC (L2)– Energy efficient and robust routing(L2) – Data centric routing(L2) - WSN Applications- Home Control - Building Automation - Industrial Automation(L3)

UNIT – IV	BUILDING SYSTEM AUTOMATION	9

Sensor Types & Characteristics: Sensing Voltage, Current, flux, Torque, Position, Proximity, Accelerometer(L2) - Data acquisition system(L2)- Signal conditioning circuit design(L2)- Uc Based & PC based data acquisition (L2)– UC for automation and protection of electrical appliances (L3)–processor based digital controllers for switching Actuators: Stepper motors, Relays (L3)–System automation with multi-channel Instrumentation and interface(L3)

UNIT–V	COMMUNICATION FOR LARGE ELECTRICAL SYSTEM AUTOMATION	9

Data Acquisition, Monitoring, Communication, Event Processing, and Polling Principles(L2), SCADA system principles(L2) – outage management(L2)– Decision support application(L2) - substation automation(L2), extended control feeder automation(L2), Performance measure and response time, SCADA Data Models, need, sources, interface(L2)

	Total : 45 PERIODS

Course Outcomes: At the end of this course, the students will have the ability to		BLOOM'S Taxonomy
CO1	Analyze the different bus communication protocols used for embedded networking	L2 - Understand
CO2	Explain the basic concepts of embedded networking	L2 - Understand
CO3	Apply the embedded networking concepts in wireless networks	L3 - Apply
CO4	Relate different data acquisition concepts	L3 - Apply
CO5	Build a system automation for different applications	L2 - Understand

REFERENCE BOOKS:	
1.	Mohammad Ilyas And ImadMahgoub, 'Handbook of sensor Networks: Compact wireless and wired sensing systems', CRC Press,2005
2.	Peter W Gofton , "Understanding Serial Communication", Sybes International, 2000
3.	Jan Axelson 'Embedded Ethernet and Internet Complete', Penram publications
4.	Krzysztof Iniewski,"Smart Grid ,Infrastructure& Networking",TMcGH,2012
5.	Control and automation of electrical power distribution systems, James Northcote-Green, Robert Wilson, CRC, Taylor and Francis, 2006

WEB REFERENCES:
https://archive.nptel.ac.in/courses/106/105/106105217/
https://archive.nptel.ac.in/courses/106/105/106105160/

ONLINE COURSES:
https://archive.nptel.ac.in/courses/106/105/106105217/
https://archive.nptel.ac.in/courses/106/105/106105081/

VIDEO REFERENCES:
https://www.youtube.com/watch?v=0RFYDNG6IU4
https://www.youtube.com/waStch?v=KCcdF4IVrQk&t=4s
https://www.youtube.com/watch?v=ycaz99NogS4&list=PLJ5C_6qdAvBHroAfekCO7K4xphEF74UPc

Mapping of COs with POs						
COs	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
1	1	2			3	1
2		2			2	1
3	3	2	2	3	2	3
4	2		3	3		2
5	3		3	3		2
Avg.	**2.25**	**2**	**2.7**	**3**	**2.3**	**1.8**
1–Low, 2 –Medium, 3–High.						

ME23ET308	EMBEDDED CONTROL FOR ELECTRIC DRIVES	Version : 1.0				
Programme & Branch	**M.E. EMBEDDED SYSTEM TECHNOLOGIES**	**CP**	**L**	**T**	**P**	**C**
		3	**3**	**0**	**0**	**3**

Course Objectives:

1	To provide the control concept for electrical drives
2	To emphasis the need for embedded system for controlling the electrical drives
3	To provide knowledge about various embedded system based control strategy for electrical drives
4	To Impart the knowledge of BLDC Motor Control
5	To familiarize the high performance computing for electrical drives.

UNIT–I	**INTRODUCTION ELECTRICAL DRIVES**	**9**

Electric drive and its classifications(L2), Four-quadrant drive, Dependence of load torque on various factors(L2), Dynamics of motor-load combination-Solid State Controlled Drives(L3)-Machine learning and optimization techniques for electrical drives(L3)- IoT for Electrical drives applications(L3).

UNIT–II	**OVERVIEW OF EMBEDDED PROCESSOR**	**9**

Embedded Processor architecture(L2)-RTOS(L2) – Hardware/software co-design(L2)-Programming with SoC processors(L3).

UNIT– III	**INDUCTION MOTOR CONTROL**	**9**

Types(L2)- Speed control methods(L2)-PWM techniques(L2)- VSI fed three-phase induction motor- Fuzzy logic Based speed control for three phase induction motor-FPGA based three phase induction motor control(L3)

UNIT – IV	**BLDC MOTOR CONTROL**	**9**

Overview of BLDC Motor(L2) -Speed control methods (L2)-PWM techniques(L2)- ARM processor based BDLC motor control(L2)- ANN for BLDC Motor control and operation(L3).

UNIT–V	**SRM MOTOR CONTROL**	**9**

Overview of SRM Motor(L2) -Speed control methods(L2) -PWM techniques(L2)- FPGA based SRM motor control(L2)- DNN for SRM Motor control and operation(L3)

	Total : 45 PERIODS

Course Outcomes: At the end of this course, the students will have the ability to	**BLOOM'S Taxonomy**
CO1	Interpret the significance of embedded control of electrical drives	L3 – Apply
CO2	Deliver insight into various control strategy for electrical drives.	L3 – Apply
CO3	Developing knowledge on Machine learning and optimization techniques for motor control.	L3 – Apply
CO4	Develop embedded system solution for real time application such as Electric vehicles and UAVs.	L3 – Apply
CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded system skills required for motor control strategy.	L3 – Apply

REFERENCE BOOKS:

1.	Krishnan, "Electric Motor Drives – Modeling, Analysis and Control",Prentice-Hall of India Pvt. Ltd., New Delhi,2010.
2.	VedamSubramanyam, "Electric Drives – Concepts and Applications", Tata McGraw- Hill

3.	K. Venkataratnam ,Special Electrical Machines, Universities Press, 2014.
4.	Steve Furber, 'ARM system on chip architecture', Addision Wesley,2010.
5.	Ron Sass and AnderewG.Schmidt, " Embedded System design with platform FPGAs: Principles and Practices", Elsevier, 2010.
6.	Steve Kilts, "Advanced FPGA Design: Architecture, Implementation, and Optimization" Willey, 2007

(top partial row: publishing company Ltd., New Delhi, 2002)

WEB REFERENCES:

https://www.slideshare.net/udaywankar/arm-processor-based-speed-control-of-bldc-motor

ONLINE COURSES:

https://nptel.ac.in/courses/108104011

https://onlinecourses.nptel.ac.in/noc22_ee94/

VIDEO REFERENCES:

https://www.youtube.com/watch?v=31hUDWjzLjY

https://www.youtube.com/watch?v=Gkp753foAgE

Mapping of COs with POs						
CO	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
1	1	-	2	-	2	-
2	1	1	3	-	-	2
3	2	-	-	-	3	-
4	1	2	3	1	-	-
5	-	-	-	-	3	-
Avg.	**1.66**	**1.5**	**2.7**	**1**	**2.7**	**2**
1–Low, 2 –Medium, 3–High.						

ME23MC701	UNIVERSAL HUMAN VALUES AND ETHICS	Version: 1.0

	(COMMON to ALL BRANCHES)					

Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	2	1	0	3

Course Objectives:

1.	To understand the concept of Universal Human Values.
2.	To discuss theoretical and practical implications of UHV.
3.	To relate the use of harmony in the family and society.
4.	To classify the harmony in the nature methods.
5.	To construct 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.	Interpret the concepts of Universal Human Values.	L2 - Understand
2.	Summarize both theoretical and practical implications of Universal Human Values.	L2 - Understand
3.	Build the harmony in family and society.	L3 - Apply
4.	Practice harmony in all human existence.	L3 - Apply
5.	Relate human values in both personal and professional life.	L2- Understand

TEXTBOOKS:

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.

REFERENCE BOOKS:

1.	R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi, 2010.
2.	B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted 2008.
3.	Frankl, Viktor E. Yes to Life In spite of Everything, Penguin Random House, London, 2019.
4.	Van Zomeren, M., & Dovidio, J. F. The Oxford Handbook of the Human Essence (Eds.), New York Oxford University Press, 2018.
5.	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.	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						
COs	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1						2
CO2						
CO3						3
CO4						
CO5						3
Avg.						**2.6**
1–Low, 2 –Medium, 3–High.						

ME23ET309	EMBEDDED SYSTEMS- II LABORATORY		Version : 1.0		
Programme & Branch	**M.E. EMBEDDED SYSTEM TECHNOLOGIES**	**CP**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**	**2**

Course Objectives:

1	To involve the students to Practice on Workbench /Software Tools/ Hardware Processor Boards with the supporting Peripherals.
2	To teach the concepts of algorithm development & programming on software tools and Digital processors with peripheral interfaces.
3	To encourage students to practice in open source softwares / packages /tools
4	To train though hands-on practices in commercial and licensed Hardware-software suites
5	Practicing through the subdivisions covered within experiments listed below to expose the students into the revising the concepts acquired from theory subjects.

List of Experiments / Exercises

1.	Programming ARM processor : ARM7 / ARM9/ARM Cortex
2.	Programming with Rasberry Pi Microcontroller Board
3.	I/O Programming with Arduino Microcontroller
4.	Programming with DSP Processor Boards with Board
5.	Designing of Filters in DSP Processor Boards.
6.	Programming in Open source software's/ Platforms
7.	Study of one type of Real Time Operating Systems (RTOS)
8.	Programming & Simulation in Python Simulators/Tools/others
9.	Linux programming Tool chain
10.	Programming & Simulation in GUI Simulators/Tools/others

	Total : 60 PERIODS

Course Outcomes: At the end of this course, the students will have the ability to	**BLOOM'S Taxonomy**
CO1	Experiment and demonstrate with simulators, in programming processor boards, processor interfacing/ designing digital controllers.	L3 - Apply
CO2	Design & simulate Arithmetic, Logic programs, Filters, Signal analysis with simulators/experiments, in programming processor boards, processor interfacing/ Tools.	L3 - Apply
CO3	Develop real time solution for embedded applications.	L3 - Apply
CO4	Program and compile in various tools & software domains.	L3 - Apply

CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in commercial embedded processors and its programmable interfacing.	L3 - Apply

REFERENCE BOOKS:	
1.	"The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors" by Joseph Yiu, Third Edition, Newnes, 2014.
2.	"Raspberry Pi Cookbook: Software and Hardware Problems and Solutions" by Simon Monk, O'Reilly Media, 2016.
3.	"Arduino Cookbook" by Michael Margolis, Second Edition, O'Reilly Media, 2011.
4.	"Digital Signal Processing: Principles, Algorithms, and Applications" by Proakis and Manolakis, Fourth Edition, Pearson, 2006.
5.	"Design of Digital Filters" by Charles S. Williams, PHI Learning, 2014.
6.	"Python Programming: An Introduction to Computer Science" by John Zelle, Franklin, Beedle & Associates Inc., 2004.
7.	"Mastering Embedded Linux Programming" by Chris Simmonds, Second Edition, Packt Publishing, 2018.
8.	"Programming Embedded Systems: With C and GNU Development Tools" by Michael Barr, O'Reilly Media, 2006.
9.	"Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux" by Derek Molloy, Wiley, 2016.
10.	"Real-Time Operating Systems: Book 1 - The Theory" by Jim Cooling, Newnes, 2006.

Mapping of COs with POs						
COs	**PO**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
1	1	3	1	1	2	1
2		1	2			
3	1		3	2	3	
4	2	2	3	3	3	3
5	3	2	3	3	3	3
Avg	1.75	2	2.4	2.25	2.75	1.75
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:

Assigning the faculty supervisor
Selecting a subject, narrowing the subject into a topic
Stating an objective.
Collecting the relevant bibliography (atleast 20 research papers)
Studying the papers understanding the authors contributions and critically analysing each paper.
Preparing a 20-25 page literature review report
Preparing conclusions based on the literature review report.
Writing the Final Review Paper
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

ME23ET401	WIRELESS AND MOBILE COMMUNICATION		Version: 1.0			
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To study the Channel planning for Wireless Systems
2	To study Mobile Radio Propagation and Equalization and Diversity
3	To study the Equalization and Diversity
4	To study the Wireless multiple access and IP.
5	To provide insight into wideband code division-based access.

UNIT–I	THE CELLULAR CONCEPT	9

System Design Fundamentals: Introduction(L2), Frequency Reuse(L2), Channel Assignment Strategies(L2), Handoff Strategies(L2)-Prioritizing Handoffs(L2), Practical Handoff Considerations(L3), Interference, and system capacity –Co-channel Interference and system capacity(L3), Channel planning for Wireless Systems(L2), Adjacent Channel interference(L3), Power Control for Reducing interference(L3), Trunking and Grade of Service(L3), Improving Coverage & Capacity in Cellular Systems(L3)-Cell Splitting, Sectoring(L3).

UNIT–II	MOBILE RADIO PROPAGATION: LARGE-SCALE PATH LOSS:	9

Introduction to Radio Wave Propagation(L1), Free Space Propagation Model(L2), Relating Power to Electric Field(L2), Diffraction-Fresnel Zone Geometry(L3), Knife edge Diffraction Model(L2), Multiple knife-edge Diffraction(L2), Scattering(L2), Outdoor Propagation Models-Longley-Ryce Model, Okumura Model, Hata Model(L3), Indoor Propagation Models-Partition losses, Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model(L3), Signal penetration into buildings, Ray Tracing and Site Specific Modelling(L3)

UNIT– III	MOBILE RADIO PROPAGATION	9

Small –Scale Fading and Multipath(L2): Small Scale Multipath propagation-Factors influencing small-scale fading, Doppler shift, Impulse Response Model of a multipath channel(L2)-Relationship between Bandwidth and Received power(L3), Small-Scale Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels(L2)-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading(L3)-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading(L2), Fundamentals of Equalization(L2), Training A Generic Adaptive Equalizer(L3), Equalizers in a communication Receiver(L3), Linear Equalizers, Nonlinear Equalization(L3)

UNIT – IV	WIDEBAND CODE DIVISION MULTIPLE ACCESS	9

CDMA system overview(L1) -air interface (L2)–physical and logical channel–speech coding, multiplexing and channel coding (L2)–spreading and modulation(L2): frame structure, spreading codes-uplink-downlink(L2) – 33 physical layer procedures: cell search and synchronization-establishing a connection-power control handover-overload control(L3).

UNIT–V	IP MOBILITY FRAMEWORK	9

Challenges of IP Mobility -Address Management(L1) -Dynamic Host Configuration Protocol and Domain Name Server Interfaces(L2) –Security(L2) –Mobility-Based AAA Protocol(L2) -IP Mobility Architecture Framework(L2) -x Access Network -IPv6 Challenges for IP Mobility(L3).

	Total: 45 PERIODS

Course Outcomes: Upon completion of this course, the students will be able to:	BLOOM'S Taxonomy

CO1	Understand Cellular communication concepts	L3 - Apply
CO2	Explain the mobile radio propagation	L3 - Apply
CO3	Perceive the wireless network's different types of MAC protocols	L3 - Apply
CO4	Analyze the Equalization and Diversity	L3 - Apply
CO5	Build the Wireless multiple access and IP	L3 - Apply

REFERENCE BOOKS:

1.	Wireless Communications, Principles, Practice –Theodore, S. Rappaport, 2nd Ed., 2002, PHI.
2.	Wireless Communications Andrea Goldsmith, 2005 Cambridge University Press.
3.	Principles of Wireless Networks –KavehPahLaven and P. Krishna Murthy, 2002, PE
4.	Mobile Cellular Communication –GottapuSasibhushana Rao, Pearson Education, 2012
5.	Wireless Digital Communications –KamiloFeher, 1999, PHI
6.	Wireless Communication and Networking –William Stallings, 2003, PHI

WEB REFERENCES:

https://archive.nptel.ac.in/courses/108/106/106106167/

https://archive.nptel.ac.in/courses/117/102/117102062/

ONLINE COURSES:

https://onlinecourses.nptel.ac.in/noc23_ee79

https://nptel.ac.in/courses/117104115

VIDEO REFERENCES:

https://www.youtube.com/watch?v=1Ag6ZGnFIFo&t=3s

https://www.youtube.com/watch?v=CUyF0YGIA5Y

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

ME23ET402		VIRTUAL INSTRUMENTATION	Version: 1.0				
Programme & Branch		M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
			3	3	0	0	3

Course Objectives:

1	Understanding the difference between conventional and graphical programming.
2	Introducing the basics of Lab VIEW and programming concepts.
3	Differentiating the real-time and virtual instrument
4	Represent and review signals acquire process in the digital domain.
5	Analyzing the basics of data acquisition and learning the concepts of data acquisition with Lab VIEW.

UNIT–I	FUNDAMENTALS OF VIRTUAL INSTRUMENTATION	9

Fundamental Concepts of Virtual Instrumentation (VI) and Graphical Programming(L2) - Virtual instruments and Traditional instruments(L2), Hardware and Software in virtual instrumentation(L2), Data Flow Programming (L2)- Data Types (L2)– Customization of VI Properties (L3)- VI Documentation(L1)

UNIT–II	PROGRAMMING STRUCTURES	9

Software Environment (L2)- Modular programming (L2)- Formula Nodes (L2)- Loops (L2)- Shift Registers (L2)- Local and Global Variables(L2) – Case and Sequence Structures(L2) - Arrays and Clusters (L2)- Graphs and Charts (L2)- State Machines (L3)- String and File I/O(L2).

UNIT– III	DATA ACQUISITION AND INTERFACING STANDARDS	9

PC-based data acquisition (L2)– DAQ hardware and software architecture(L2) – DAQ hardware configuration, sampling methods and grounding techniques, analog I/O, digital I/O, counter/timer(L2) - Communication(L2): Interfacing of external instruments to a PC - RS232 - RS485(L2) - GPIB (L2)– System Interface Buses: USBPCI, PXI(L2); Introduction to bus protocols of MOD bus and CAN bus (L2)- Industrial Ethernet(L2).

UNIT – IV	ADVANCED PROGRAMMING	9

Introduction(L1), Definition of State Machine(L1), A Simple State Machine, Event Structures(L2). File Input / Output: Introduction(L1), File Formats, File I/O Functions(L2), Path Functions(L2), Sample VIs to Demonstrate File WRITE and READ Function String Handling: Introduction(L1), String Functions(L2), Lab VIEW String Formats(L2), Typical examples Use of analysis tools and application of VI: Fourier transforms, Power spectrum, Simulation of systems using VI: Development of Control system, Image acquisition and processing(L3)

UNIT–V	CASE STUDIES	9

Temperature Monitoring System using PC-based Data Acquisition System - Machine vision, Motion control(L3), Configuration of Real-Time I/O Hardware in MAX (L3)- Host & Target VI (L3)– Prioritization of Tasks– Timed Programming Structures in Lab VIEW (L3)– Real-Time Application Deployment using my RIO (L3)– Run-time Interaction with Deployed Applications (L3)– Running Web Services in my RIO(L2).

	Total: 45 PERIODS

Course Outcomes: Upon completion of this course, the students will be able to:	BLOOM'S Taxonomy
CO1	Infer and Interpret the fundamentals of Virtual Instrumentation and Data Acquisition	L3 - Apply
CO2	Explain the difference between traditional and virtual instrumentation	L3 - Apply

CO3	Illustrate the theoretical concepts to realize practical systems.	L2 - Understand
CO4	Analyze and evaluate the performance of Virtual Instrumentation System	L3 - Apply
CO5	Build a VI system to solve real-time problems using data acquisition.	L3 - Apply

REFERENCE BOOKS:

1.	Jovitha Jerome, —Virtual Instrumentation using Lab VIEWǁ, PHI Learning Pvt. Ltd., 2010.
2.	Sanjay Gupta and Joseph John, "Virtual Instrumentation Using Lab VIEW", Tata McGraw Hill, 2008
3.	Gary Johnson and Richard Jennings, —Lab VIEW Graphical Programmingǁ, McGraw Hill Inc., Fourth Edition, 2006
4.	Rick Bitter, Taqi Mohiuddin, and Matt Nawrocki, "Lab VIEW Advanced Programming 35 Techniques", CRC Press, 2009
5.	Lisa. K. Wills, "Lab VIEW for Everyone", Prentice Hall of India, 2nd Edition, 2008
6.	William Buchanan, —Computer Buses Design and Applicationǁ, CRC Press, 2000

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https://learn.ni.com/learn/article/labview-tutorial

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https://www.ni.com/en/shop/services/education-services/customer-education-courses/labview-core-1-course-overview.html

VIDEO REFERENCES:

https://www.youtube.com/watch?v=7SAyVrgyCl4

https://www.youtube.com/watch?v=DmgGgDzLgI0

Mapping of COs with POs						
COs	PO					
	1	2	3	4	5	6
CO1		2	1	2		
CO2			2			
CO3	1	3	3	3	1	1
CO4	2	2	3	3	2	2
CO5	3	3	3	3	3	3
AVG	2	2.5	2.4	2.75	2	2
1–Low, 2 –Medium, 3–High.						

ME23ET403	EMBEDDED PROCESSOR DEVELOPMENT			Version: 1.0		
Programme &Branch	**M.E. EMBEDDED SYSTEM TECHNOLOGIES**	**CP**	**L**	**T**	**P**	**C**
		3	**3**	**0**	**0**	**3**

Course Objectives:

1	To learn about basic concepts of embedded systems.
2	To learn about ARM architecture
3	To learn C language and assembly programming.
4	To learn Object orientation for programming and C++
5	To learn software modeling fundamentals.

UNIT–I	EMBEDDED CONCEPTS	9

Introduction to embedded systems(L1), Application Areas(L2), Categories of embedded systems(L2), Overview of embedded system architecture(L2), Specialties of embedded systems(L2), recent trends in embedded systems(L2), Architecture of embedded systems(L2), Hardware architecture(L2), Software architecture(L2), Application Software(L2), Communication Software(L2), Development and Debugging Tools(L2)

UNIT–II	ARM ARCHITECTURE AND OVERVIEW OF CORTEX	9

Background of ARM Architecture(L2), Architecture Versions(L2), Processor Naming(L2), Instruction Set Development(L2), Thumb-2, and Instruction Set Architecture. Overview of Cortex-M3 (L2), Cortex-M3 Basics: Registers, General Purpose Registers, Stack Pointer, Lk Register, Program Counter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector. Tables, Stack Memory Operations, Reset Sequence. Instruction Sets: Assembly Basics, Instruction List, Instruction Descriptions(L2). Cortex-M3 Implementation Overview: Pipeline, Block Diagram, Bus Interfaces on Cortex-M3, I-Code Bus, D-Code Bus, System Bus, External PPB and DAP Bus(L2)

UNIT– III	CORTEX-M3/M4 PROGRAMMING	9

Overview(L1), Typical Development Flow, Using C, CMSIS (Cortex Microcontroller Software Interface Standard) (L3), Using Assembly Exception Programming: Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation(L2). Memory Protection Unit and other Cortex-M3 features: MPU Registers, Setting Up the MPU, Power Management, Multiprocessor Communication(L2).

UNIT – IV	UNIFIED MODELING LANGUAGE	9

Connecting the object model with the use case model (L2)– Key strategies for object identification (L2)– UML basics(L2). Object state behavior (L2)– UML state charts (L2)– Role of scenarios in the definition of behavior – Timing diagrams (L3)– Sequence diagrams(L3) – Event hierarchies (L2)– types and strategies of operations(L2) – Architectural design in UML concurrency design – threads in UML(L2).

UNIT–V	EMBEDDED SOFTWARE DEVELOPMENT TOOLS AND RTOS	9

The compilation process (L2)– libraries (L2)– porting kernels(L2) – C extensions for embedded systems(L2)(L2) – emulation and debugging techniques(L2) – RTOS(L2) - system design using RTOS(L3).

	Total: 45 PERIODS

Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Demonstrate basic concepts of embedded system	L2 - Understand

CO2	Build ARM architecture	L2 - Understand
CO3	Understand C language and assembly programming	L3 - Apply
CO4	Build and compile Object orientation for programming and C++.	L3 - Apply
CO5	Create software modeling	L3 - Apply

REFERENCE BOOKS:

1.	The Definitive Guide to the ARM Cortex-M3, Joseph Yiu, Second Edition, Elsevier Inc. 2010.
2.	Embedded/Real-Time Systems Concepts, Design and Programming Black Book, Prasad, KVK
3.	David Seal "ARM Architecture Reference Manual", 2001 Addison Wesley, England; Morgan Kaufmann Publishers
4.	Andrew N Sloss, Dominic Symes, C0hris Wright, "ARM System Developer's Guide -Designing and Optimizing System Software", 2006, Elsevier
5.	Steve Furber, "ARM System-on-Chip Architecture", 2nd edition, Pearson Education.
6.	Cortex-M series-ARM Reference Manual
7.	Cortex-M3 Technical Reference Manual (TRM). 8. STM32L152xx ARM Cortex M3 Microcontroller Reference Manual
8.	ARM Company Ltd. "ARM Architecture Reference Manual–RM DDI 0100E".
9.	David E. Simon, "An Embedded Software Primer", Pearson Education, 2003.
10.	Arnold. S. Berger, "Embedded Systems Design -An introduction to Processes, Tools and Techniques", Easwer Press.
11.	ARM v7-M Architecture Reference Manual (ARM v7-M ARM)
12.	Ajay Deshmukh, "Microcontroller -Theory & Applications", Tata McGraw Hill.

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https://www.arm.com/architecture

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https://onlinecourses.nptel.ac.in/noc19_cs48/

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https://www.youtube.com/watch?v=t5SuR0rbAxA&list=PLrgz73xxhUkPBK2de3CuRb7F3zKh_sqUp

Mapping of COs with POs						
COs	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2	3	1	1		3
CO2	3		3	3	2	
CO3			2	2	3	
CO4			3		3	
CO5	2		3	2	3	
AVG	2.33	3	2.4	2	2.75	3
1–Low, 2 –Medium, 3–High.						

ME23ET404	AUTOMOTIVE EMBEDDED SYSTEM	Version: 1.0				
Programme &Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To expose the students to the fundamentals and building of Electronic Engine Control systems.
2	To teach functional components and circuits for vehicles.
3	To discuss programmable controllers for vehicle management systems
4	To teach logic of automation & and commercial techniques for vehicle communication.
5	To introduce the embedded systems concepts for E-vehicle system development.

UNIT–I	BASIC ELECTRONIC ENGINE CONTROL SYSTEMS	9

Overview of Automotive systems(L2), fuel economy(L2), air-fuel ratio(L2), emission limits(L2), and vehicle performance(L2); Automotive microcontrollers(L2)- Electronic control Unit(L2)- Hardware & software selection and requirements for Automotive applications(L2) – open source ECU- RTOS - Concept for Engine management(L3); Introduction to AUTOSAR and Introduction to Society SAE(L2)- Functional safety ISO 26262(L2)- Simulation and modeling of automotive system components(L3).

UNIT–II	SENSORS AND ACTUATORS FOR AUTOMOTIVES	9

Review of sensors(L2)- sensors interface to the ECU, conventional sensors and actuators, Modern sensors and actuators (L2)- LIDAR sensor(L2)- smart sensors- MEMS/NEMS sensors and actuators for automotive applications(L3).

UNIT– III	VEHICLE MANAGEMENT SYSTEMS	9

Electronic Engine Control-engine mapping, air/fuel ratio spark timing control strategy, fuel control, electronic ignition(L2)- Adaptive cruise control (L2)- speed control(L2)-anti-locking braking system(L2)-electronic suspension - electronic steering(L2), Automatic wiper control(L2)- body control system; Vehicle system schematic for interfacing with EMS, ECU(L2). Energy Management system for electric vehicles(L2)- Battery management system(L2), power management system(L2)-electrically assisted power steering system adaptive lighting system(L2)- Safety and Collision Avoidance(L2).

UNIT – IV	ONBOARD DIAGNOSTICS AND TELEMATICS	9

Onboard diagnosis of vehicles(L2) -System diagnostic standards and regulation requirements Vehicle communication protocols Bluetooth(L2), CAN(L2), LIN(L2), FlexRay(L2), MOST(L2), KWP2000 (L2) and recent trends in vehicle communications- Navigation(L2)- Connected Cars technology(L2) – Tracking- Security for data communication(L2)- dashboard display and Virtual Instrumentation, multimedia electronics(L2)- Role of IOT in Automotive systems(L3)

UNIT–V	ELECTRIC VEHICLES	9

Electric vehicles (L2)–Components(L2)- Plug-in Electrical Vehicle(L2)- Charging station(L2) – Aggregator(L2) - Autonomous vehicles(L2)

	Total: 45 PERIODS

Course Outcomes: Upon completion of this course, the students will be able to:		BLOOM'S Taxonomy
CO1	Insight into the significance of the role of embedded systems for automotive applications.	L3 - Apply
CO2	Illustrate the need, selection of sensors and actuators, and interfacing with ECU	L3 - Apply

CO3	Develop the Embedded concepts for vehicle management and control systems	L2 - Understand
CO4	Demonstrate the need for Electrical vehicles and able to apply the embedded system technology for various aspects of EVs	L3 - Apply
CO5	Improved Employability and entrepreneurship capacity due to knowledge gradation on recent trends in embedded systems design and its application in automotive systems.	L2 - Understand

REFERENCE BOOKS:

1.	William B. Ribbens," Understanding Automotive Electronics", Elsevier,2012
2.	Ali Emedi, Mehrdedehsani, John M Miller, "Vehicular Electric power system- land, Sea, Air and Space Vehicles" Marcel Decker, 2004.
3.	L.Vlacic, M.Parent, F.Harahima," Intelligent VehiclTechnologies", SAE International,2001
4.	Jack Erjavec, JeffArias," Alternate Fuel Technology-Electric, Hybrid& Fuel Cell Vehicles", Cengage,2012
5.	Electronic Engine Control technology – Ronald K Jurgen Chilton's guide to Fuel Injection – Ford
6.	Automotive Electricals / Electronics System and Components, Tom Denton, 3rd Edition, 2004

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Mapping of COs with POs						
COs	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1		2	1	1		2
CO2	2	3	2	2	2	3
CO3	3	3	3	3	3	2
CO4	3	3	3	3	3	2
CO5	3	3	3	3	3	2
AVG	2.75	2.8	2.4	2.4	2.75	2.2
1–Low, 2 –Medium, 3–High.						

ME23ET405	INTELLIGENT CONTROL AND AUTOMATION			Version: 1.0		
Programme &Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To Impart knowledge of various optimization techniques and hybrid schemes.
2	To introduce the concept, Analysis, and implementation of ANN and Fuzzy logic controllers
3	To Emphasize the need for Genetic algorithms and their role in automation.
4	To provide the basics of automation and its requirements
5	To demonstrate the role of Intelligent controllers in automation applications.

UNIT–I	ARTIFICIAL NEURAL NETWORK & FUZZY LOGIC:	9

ARTIFICIAL NEURAL NETWORK: Learning with ANNs, single-layer networks, multi-layer perceptrons, Back propagation algorithm (BPA) ANNs for identification, ANNs for control, and Adaptive neuro controller. Fuzzy Logic Control: Introduction, fuzzy sets, fuzzy logic, fuzzy logic controller design, Fuzzy Modelling & and identification, Adaptive Fuzzy Control Design.

UNIT–II	GENETIC ALGORITHM	9

Basic concept of Genetic algorithm and detail algorithmic steps- Hybrid genetic algorithm - Solution for typical control problems using genetic algorithm. Concept on some other search techniques like Tabu search, Ant-colony search, and Particle Swarm Optimization

UNIT– III	HYBRID CONTROL SCHEMES	9

Fuzzification and rule base using ANN–Neuro-fuzzy systems-ANFIS–Optimization of membership function and rule base using Genetic Algorithm and Particle Swarm Optimization...

UNIT – IV	AUTOMATION	9

Introduction to Automation - Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automation- Industrial Automation -computer vision for automation- PLC and SCADA based Automation- IoT for automation- Industry 4.0.

UNIT–V	INTELLIGENT CONTROLLER FOR AUTOMATION APPLICATION	9

Applications of Intelligent controllers in Industrial Monitoring, optimization, and control- Smart Appliances- Automation concept for Electrical vehicle- Intelligent controller and Automation for Power Systems.

Total: 45 PERIODS

Course Outcomes: Upon completion of this course, the students will be able to:		BLOOM'S Taxonomy
CO1	Demonstrate the basic architectures of NN and Fuzzy logic	L1 – Understand
CO2	Design and implement GA algorithms and know their limitations.	L2 - Understand
CO3	Explain and evaluate hybrid control schemes and PSO	L2 - Understand
CO4	Interpret the significance of Automation concepts.	L3 – Analyze
CO5	Develop the intelligent controller for automation applications.	L3 - Apply

	REFERENCE BOOKS:	
1.	Laurene V.Fausett, "Fundamentals of Neural Networks, Architecture, Algorithms, and Applications", Pearson Education, 2008
2.	Timothy J.Ross, "Fuzzy Logic with Engineering Applications", Wiley, Third Edition, 2010
3.	David E.Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning", Pearson Education, 2009.
4.	W.T.Miller, R.S.Sutton and P.J.Webrose, "Neural Networks for Control", MIT Press, 1996
5.	Srinivas Medida, Pocket Guide on Industrial Automation for Engineers and Technicians, IDC Technologies
6.	ChanchalDey and Sunit Kumar Sen, Industrial Automation Technologies, 1st Edition, CRC Press, 2022.

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https://www.youtube.com/watch?v=xbYgKoG4x2g&list=PL3EA65335EAC29EE8

Mapping of COs with POs						
COs	PO					
	1	2	3	4	5	6
CO1	1	1	1	1		1
CO2	2	2	3	3	3	2
CO3	3	2	2	2		
CO4	3	2	2	2		
CO5	3		3	3		2
AVG	2.4	1.75	2.2	2.2	3	1.67
1–Low, 2 –Medium, 3–High.						

ME23ET406	UNMANNED AERIAL VEHICLE			Version: 1.0		
Programme &Branch	**M.E. EMBEDDED SYSTEM TECHNOLOGIES**	**CP**	**L**	**T**	**P**	**C**
		3	**3**	**0**	**0**	**3**

Course Objectives:

1	To make the students understand the basic concepts and components of UAV systems.
2	To teach the UAV design concepts
3	To provide an insight into the hardware structure for UAVs
4	To emphasize the communication protocol requirements and control strategy for UAVs.
5	To highlight the need and the role of UAVs for real-time applications and the development of real-time UAVs

UNIT–I	**INTRODUCTION TO UAV**	**9**

Overview and background(L1) - History of UAV(L1) –classification(L1) – societal impact and future outlook Unmanned Aerial System (UAS) components (L2)-models and prototypes(L2) – System Applications(L2)

UNIT–II	**THE DESIGN OF UAV SYSTEMS**	**9**

Introduction to Design and Selection of the System(L2)- Aerodynamics and Airframe Configurations(L2) - Characteristics of Aircraft Types(L2)- Design Standards(L2)-Regulatories and regulations(L2) - Design for Stealth- control surfaces-specifications(L3).

UNIT– III	**HARDWARE FOR UAVs**	**9**

Real-time Embedded processors for UAVs(L2) - sensors-servos-accelerometer (L2)–gyros(L2)-actuators(L2)- power supply(L2) - integration(L2), installation(L2), configuration(L2), and testing (L2)–MEMS/NEMS sensors and actuators for UAVs(L2)- Autopilot(L2) – AGL(L2)

UNIT – IV	**COMMUNICATION PAYLOADS AND CONTROLS**	**9**

Payloads(L2)-Telemetry-tracking(L2)-Aerial photography(L2) -controls(L2)-PID feedback(L2)-radio control frequency range(L2) –modems-memory system(L2)-simulation(L3)-ground test(L2)-analysis-trouble shooting(L2)

UNIT–V	**THE DEVELOPMENT OF UAV SYSTEMS**	**9**

Waypoints navigation-ground control software(L2)- System Ground Testing(L2)- System In-flight Testing(L2)- Mini, Micro, and Nano UAVs(L2)- Case study: Agriculture- Health- Surveying- Disaster Management and Defense(L3).

		Total: 45 PERIODS

Course Outcomes: **Upon completion of this course, the students will be able to:**	**BLOOM'S Taxonomy**
CO1	Identify different hardware for UAV	L2 – Understand
CO2	Determine preliminary design requirements for an unmanned aerial vehicle	L3 - Apply
CO3	Design UAV system.	L2 - Understand
CO4	Identify and Integrate various systems of unmanned aerial vehicles.	L3 - Apply
CO5	Design micro aerial vehicle systems by considering practical limitations. Demonstrate the basic architectures of NN and Fuzzy logic.	L3 - Apply

REFERENCE BOOKS:

1.	Reg Austin "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010. 2. 3. 4. 5

2.	Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998
3.	Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics Company, 2001
4.	Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007
5.	Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998. Laurene V.Fausett, "Fundamentals of Neural Networks, Architecture, Algorithms, and Applications", Pearson Education, 2008

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Mapping of COs with POs						
COs	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	1	3	2			2
CO2	3	3	3			2
CO3	3	3	3	3	3	3
CO4			2	3	3	2
CO5	3		3	3	3	3
AVG	2.5	3	2.6	3	3	2.4
1–Low, 2 –Medium, 3–High.						

Beyond Knowledge

ME23ET407	DSP BASED SYSTEM DESIGN			Version: 1.0		
Programme &Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3

Course Objectives:

1	To understand various representation methods of the DSP system
2	To provide insight into different DSP algorithms
3	To familiarize the various architectures of the DSP system
4	To perform analysis of DSP architectures and to learn the implementation of DSP systems in programmable hardware
5	To learn the details of DSP system interfacing with other peripherals

UNIT–I	REPRESENTATION OF DSP SYSTEM	9

Single Core and Multicore(L2), Architectural requirement of DSPs- high throughput, low cost, low power, small code size, embedded applications(L2). Representation of digital signal processing systems(L2) - block diagrams, signal flow graphs, data-flow graphs, dependence graphs(L2). Techniques for enhancing computational throughput(L2) - parallelism and pipelining(L2).

UNIT–II	DSP ALGORITHMS	9

DSP algorithms - Convolution, Correlation, FIR/IIR filters, FFT, adaptive filters, sampling rate converters, DCT, Decimator, Expander, and Filter Banks(L3). DSP applications(L3). Computational characteristics of DSP algorithms and applications(L3), Numerical representation of signals-word length effect and its impact, Carry-free adders, Multiplier(L3).

UNIT– III	SYSTEM ARCHITECTURE	9

Introduction(L2), Basic Architectural Features(L2), DSP Computational Building Blocks(L2), Bus Architecture and Memory(L2), Data Addressing Capabilities(L2), Address Generation Unit(L2), Programmability and Program Execution(L2), Features for External Interfacing(L2). VLIW architecture(L2). Basic performance issues in pipelining(L2), Simple implementation of MIPS(L2), Instruction Level Parallelism(L2), Dynamic Scheduling(L2), Dynamic Hardware Prediction(L2), and Memory hierarchy(L2).Study of FIxed point and floating point DSP architectures(L2)

UNIT – IV	ARCHITECTURE ANALYSIS ON PROGRAMMABLE HARDWARE	9

Analysis of basic DSP Architectures on programmable hardware(L2). Algorithms for FIR, IIR, Lattice filter structures, architectures for real and complex fast Fourier transforms, 1D/2D Convolutions, Winograd minimal filtering algorithm(L3). FPGA: Architecture, different sub-systems, design flow for DSP system design, mapping of DSP algorithms onto FPGA(L2).

UNIT–V	SYSTEM INTERFACING	9

Examples of digital signal processing algorithms suitable for parallel architectures such as GPUs and multi GPUs(L2). Interfacing: Introduction, Synchronous Serial Interface CODE(L2), A CODEC Interface Circuit, ADC interface(L2).

	Total: 45 PERIODS

Course Outcomes: Upon completion of this course, the students will be able to:	BLOOM'S Taxonomy
CO1	Evaluate the DSP system using various methods.	L2 - Understand
CO2	Design algorithm suitable for different DSP applications	L3 – Apply

CO3	Explain various architectures of the DSP system	L2 - Understand
CO4	Implement a DSP system in programmable hardware	L3 – Apply
CO5	Build interfacing of the DSP system with various peripherals.	L2 - Understand

REFERENCE BOOKS:	
1.	Sen M Kuo, Woon Seng S Gan, Digital Signal Processors
2.	Digital Signal Processing and Application with C6713 and C6416 DSK, Rulph Chassaing, Worcester Polytechnic Institute, A Wiley Interscience Publication
3.	Architectures for Digital Signal Processing, Peter Pirsch John Weily, 2007
4.	DSP Processor and Fundamentals: Architecture and Features. Phil Lapsley, JBier, AmitSohan, Edward A Lee; Wiley IEEE Press
5.	K. K. Parhi - VLSI Digital Signal Processing Systems - Wiley – 1999.
6.	RulphChassaing, Digital signal processing, and applications with C6713 and C6416 DSK, Wiley, 2005
7.	Keshab K Parhi, VLSI Digital Signal Processing Systems: Design and Implementation, student Edition, Wiley, 1999.
8.	Nasser Kehtarnavaz, Digital Signal Processing System Design: LabVIEW-Based Hybrid Programming, Academic Press, 2008

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Mapping of COs with POs						
COs	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1		3				
CO2	3	3	3	2	3	2
CO3		3				
CO4	3		3	3	3	3
CO5	2		3	2	3	3
AVG	2.67	3	3	2.33	3	2.67
1–Low, 2 –Medium, 3–High.						

ME23ET408	**MACHINE LEARNING AND DEEP LEARNING**	**Version : 1.0**				
Programme & Branch	**M.E. EMBEDDED SYSTEM TECHNOLOGIES**	**CP**	**L**	**T**	**P**	**C**
		3	**0**	**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

C**ourse 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, 2012, 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. 2009.
4.	Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006
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	PO					
	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	
AVG	2.42	3	2.57		3	
1–Low, 2 –Medium, 3–High.						

ME23CP501/ ME23CP310	SECURITY PRACTICES				Version: 1.0	
EXCEPT FOR M.E. - COMPUTER SCIENCE AND ENGINEERING						
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 (L 2)– 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.

<table>
<tr><th colspan="7">Mapping of COs with POs</th></tr>
<tr><th rowspan="2">COs</th><th colspan="6">POs</th></tr>
<tr><th>PO1</th><th>PO2</th><th>PO3</th><th>PO4</th><th>PO5</th><th>PO6</th></tr>
<tr><td>CO1</td><td>1</td><td>2</td><td>1</td><td>1</td><td>2</td><td>1</td></tr>
<tr><td>CO2</td><td>2</td><td>1</td><td>3</td><td>1</td><td>1</td><td>2</td></tr>
<tr><td>CO3</td><td>-</td><td></td><td>2</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO4</td><td>2</td><td>2</td><td>1</td><td>2</td><td>1</td><td>3</td></tr>
<tr><td>CO5</td><td>1</td><td>-</td><td>1</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>Average</td><td>1.5</td><td>1.67</td><td>1.6</td><td>8</td><td>1.4</td><td>2.4</td></tr>
<tr><td colspan="7">1–Low, 2 –Medium, 3–High.</td></tr>
</table>

Beyond Knowledge

ME23CP502 / ME23CP401	CLOUD COMPUTING TECHNOLOGIES			Version: 1.0		
EXCEPT FOR M.E. - COMPUTER SCIENCE AND ENGINEERING						
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						
COs	**POs**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	-	-	-	2	2	1
CO2	2	3	1	-	-	1
CO3	3	-	3	-	1	3
CO4	-	-	-	2	-	3
CO5	3	2	-	-	-	-
Average	2.67	2.5	2	2	1.5	2
1–Low, 2 –Medium, 3–High.						

ME23CP503 / ME23CP415	BLOCKCHAIN TECHNOLOGIES			Version: 1.0		
EXCEPT FOR M.E. - COMPUTER SCIENCE AND ENGINEERING						
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 Blockchain technology.
2.	During this course the learner will explore various aspects of Blockchain technology like application in various domains
3.	By implementing, learners will have idea about private and public Blockchain, 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:	**BLOOMS**

Upon completion of this course the students will be able to:		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.						

Beyond Knowledge

ME23CP504 / ME23CP414	DEEP LEARNING	Version: 1.0		

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

EXCEPT FOR M.E. - COMPUTER SCIENCE AND ENGINEERING

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) Hyperparameters(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 Autoencoding(L2) Convolutional Auto Encoding(L2) Variational Auto Encoding(L3) Generative Adversarial Networks (L2) Autoencoders for Feature Extraction(L2) Auto Encoders for Classification (L3). Denoising Autoencoders(L2) Sparse Autoencoders(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.

TOTAL: 45 PERIODS

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	1.67	3	2.6	2.6
1–Low, 2 –Medium, 3–High.						

ME23CP505	DESIGN THINKING			Version: 1.0		

EXCEPT FOR M.E. - COMPUTER SCIENCE AND ENGINEERING						
Programme & Branch	**M.E. – COMPUTER SCIENCE AND ENGINEERING**	**C P**	**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	U**X 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 semester 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		
EXCEPT FOR M.E. - COMPUTER SCIENCE AND ENGINEERING					

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.

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–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:	**BLOOM'S**

	Upon completion of this course the students will be able to:	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, 1t 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:		BLOOM'S
Upon completion of this course the students will be able to:		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-	L4 - Analyze

	wise comparison tests.	
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

Course Outcomes: At the end of this course, the students will have the ability 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
Course Outcomes:	**BLOOM'S**

Upon completion of this course the students will be able to:		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						
COs	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		

<div align="center">EXCEPT FOR M.E. EMBEDDED SYSTEM TECHNOLOGIES</div>

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						
COs	**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.						

ME23AC701	ENGLISH FOR RESEARCH PAPER WRITING		Version: 1.0			
(COMMON TO ALL BRANCHES)						
Programme& Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	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

TEXTBOOKS:

1.	Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
2.	Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006.

REFERENCE BOOKS:

1.	Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006.
2.	Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

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

Programme& Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	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 OfIndia, New Delhi, 2001.

ME23AC703	CONSTITUTION OF INDIA	Version: 1.0

(COMMON TO ALL BRANCHES)						

Programme& Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		2	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:- 30 PERIODS

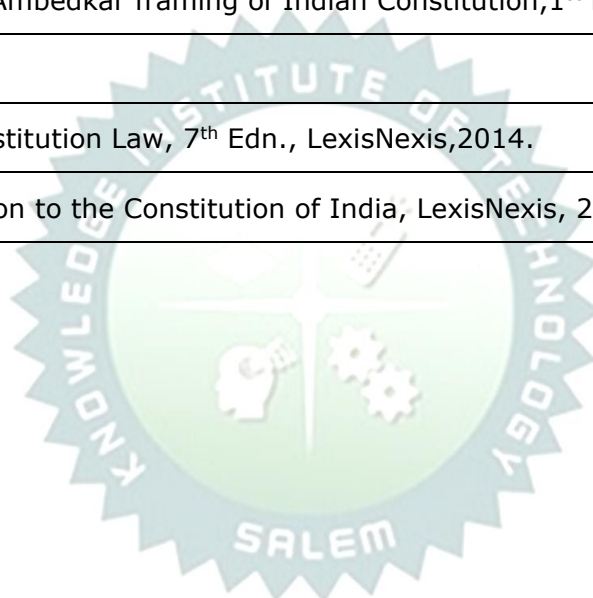| **OPEN ENDED PROBLEMS /QUESTIONS** |
|---|
| Course specific open ended problems will be solved during the classroom teaching. Such problems can be given as assignments and evaluated as internal assessment only and not for the end semester examination |

Course Outcomes: Upon completion of this course the students will be able to:		BLOOMS Taxonomy
CO1	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 (தமிழில்)	Version: 1.0

(COMMON TO ALL BRANCHES)						

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

Course Objectives:

1	சங்க இலக்கியம் பற்றி மாணவர்களுக்கு எடுத்துரைத்தல்
2	நீதி நூல்கள் வாயிலாக அறக்கருத்துகளை எடுத்து கூறுதல்.
3	சிலப்பதிகாரம், மணிமேகலை காப்பியங்களை எடுத்துரைத்தல்.
4	இலக்கியங்களில் காணப்படும் அருள்நெறிக் கதைகளைப் பற்றி விளக்குதல்.
5	தற்காலத் தமிழ் இலக்கியங்களை மாணவர்களுக்கு தெரியப்படுத்துதல்.

UNIT–I	சங்க இலக்கியம்	**6**

1. தமிழின் துவக்க நூல் தொல்காப்பியம் - எழுத்து, சொல், பொருள் (L1)
2. அகநானூறு (82) - இயற்கை இன்னிசை அரங்கம் (L1)
3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி (L1)
4. புறநானூறு (95, 195) – போரை நிறுத்திய ஔவையார் (L1)

UNIT–II	அறநெறித்தமிழ்	**6**

1. அறநெறி வகுத்த திருவள்ளுவர் - அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புறவு அறிதல், ஈகை, புகழ் (L2)
2. பிற அறநூல்கள் – இலக்கிய மருந்து - ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்) (L2)

UNIT–III	இரட்டைக்காப்பியங்கள்	**6**

1. கண்ணகியின் புரட்சி- சிலப்பதிகார வழக்குரை காதை (L1)
2. சமூக சேவை இலக்கியம் மணிமேகலை – சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை (L1)

UNIT–IV	அருள்நெறித்தமிழ்	**6**

1. சிறுபாணாற்றுப்படை – பாரி முல்லைக்கு தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஔவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள். (L2)
2. நற்றிணை – அன்னைக்குரிய புன்னை சிறப்பு (L2)
3. திருமந்திரம் (617,618) இயமம் நியமம் விதிகள் (L2)
4. தர்மசாலையை நிறுவிய வள்ளலார் (L2)
5. புறநானூறு – சிறுவனே வள்ளலானான் (L2)
6. அகநானூறு (4) – வண்டு (L2)
7. நற்றிணை (11) – நண்டு (L2)
8. கலித்தொகை (11) – யானை, புறா (L2)
9. ஐந்திணை ஐம்பது (27) – மான் (L2)
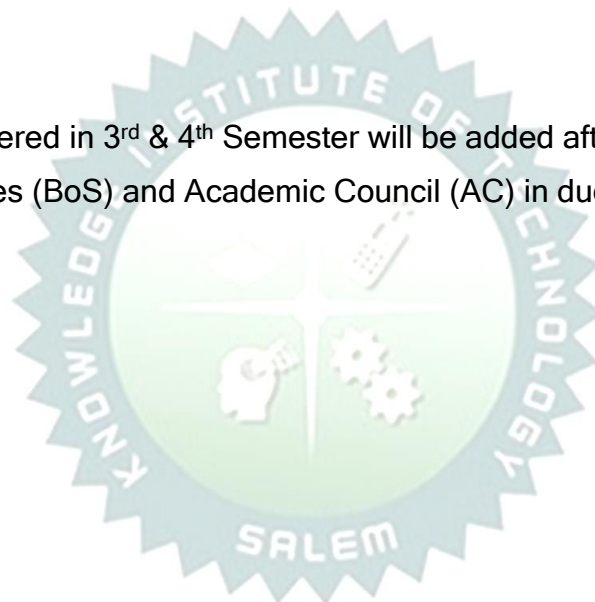
a.	ஆகியவை பற்றிய செய்திகள் (L2)	
UNIT−V	**நவீன தமிழ் இலக்கியம்**	**6**

1. உரைநடைத்தமிழ் (L1)

   – தமிழின் முதல் புதினம் (L1)

   – தமிழின் முதல் சிறுகதை (L1)

   – கட்டுரை இலக்கியம் (L1)

   – பயண இலக்கியம் (L1)

   – நாடகம் (L1)

2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும் (L1)

3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும் (L1)

4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும் (L1)

5. அறிவியல் தமிழ் (L1)

6. இணையத்தில் தமிழ் (L1)

7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம் (L1)

		Total: 30 PERIODS
Course Outcomes: **Upon completion of this course the students will be able to:**		**BLOOMS Taxonomy**
CO1	சங்க இலக்கியம் மாணவர்கள் முழுமையாக அறிந்து பயன்பெறுதல்.	L1 - நினைவில் கொள்ளுதல்
CO2	அறநெறி இலக்கியம் வாயிலாக வாழ்வியலுக்குத் தேவையான தூய்மைப் பணிகளை மேற்கொள்ளுதல்.	L2 - புரிந்து கொள்ளுதல்
CO3	சிலப்பதிகாரம், மணிமேகலை காப்பியங்களில் உள்ள நீதிக்கருத்துகளை மாணவர்கள் தெரிந்துகொள்ளுதல்.	L1 - நினைவில் கொள்ளுதல்
CO4	இலக்கியங்களில் காணப்படும் அருள்நெறிக் கதைகளைப் பற்றி விளக்குதல்.	L2 - புரிந்து கொள்ளுதல்
CO5	தற்காலத் தமிழ் இலக்கியங்களை மாணவர்கள் தெரிந்து அவற்றின் வாயிலாக பயன் அடைதல்.	L1 - நினைவில் கொள்ளுதல்
TEXTBOOKS: தமிழ் இலக்கிய வெளியீடுகள் புத்தகங்கள்		
1.	தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University) - www.tamilvu.org.	
2.	தமிழ் விக்கிப்பீடியா (Tamil Wikipedia) -https://ta.wikipedia.org.	
3.	தர்மபுர ஆதீன வெளியீடு.	
4.	வாழ்வியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்.	
5.	தமிழ்க்கலைக்களஞ்சியம் - தமிழ் வளர்ச்சித்துறை (thamilvalarchithurai.com).	
6.	அறிவியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்.	

ME23AC704	CLASSICAL TAMIL LITERATURE (ENGLISH VERSION)		Version: 1.0		
	(COMMON TO ALL BRANCHES)				
Programme & Branch	**M.E. EMBEDDED SYSTEM TECHNOLOGIES**	**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 about Silappathikaram & Manimekalai.
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 courses offered in 3rd & 4th Semester will be added after the approval of Board of Studies (BoS) and Academic Council (AC) in due course.