

# **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, Kakpalayam – 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](http://www.kiot.ac.in)

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## KNOWLEDGE INSTITUTE OF TECHNOLOGY (AUTONOMOUS), SALEM

Approved by AICTE, Affiliated to Anna University,  
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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

<b>A</b>	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>B</b>	To nurture talent, Innovation, entrepreneurship, all-round personality and value system among the students and to foster competitiveness among students
<b>C</b>	To undertake collaborative projects which offer opportunities for long-term interaction with academia and industry
<b>D</b>	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

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

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

<b>PROGRAM OUTCOMES (POs)</b>	
<b>PO 1</b>	An ability to independently carry out research / investigation and development work to solve practical problems.
<b>PO 2</b>	An ability to write and present a substantial technical report / document.
<b>PO 3</b>	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.
<b>PO 4</b>	Be able to design and develop Embedded system automation based on dedicated ICs that have computation, networking and control capacity.
<b>PO 5</b>	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.
<b>PO 6</b>	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

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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	
<b>SEMESTER I</b>												
-	-	Induction Program	-	-	-	-	-	-	-	-	-	
<b>THEORY</b>												
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	3	0	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	
<b>PRACTICAL</b>												
8	ME23ET305	Embedded Systems- I Laboratory	PC	4	0	0	4	2	60	40	100	
<b>EMPLOYABILITY ENHANCEMENT</b>												
9	ME23PT801	Technical Seminar / Case study Presentation	EEC	2	0	0	2	0	100	-	100	
<b>Total</b>					<b>27</b>	<b>20</b>	<b>1</b>	<b>6</b>	<b>21</b>	<b>500</b>	<b>400</b>	<b>900</b>

<b>SEMESTER II</b>												
<b>THEORY</b>												
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	
<b>PRACTICAL</b>												
9	ME23ET309	Embedded Systems - II Laboratory	PC	4	0	0	4	2	60	40	100	
<b>EMPLOYABILITY ENHANCEMENT</b>												
10	ME23PT802	Research Paper Review and presentation	EEC	2	0	0	2	1	100	-	100	
<b>Total</b>					<b>29</b>	<b>23</b>	<b>0</b>	<b>6</b>	<b>24</b>	<b>540</b>	<b>460</b>	<b>1000</b>

\* Audit Course is optional

**KNOWLEDGE INSTITUTE OF TECHNOLOGY (AUTONOMOUS), SALEM - 637504**

**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
<b>SEMESTER III</b>											
<b>THEORY</b>											
1	ME23ET4XX	Professional Elective-III	PE	3	3	0	0	3	40	60	100
2	ME23ET4XX	Professional Elective-IV	PE	3	3	0	0	3	40	60	100
3	ME23ET310	IoT for Smart Systems	PC	3	3	0	0	3	40	60	100
4	ME23XX5XX	Open Elective-II	OE	3	3	0	0	3	40	60	100
<b>PRACTICAL</b>											
5	ME23ET601	Project Work Phase-I	PW	12	0	0	12	6	60	40	100
<b>Total</b>				<b>24</b>	<b>12</b>	<b>0</b>	<b>12</b>	<b>18</b>	<b>220</b>	<b>280</b>	<b>500</b>
<b>SEMESTER IV</b>											
<b>PRACTICAL</b>											
1	ME23ET602	Project Work Phase-II	PW	24	0	0	24	12	60	40	100
<b>Total</b>				<b>24</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>	<b>60</b>	<b>40</b>	<b>100</b>
										<b>Total Number of Credits: 75</b>	

**AUDIT COURSES - I & II**

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
4	ME23AC704	நற்றமிழ் இலக்கியம்	AC	2	2	0	0	0	100	-	100

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**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
<b>Professional Elective – I &amp; II</b>											
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

**Open Electives – I & II**

S. No.	Course Code	Course Title	Periods / Week						Maximum Marks		
			CAT	CP	L	T	P	C	CIA	ESE	Total
<b>Except M.E. Computer Science and Engineering</b>											
1	ME23CP501	Security Practices	OE	3	3	0	0	3	60	40	100
2	ME23CP502	Cloud Computing Technologies	OE	3	3	0	0	3	60	40	100
3	ME23CP503	Blockchain Technologies	OE	3	3	0	0	3	60	40	100
4	ME23CP504	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
<b>Except M.E. Industrial Safety Engineering</b>											
7	ME23IS501	Environmental Safety	OE	3	3	0	0	3	60	40	100
8	ME23IS502	Electrical safety	OE	3	3	0	0	3	60	40	100
9	ME23IS503	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
<b>Except M.E. Embedded System Technologies</b>											
12	ME23ET501	IoT for Smart Systems	OE	3	3	0	0	3	60	40	100
13	ME23ES502	Machine Learning and Deep Learning	OE	3	3	0	0	3	60	40	100
14	ME23ES503	Renewable Energy Technology	OE	3	3	0	0	3	60	40	100
15	ME23ES504	Smart Grid	OE	3	3	0	0	3	60	40	100
<b>Except M.E. VLSI Design</b>											
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

### SEMESTER-WISE CREDITS DISTRIBUTION

SUMMARY							
Sl. No.	Course Category	Credits per Semester				Credits	Credit %
		I	II	III	IV		
1	<b>FC</b>	4	-	-	-	4	<b>5</b>
2	<b>RM</b>	3	-	-	-	3	<b>4</b>
3	<b>PC</b>	14	11	3	-	28	<b>37</b>
4	<b>PE</b>	-	6	6	-	12	<b>16</b>
5	<b>OE</b>	-	3	3	-	6	<b>8</b>
6	<b>PW</b>	-	-	6	12	18	<b>24</b>
7	<b>MC/AC</b>	✓	3	-	-	3	<b>4</b>
8	<b>EEC</b>	✓	1	-	-	1	<b>1</b>
	<b>Total</b>	<b>21</b>	<b>24</b>	<b>18</b>	<b>12</b>	<b>75</b>	<b>100</b>

CA T	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				

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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
<b>Course Objectives:</b>									
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.								
<b>UNIT-I</b>		<b>FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS</b>			<b>9+3</b>				
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 Poisson’s equations(L3).									
<b>UNIT-II</b>		<b>GRAPH THEORY</b>			<b>9+3</b>				
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).									
<b>UNIT- III</b>		<b>OPTIMIZATION TECHNIQUES</b>			<b>9+3</b>				
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) .									
<b>UNIT – IV</b>		<b>PROBABILITY AND RANDOM VARIABLES</b>			<b>9+3</b>				
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).									
<b>UNIT-V</b>		<b>QUEUEING THEORY</b>			<b>9+3</b>				
Single and multiple servers(L2) – Markovian queuing models(L3) – Finite and infinite capacity queues(L3) – Finitesource model(L3) – Queuing applications(L3).									
		<b>OPEN ENDED PROBLEMS / QUESTIONS</b>							
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.									
								<b>Total : 60</b>	
<b>PERIODS</b>									
<b>Course Outcomes:</b>								<b>BLOOM’S Taxonomy</b>	
<b>Upon completion of this course the students will be able to:</b>									
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 assignment related problems.	L3 – Apply
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
<b>REFERENCE BOOKS:</b>		
1.	Taha H .A., " Operations Research: An Introduction " , 9 <sup>th</sup> Edition, Pearson Education Asia,New Delhi, 2016.	
2.	Walpole R.E., Myer R.H., Myer S.L., and Ye, K., " Probability and Statistics for Engineersand Scientists ", 7 <sup>th</sup> Edition, Pearson Education, Delhi, 2002.	
3.	Sankara Rao, K., " Introduction to Partial Differential Equations ", Prentice Hall ofIndia 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 ", 4 <sup>th</sup> Edition, John Wiley and Sons, 2009.	
<b>VIDEO REFERENCES:</b>		
1.	<a href="https://www.youtube.com/watch?v=6RcRSli0YEI&amp;list=PLEAYkSg4uSQ3NwwQtFSgnKPF5x4iI_XTb">https://www.youtube.com/watch?v=6RcRSli0YEI&amp;list=PLEAYkSg4uSQ3NwwQtFSgnKPF5x4iI_XTb</a> Prof Rajiv Misra IIT-Karagpur	
2.	<a href="https://www.youtube.com/watch?v=vqJuFD0GdJA">https://www.youtube.com/watch?v=vqJuFD0GdJA</a> (Dr P N Agarwal IIT R)	
<b>WEB REFERENCES:</b>		
1.	<a href="http://stankova.net/book.pdf">http://stankova.net/book.pdf</a>	
2.	<a href="https://www.edanz.com/blog/anova-explained">https://www.edanz.com/blog/anova-explained</a>	
<b>ONLINE COURSES:</b>		
1.	<a href="https://nptel.ac.in/courses/110105087">https://nptel.ac.in/courses/110105087</a>	
2.	<a href="https://onlinecourses.nptel.ac.in/noc23_ge25/preview">https://onlinecourses.nptel.ac.in/noc23_ge25/preview</a>	

Mapping of COs with POs						
Cos	POs					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2					
CO2	2					
CO3	2					
CO4	2					
CO5	2					
<b>Average</b>	<b>2</b>					

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
<b>Course Objectives:</b>									
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.								
<b>UNIT-I</b>		<b>CONCEPT OF RESEARCH</b>					<b>6+3</b>		
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).									
<b>UNIT-II</b>		<b>RESEARCH METHODS AND JOURNALS</b>					<b>6+3</b>		
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).									
<b>UNIT- III</b>		<b>PAPER WRITING AND RESEARCH TOOLS</b>					<b>6+3</b>		
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)									
<b>UNIT - IV</b>		<b>EFFECTIVE TECHNICAL THESIS WRITING/PRESENTATION</b>					<b>6+3</b>		
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).									
<b>UNIT-V</b>		<b>NATURE OF INTELLECTUAL PROPERTY</b>					<b>6+3</b>		
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).									
<b>Total : 30+15=45 PERIODS</b>									
<b>OPEN ENDED PROBLEMS / QUESTIONS</b>									

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.

<b>COURSE OUTCOMES: Upon completion of this course the students will be able to:</b>		<b>BLOOM'S Taxonomy</b>
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.	<a href="https://www.youtube.com/watch?v=1vf8ZvADxfY&amp;list=PLLhSIFFDZcUWRlgiXMkd1rNeLSz1You40">https://www.youtube.com/watch?v=1vf8ZvADxfY&amp;list=PLLhSIFFDZcUWRlgiXMkd1rNeLSz1You40</a>
2.	<a href="https://www.youtube.com/watch?v=eIUaS51U05M&amp;list=PLIEVEMAFhG4_JmLtWGr6G0PRGB13xapyC">https://www.youtube.com/watch?v=eIUaS51U05M&amp;list=PLIEVEMAFhG4_JmLtWGr6G0PRGB13xapyC</a>

**WEB REFERENCES:**

1.	<a href="https://www.researchgate.net/">https://www.researchgate.net/</a>
2.	<a href="https://www.wipo.int/about-ip/en/">https://www.wipo.int/about-ip/en/</a>

**ONLINE COURSES:**

1.	<a href="https://onlinecourses.nptel.ac.in/noc23_ge36/preview">https://onlinecourses.nptel.ac.in/noc23_ge36/preview</a>
2.	<a href="https://onlinecourses.nptel.ac.in/noc22_hs59/preview">https://onlinecourses.nptel.ac.in/noc22_hs59/preview</a>

<b>Mapping of COs with POs</b>						
<b>COs</b>	<b>POs</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
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

<b>ME23ET301</b>	<b>DESIGN OF EMBEDDED SYSTEMS</b>	<b>Version : 1.0</b>				
<b>Programme &amp; Branch</b>	<b>M.E. EMBEDDED SYSTEM TECHNOLOGIES</b>	<b>CP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Course Objectives:</b>						
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					
<b>UNIT-I</b>	<b>INTRODUCTION TO EMBEDDED SYSTEMS</b>	<b>9</b>				
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).						
<b>UNIT-II</b>	<b>EMBEDDED NETWORKING BY PROCESSORS</b>	<b>9</b>				
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 <sup>2</sup> C) (L2)- CAN Bus(L2) –Wireless protocol based on Wifi , Bluetooth, Zigbee(L2) – Introduction to Device Drivers(L2).						
<b>UNIT- III</b>	<b>RTOS BASED EMBEDDED SYSTEM DESIGN</b>	<b>9</b>				
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).						
<b>UNIT - IV</b>	<b>MODELLING WITH HARDWARE/SOFTWARE DESIGN APPROACHES</b>	<b>9</b>				
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).						
<b>UNIT-V</b>	<b>EMBEDDED SYSTEM APPLICATION DEVELOPMENT</b>	<b>9</b>				
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.						
<b>Total : 45 PERIODS</b>						
<b>OPEN ENDED PROBLEMS / QUESTIONS</b>						
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).						



<b>Course Outcomes:</b> At the end of this course, the students will		<b>BLOOM'S Taxonomy</b>
C01	Demonstrate the functionalities of processor internal blocks, with their requirement.	L2 - Understand
C02	Analyze that Bus standards are chosen based on interface overheads without sacrificing processor performance	L2 - Understand
C03	Explain the role and features of RT operating system, that makes multitask execution possible by processors.	L2 - Understand
C04	Illustrate that using multiple CPU based on either hardcore or softcore helps data overhead management with processing-speed reduction for uC execution.	L3 - Apply
C05	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.	<a href="https://www.ripublication.com/ijaer17/ijaerv12n18_113">https://www.ripublication.com/ijaer17/ijaerv12n18_113,</a>
2.	<a href="https://www.embedded.com/serial-protocols-compared/">https://www.embedded.com/serial-protocols-compared/</a>

#### ONLINE COURSES:

1.	<a href="https://onlinecourses.nptel.ac.in/noc20_cs14/preview">https://onlinecourses.nptel.ac.in/noc20_cs14/preview</a>
2.	<a href="https://onlinecourses.nptel.ac.in/noc21_cs08/preview">https://onlinecourses.nptel.ac.in/noc21_cs08/preview</a>

#### VIDEO REFERENCES:

1.	<a href="https://www.youtube.com/watch?v=3RfqkVyvnnc">https://www.youtube.com/watch?v=3RfqkVyvnnc</a>
2.	<a href="https://www.youtube.com/watch?v=U5CDf4TNARE">https://www.youtube.com/watch?v=U5CDf4TNARE</a>
3.	<a href="https://www.youtube.com/watch?v=Gkp753foAgE">https://www.youtube.com/watch?v=Gkp753foAgE</a>

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
<b>Avg</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2.4</b>	<b>1</b>	<b>2</b>
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
<b>Course Objectives:</b>						
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.					
<b>UNIT-I</b>	<b>BASIC C PROGRAMMING</b>	<b>9</b>				
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).						
<b>UNIT-II</b>	<b>EMBEDDED C</b>	<b>9</b>				
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).						
<b>UNIT- III</b>	<b>C PROGRAMMING TOOL-CHAIN IN LINUX</b>	<b>9</b>				
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).						
<b>UNIT - IV</b>	<b>PYTHON PROGRAMMING</b>	<b>9</b>				
Introduction(L1) - Parts of Python Programming Language(L2) - Control Flow Statements(L3) - Functions (L3)- Strings Lists (L3)- Dictionaries (L3)- Tuples and Sets (L3).						
<b>UNIT-V</b>	<b>MODULES, PACKAGES AND LIBRARIES IN PYTHON</b>	<b>9</b>				
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).						
<i>Beyond Knowledge</i>						<b>Total : 45 PERIODS</b>
<b>OPEN ENDED PROBLEMS / QUESTIONS</b>						
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.						
<b>Course Outcomes:</b>						<b>BLOOM'S Taxonomy</b>
At the end of this course, the students will demonstrate the ability to						
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	Have improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded programming skills.					L3 - Apply



<b>REFERENCE BOOKS:</b>	
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.
<b>WEB REFERENCES:</b>	
1.	<a href="https://www.javatpoint.com/gcc-linux">https://www.javatpoint.com/gcc-linux</a>
2.	<a href="https://www.geeksforgeeks.org/python-set-3-strings-lists-tuples-iterations/">https://www.geeksforgeeks.org/python-set-3-strings-lists-tuples-iterations/</a>
<b>ONLINE COURSES:</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc19_cs41/preview">https://onlinecourses.nptel.ac.in/noc19_cs41/preview</a>
2.	<a href="https://onlinecourses.nptel.ac.in/noc19_cs41/preview">https://onlinecourses.nptel.ac.in/noc19_cs41/preview</a>
<b>VIDEO REFERENCES:</b>	
1.	<a href="https://www.youtube.com/watch?v=XTiIILOY8&amp;list=PLEAYkSg4uSQ2k6GwNhpgSHodGT8wfvqwu">https://www.youtube.com/watch?v=XTiIILOY8&amp;list=PLEAYkSg4uSQ2k6GwNhpgSHodGT8wfvqwu</a>
2.	<a href="https://www.youtube.com/watch?v=c235EsGFcZs">https://www.youtube.com/watch?v=c235EsGFcZs</a>
3.	<a href="https://www.youtube.com/watch?v=c235EsGFcZs">https://www.youtube.com/watch?v=c235EsGFcZs</a>

<b>Mapping of COs with POs</b>						
<b>CO</b>	<b>PO</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
<b>1</b>	-	-	2	-	3	-
<b>2</b>	1	-	1	-	2	-
<b>3</b>	-	2	-	-	2	-
<b>4</b>	1	-	1	1	1	-
<b>5</b>	-	-	2	2	3	2
<b>Avg</b>	<b>1</b>	<b>2</b>	<b>1.5</b>	<b>1.5</b>	<b>2.2</b>	<b>2</b>
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
<b>Course Objectives:</b>						
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.					
<b>UNIT-I</b>	<b>PIC MICROCONTROLLER</b>	<b>9</b>				
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).						
<b>UNIT-II</b>	<b>ARM ARCHITECTURE</b>	<b>9</b>				
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)						
<b>UNIT- III</b>	<b>PERIPHERALS OF PIC AND ARM MICROCONTROLLER</b>	<b>9</b>				
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).						
<b>UNIT - IV</b>	<b>ARM MICROCONTROLLER PROGRAMMING</b>	<b>9</b>				
ARM general Instruction set(L2) – Thumb instruction set (L2)–Introduction to DSP on ARM – Implementation example of Filters(L3)						
<b>UNIT-V</b>	<b>DESIGN WITH PIC AND ARM MICROCONTROLLERS</b>	<b>9</b>				
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)						
<b>Total : 45 PERIODS</b>						
<b>OPEN ENDED PROBLEMS / QUESTIONS</b>						
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.						
<b>Course Outcomes:</b> At the end of this course, the students will have the ability to						<b>BLOOM’S Taxonomy</b>
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	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in commercial embedded processors	L3 - Apply
<b>REFERENCE BOOKS:</b>		
1.	Steve Furber, 'ARM system on chip architecture', Addison 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	
<b>WEB REFERENCES:</b>		
1.	<a href="https://piembsystech.com/arm-microcontroller/">https://piembsystech.com/arm-microcontroller/</a>	
2.	<a href="https://www.elprocus.com/introduction-to-pic-microcontrollers-and-its-architecture/">https://www.elprocus.com/introduction-to-pic-microcontrollers-and-its-architecture/</a>	
<b>ONLINE COURSES:</b>		
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2.	<a href="https://archive.nptel.ac.in/courses/106/105/106105193/">https://archive.nptel.ac.in/courses/106/105/106105193/</a>	
<b>VIDEO REFERENCES:</b>		
1.	<a href="https://www.youtube.com/watch?v=0xgvINDxXJI&amp;list=PLbRMhDVUMngcJu5oUhgpgYqtOn7DmSfuU">https://www.youtube.com/watch?v=0xgvINDxXJI&amp;list=PLbRMhDVUMngcJu5oUhgpgYqtOn7DmSfuU</a>	
2.	<a href="https://www.youtube.com/watch?v=y9RAhEflfJs&amp;list=PL419D0518A8E82285">https://www.youtube.com/watch?v=y9RAhEflfJs&amp;list=PL419D0518A8E82285</a>	
3.	<a href="https://www.youtube.com/watch?v=3OmyM4-zuQw&amp;t=1s">https://www.youtube.com/watch?v=3OmyM4-zuQw&amp;t=1s</a>	

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	-	-	-
<b>Avg</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>1.5</b>	<b>-</b>
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
<b>Course Objectives:</b>							
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.						
<b>UNIT-I</b>	<b>INTRODUCTION TO ADVANCED DIGITAL SYSTEM DESIGN</b>					<b>9</b>	
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).							
<b>UNIT-II</b>	<b>CMOS BASICS &amp; IC FABRICATION</b>					<b>9</b>	
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).							
<b>UNIT- III</b>	<b>ASIC AND RECONFIGURABLE PROCESSOR AND SoC DESIGN</b>					<b>9</b>	
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).							
<b>UNIT - IV</b>	<b>ANALOG VLSI DESIGN</b>					<b>9</b>	
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).							
<b>UNIT-V</b>	<b>DESIGN WITH PIC AND ARM MICROCONTROLLERS</b>					<b>9</b>	
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).							
<b>Total : 45 PERIODS</b>							
<b>OPEN ENDED PROBLEMS / QUESTIONS</b>							
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.							
<b>Course Outcomes:</b>						<b>BLOOM'S Taxonomy</b>	
At the end of this course, the students will have the ability to							
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, 1 <sup>st</sup> 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 Univerity Press,2015.
8.	Zainalatsed in Navabi, 'VHDL Analysis and Modelling of Digital Systems', 2n Edition, Tata McGraw Hill, 1998.

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1.	<a href="https://archive.nptel.ac.in/courses/108/106/108106177/">https://archive.nptel.ac.in/courses/108/106/108106177/</a>
2.	<a href="https://nptel.ac.in/courses/117101058">https://nptel.ac.in/courses/117101058</a>

#### ONLINE COURSES:

1.	<a href="https://onlinecourses.nptel.ac.in/noc20_cs14/">https://onlinecourses.nptel.ac.in/noc20_cs14/</a>
2.	<a href="https://onlinecourses.nptel.ac.in/noc21_ee39/">https://onlinecourses.nptel.ac.in/noc21_ee39/</a>

#### VIDEO REFERENCES:

1.	<a href="https://www.youtube.com/watch?v=oL8SKNxEaHs&amp;list=PLLy_2iUCG87Bdulp9brz9AcvW_TnFCUmM">https://www.youtube.com/watch?v=oL8SKNxEaHs&amp;list=PLLy_2iUCG87Bdulp9brz9AcvW_TnFCUmM</a>
2.	<a href="https://www.youtube.com/watch?v=BoIOLczVuIQ&amp;list=PLyqSpQzTE6M_dZdF7Bd-ncI5_L_1VkXF">https://www.youtube.com/watch?v=BoIOLczVuIQ&amp;list=PLyqSpQzTE6M_dZdF7Bd-ncI5_L_1VkXF</a>

Mapping of COs with POs						
CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
<b>1</b>	-	-	-	1	-	-
<b>2</b>	2	-	2	2	-	-
<b>3</b>	-	-	3	3	2	1
<b>4</b>	2	-	2	3	1	-
<b>5</b>	-	1	1	3	3	1
<b>Avg</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2.4</b>	<b>2</b>	<b>1</b>
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
<b>Course Objectives:</b>									
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.								
<b>List of Experiments / Exercises</b>									
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)								
<b>Total : 60 PERIODS</b>									
<b>Course Outcomes:</b>								<b>BLOOM'S Taxonomy</b>	
At the end of this course, the students will have the ability to									
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	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in interfacing and use of commercial embedded processors							L3 - Apply	



<b>REFERENCE BOOKS:</b>	
1.	Mohammad 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,3 <sup>rd</sup> 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

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

*Beyond Knowledge*

<b>ME23PT801</b>	<b>TECHNICAL SEMINAR / CASE STUDY PRESENTATION</b>	<b>Version : 1.0</b>				
<b>(COMMON TO ALL BRANCHES)</b>						
<b>Programme &amp; Branch</b>	<b>M.E. EMBEDDED SYSTEM TECHNOLOGIES</b>	<b>CP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>
<b>Course Objectives:</b>						
1	To encourage the students to study advanced engineering developments					
2	To prepare and present the technical and case study reports					
<b>Method of Evaluation:</b>						
<p>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.</p>						
						<b>Total : 30 PERIODS</b>
<b>Course Outcomes: Upon completion of this course the students will be able to:</b>						<b>BLOOM'S Taxonomy</b>
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

*Beyond Knowledge*

<b>Mapping of COs with POs</b>						
<b>CO</b>	<b>PO</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
1		3				
2		3				
<b>Avg</b>		<b>3</b>				
1-Low, 2 -Medium, 3-High.						





*Beyond Knowledge*

ME23ET306	REAL TIME OPERATING SYSTEM	Version : 1.0				
(COMMON TO ALL BRANCHES)						
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3
<b>Course Objectives:</b>						
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					
<b>UNIT-I</b>	<b>REVIEW OF OPERATING SYSTEMS</b>	<b>9</b>				
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)						
<b>UNIT-II</b>	<b>OVERVIEW OF RTOS</b>	<b>9</b>				
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).						
<b>UNIT- III</b>	<b>REALTIME MODELS AND LANGUAGES</b>	<b>9</b>				
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).						
<b>UNIT - IV</b>	<b>REALTIME KERNEL</b>	<b>9</b>				
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).						
<b>UNIT-V</b>	<b>APPLICATION DEVELOPMENT</b>	<b>9</b>				
Discussions on Basics of Linux supportive RTOS(L2) - Ucos(L2)-C Executive for development of RTOS Application(L3) - Case study(L3)						
<b>Total: 45 PERIODS</b>						
<b>Course Outcomes:</b> At the end of this course, the students will have the ability to					<b>BLOOM'S Taxonomy</b>	
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.	MukeshSignal 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/](https://onlinecourses.nptel.ac.in/noc21_cs98/)

**VIDEO REFERENCES:**

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

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

**Mapping of COs with POs and PSOs**

CO	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
<b>Avg.</b>	<b>2</b>	<b>2</b>	<b>1.8</b>	<b>1.5</b>	<b>2.2</b>	<b>1.75</b>

1-Low, 2 -Medium, 3-High.

ME23ET307		EMBEDDED SYSTEM NETWORKING			Version : 1.0				
(COMMON TO ALL BRANCHES)									
Programme & Branch		M.E. EMBEDDED SYSTEM TECHNOLOGIES			CP	L	T	P	C
					3	3	0	0	3
<b>Course Objectives:</b>									
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.								
<b>UNIT-I</b>		<b>EMBEDDED PROCESS COMMUNICATION WITH INSTRUMENT BUS</b>			<b>9</b>				
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).									
<b>UNIT-II</b>		<b>EMBEDDED ETHERNET</b>			<b>9</b>				
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)									
<b>UNIT- III</b>		<b>WIRELESS EMBEDDED NETWORKING</b>			<b>9</b>				
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)									
<b>UNIT – IV</b>		<b>BUILDING SYSTEM AUTOMATION</b>			<b>9</b>				
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)									
<b>UNIT-V</b>		<b>COMMUNICATION FOR LARGE ELECTRICAL SYSTEM AUTOMATION</b>			<b>9</b>				
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)									
<b>Total : 45 PERIODS</b>									
<b>Course Outcomes:</b>								<b>BLOOM'S Taxonomy</b>	
At the end of this course, the students will have the ability to									
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
<b>REFERENCE BOOKS:</b>		
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	
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<b>ONLINE COURSES:</b>		
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<a href="https://archive.nptel.ac.in/courses/106/105/106105081/">https://archive.nptel.ac.in/courses/106/105/106105081/</a>		
<b>VIDEO REFERENCES:</b>		
<a href="https://www.youtube.com/watch?v=0RFYDNG6IU4">https://www.youtube.com/watch?v=0RFYDNG6IU4</a>		
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<a href="https://www.youtube.com/watch?v=ycaz99NogS4&amp;list=PLJ5C_6qdAvBHroAfeKCO7K4xphEF74UPc">https://www.youtube.com/watch?v=ycaz99NogS4&amp;list=PLJ5C_6qdAvBHroAfeKCO7K4xphEF74UPc</a>		

Mapping of COs with POs and PSOs						
CO	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
<b>Avg.</b>	<b>2.25</b>	<b>2</b>	<b>2.7</b>	<b>3</b>	<b>2.3</b>	<b>1.8</b>
1-Low, 2 -Medium, 3-High.						

*Beyond Knowledge*

ME23ET308		EMBEDDED CONTROL FOR ELECTRIC DRIVES			Version : 1.0				
(COMMON TO ALL BRANCHES)									
Programme & Branch		M.E. EMBEDDED SYSTEM TECHNOLOGIES			CP	L	T	P	C
					3	3	0	0	3
<b>Course Objectives:</b>									
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.								
<b>UNIT-I</b>		<b>INTRODUCTION ELECTRICAL DRIVES</b>			<b>9</b>				
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).									
<b>UNIT-II</b>		<b>OVERVIEW OF EMBEDDED PROCESSOR</b>			<b>9</b>				
Embedded Processor architecture(L2)-RTOS(L2) - Hardware/software co-design(L2)- Programming with SoC processors(L3).									
<b>UNIT- III</b>		<b>INDUCTION MOTOR CONTROL</b>			<b>9</b>				
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)									
<b>UNIT - IV</b>		<b>BLDC MOTOR CONTROL</b>			<b>9</b>				
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).									
<b>UNIT-V</b>		<b>SRM MOTOR CONTROL</b>			<b>9</b>				
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)									
<b>Total : 45 PERIODS</b>									
<b>Course Outcomes:</b>								<b>BLOOM'S Taxonomy</b>	
At the end of this course, the students will have the ability to									
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
<b>REFERENCE BOOKS:</b>									
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 publishing company Ltd., New Delhi, 2002
3.	K. Venkataratnam ,Special Electrical Machines, Universities Press, 2014.
4.	Steve Furber, 'ARM system on chip architecture', Addison 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
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<a href="https://onlinecourses.nptel.ac.in/noc22_ee94/">https://onlinecourses.nptel.ac.in/noc22_ee94/</a>	
<b>VIDEO REFERENCES:</b>	
<a href="https://www.youtube.com/watch?v=31hUDWjzLjY">https://www.youtube.com/watch?v=31hUDWjzLjY</a>	
<a href="https://www.youtube.com/watch?v=Gkp753foAgE">https://www.youtube.com/watch?v=Gkp753foAgE</a>	

Mapping of COs with POs and PSOs						
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	-
<b>Avg.</b>	<b>1.66</b>	<b>1.5</b>	<b>2.7</b>	<b>1</b>	<b>2.7</b>	<b>2</b>
1–Low, 2 –Medium, 3–High.						

*Beyond Knowledge*



<b>ME23MC701</b>		<b>UNIVERSAL HUMAN VALUES AND ETHICS</b>			<b>Version: 1.0</b>				
<b>(COMMON to ALL BRANCHES)</b>									
<b>Programme &amp; Branch</b>		<b>M.E. EMBEDDED SYSTEM TECHNOLOGIES</b>			<b>CP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>			
<b>Course Objectives:</b>									
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.								
<b>UNIT-I</b>		<b>INTRODUCTION TO VALUE EDUCATION</b>			<b>9</b>				
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).									
<b>UNIT-II</b>		<b>HARMONY IN THE HUMAN BEING</b>			<b>9</b>				
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).									
<b>UNIT- III</b>		<b>HARMONY IN THE FAMILY AND SOCIETY</b>			<b>9</b>				
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).									
<b>UNIT - IV</b>		<b>HARMONY IN THE NATURE/EXISTENCE</b>			<b>9</b>				
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).									
<b>UNIT-V</b>		<b>IMPLICATIONS OF THE HOLISTIC UNDERSTANDING - A LOOK AT PROFESSIONAL ETHICS</b>			<b>9</b>				
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).									
		<b>OPEN ENDED PROBLEMS / QUESTIONS</b>							
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.									
<b>Total : 45 PERIODS</b>									



<b>Course Outcomes: Upon completion of this course the students will be able to:</b>		<b>BLOOM'S Taxonomy</b>
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.	<a href="https://www.youtube.com/c/UniversalHumanValues">https://www.youtube.com/c/UniversalHumanValues</a>
2.	<a href="https://www.youtube.com/watch?v=OgdNx0X923I">https://www.youtube.com/watch?v=OgdNx0X923I</a>

**WEB REFERENCES:**

1.	<a href="http://www.storyofstuff.com">http://www.storyofstuff.com</a>
2.	<a href="https://fdp-si.aicte-india.org/UHVII.php">https://fdp-si.aicte-india.org/UHVII.php</a>

**ONLINE COURSES:**

1.	<a href="https://nptel.ac.in/courses/109104068">https://nptel.ac.in/courses/109104068</a>
2.	<a href="https://uhv.org.in/course">https://uhv.org.in/course</a>

**Mapping of COs with POs and PSOs**

COs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2						2		
CO2								2						
CO3						3								
CO4								3				2		
CO5						3			2					
<b>Average</b>						<b>2.6</b>		<b>2.5</b>	<b>2</b>			<b>2</b>		

1-Low, 2 -Medium, 3-High.

		<b>EMBEDDED SYSTEMS- II LABORATORY</b>			<b>Version : 1.0</b>		
<b>Programme &amp; Branch</b>	<b>M.E. EMBEDDED SYSTEM TECHNOLOGIES</b>	<b>C</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	
		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>	
<b>Course Objectives:</b>							
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.						
<b>List of Experiments / Exercises</b>							
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						
<b>Total : 60 PERIODS</b>							
<b>Course Outcomes:</b> At the end of this course, the students will have the ability to						<b>BLOOM'S Taxonomy</b>	
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
<b>REFERENCE BOOKS:</b>		
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						
CO	PO					
	PO1	PO2	PO3	PO4	PO5	PO6
<b>1</b>	1	3	1	1	2	1
<b>2</b>	-	1	2	-	-	-
<b>3</b>	1	-	3	2	3	-
<b>4</b>	2	2	3	3	3	3
<b>5</b>	3	2	3	3	3	3
<b>Avg</b>	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
<b>Course Objectives:</b>						
1	To Learn scientific paper reading and wiring skills					
2	To Learn the literature review and report writing skills					
3	To understand the research gap and formulation of the research problem					
<b>The work involves the following steps:</b>						
<p>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</p>						
<b>Evaluation method:</b>						
<p>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.</p>						
						<b>Total : 30 PERIODS</b>
<b>Course Outcomes:</b>						<b>BLOOM'S Taxonomy</b>
At the end of this course, the students will demonstrate the ability to						
CO1	<b>Write</b> a scientific review paper in their field					L3 - Apply
CO2	<b>Identify</b> the research gap and formulate the research problem					L3 - Apply



**Audit courses I & II**

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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
<b>Course Objectives:</b>							
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						
<b>UNIT-I</b>	<b>INTRODUCTION TO RESEARCH PAPER WRITING</b>		<b>6</b>				
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).							
<b>UNIT-II</b>	<b>PRESENTATION SKILLS</b>		<b>6</b>				
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).							
<b>UNIT-III</b>	<b>TITLE WRITING SKILLS</b>		<b>6</b>				
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).							
<b>UNIT-IV</b>	<b>RESULT WRITING SKILLS</b>		<b>6</b>				
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).							
<b>UNIT-V</b>	<b>VERIFICATION SKILLS</b>		<b>6</b>				
Useful phrases (L1), checking Plagiarism (L1), how to ensure paper is as good as it could possibly be the first- time submission (L1).							
<b>TOTAL: 45 PERIODS</b>							

## 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.



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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
<b>Course Objectives:</b>									
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								
<b>UNIT-I</b>		<b>INTRODUCTION</b>					<b>6</b>		
Disaster: Definition(L1), Factors and Significance(L1); Difference between Hazard And Disaster(L2); Natural and Manmade Disasters: Difference, Nature, Types and Magnitude(L1).									
<b>UNIT-II</b>		<b>REPERCUSSIONS OF DISASTERS AND HAZARDS</b>					<b>6</b>		
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).									
<b>UNIT-III</b>		<b>DISASTER PRONE AREAS IN INDIA</b>					<b>6</b>		
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)									
<b>UNIT-IV</b>		<b>DISASTER PREPAREDNESS AND MANAGEMENT</b>					<b>6</b>		
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).									
<b>UNIT-V</b>		<b>RISK ASSESSMENT</b>					<b>6</b>		
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)									
<b>TOTAL: 45 PERIODS</b>									

<b>OPEN ENDED PROBLEMS /QUESTIONS</b>		
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		
<b>Course Outcomes:</b> <b>Upon completion of this course the students will be able to:</b>		<b>BLOOMS Taxonomy</b>
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
<b>TEXTBOOKS:</b>		
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.	
<b>REFERENCE BOOKS:</b>		
1.	Sahni, Pradeep Et.Al. ,” Disaster Mitigation Experiences And Reflections”, Prentice Hall OfIndia, New Delhi, 2001.	



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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			
<b>Course Objectives:</b>									
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								
<b>UNIT-I</b>		<b>HISTORY OF MAKING OF THE INDIAN CONSTITUTION</b>			<b>6</b>				
History(L1), Drafting Committee(L1), (Composition & Working)									
<b>UNIT-II</b>		<b>PHILOSOPHY OF THE INDIAN CONSTITUTION</b>			<b>6</b>				
Preamble (L1), Salient Features (L1).									
<b>UNIT-III</b>		<b>CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES</b>			<b>6</b>				
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).									
<b>UNIT-IV</b>		<b>ORGANS OF GOVERNANCE</b>			<b>6</b>				
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).									
<b>UNIT-V</b>		<b>LOCAL ADMINISTRATION</b>			<b>6</b>				
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).									
<b>UNIT-VI</b>		<b>ELECTION COMMISSION</b>			<b>6</b>				
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)									
<b>Total:- 45 PERIODS</b>									
<b>OPEN ENDED PROBLEMS /QUESTIONS</b>									
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									

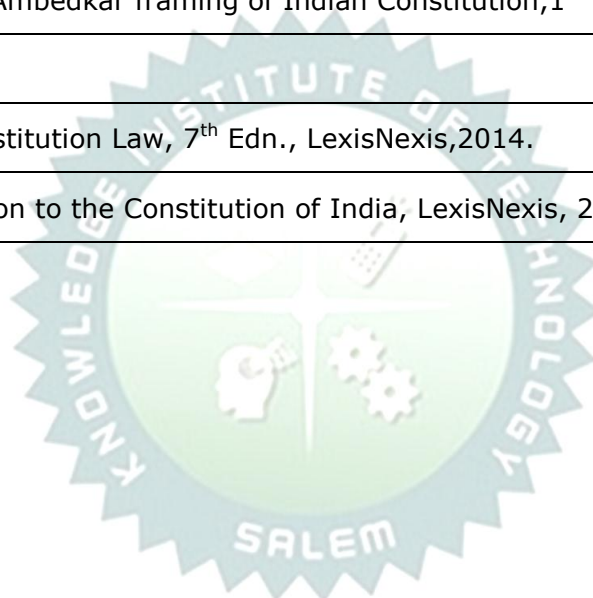
<b>Course Outcomes: Upon completion of this course the students will be able to:</b>		<b>BLOOMS Taxonomy</b>
CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	L2 – Understand
CO2	Discuss the intellectual origins of 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,1 <sup>st</sup> Edition, 2015.

**REFERENCE BOOKS:**

1.	M.P. Jain, Indian Constitution Law, 7 <sup>th</sup> Edn., LexisNexis,2014.
2.	D.D. Basu, Introduction to the Constitution of India, LexisNexis, 2015.



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ME23AC704	நற்றமிழ் இலக்கியம்	Version: 1.0				
(COMMON TO ALL BRANCHES)						
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		2	2	0	0	0
<b>Course Objectives:</b>						
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.					
<b>UNIT-I</b>	சங்க இலக்கியம்				<b>6</b>	
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)						
<b>UNIT-II</b>	அறநெறித்தமிழ்				<b>6</b>	
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)						
<b>UNIT-III</b>	இரட்டைக்காப்பியங்கள்				<b>6</b>	
1. கண்ணகியின் புரட்சி- சிலப்பதிகார வழக்குரை காதை (L1)						
2. சமூக சேவை இலக்கியம் மணிமேகலை - சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை (L1)						
<b>UNIT-IV</b>	அருள்நெறித்தமிழ்				<b>6</b>	
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)						
ஆகியவை பற்றிய செய்திகள் (L2)						
<b>UNIT-V</b>	நவீன தமிழ் இலக்கியம்				<b>6</b>	
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)
<b>Total: 30 PERIODS</b>

<b>Course Outcomes: Upon completion of this course the students will be able to:</b>		<b>BLOOMS Taxonomy</b>
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) - <a href="http://www.tamilvu.org">www.tamilvu.org</a> .
2.	தமிழ் விக்கிப்பீடியா (Tamil Wikipedia) - <a href="https://ta.wikipedia.org">https://ta.wikipedia.org</a> .
3.	தர்மபுர ஆதீன வெளியீடு.
4.	வாழ்வியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்.
5.	தமிழ்க்கலைக்களஞ்சியம் - தமிழ் வளர்ச்சித்துறை ( <a href="http://thamilvalarchithurai.com">thamilvalarchithurai.com</a> ).
6.	அறிவியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்.

*Beyond Knowledge*



*Beyond Knowledge*



ME23ET401	Wireless And Mobile Communication				Version: 1.0				
(COMMON TO ALL BRANCHES)									
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES				CP	L	T	P	C
					3	3	0	0	3
<b>Course Objectives:</b>									
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.								
<b>UNIT-I</b>	<b>THE CELLULAR CONCEPT</b>				<b>9</b>				
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).									
<b>UNIT-II</b>	<b>MOBILE RADIO PROPAGATION: LARGE-SCALE PATH LOSS:</b>				<b>9</b>				
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)									
<b>UNIT- III</b>	<b>MOBILE RADIO PROPAGATION</b>				<b>9</b>				
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)									
<b>UNIT - IV</b>	<b>WIDEBAND CODE DIVISION MULTIPLE ACCESS</b>				<b>9</b>				
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).									
<b>UNIT-V</b>	<b>IP MOBILITY FRAMEWORK</b>				<b>9</b>				
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).									
<b>Total: 45 PERIODS</b>									
<b>Course Outcomes:</b>					<b>BLOOM'S</b>				

Upon completion of this course, the students will be able to:		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://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 and PSOs						
CO	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						
<b>AVG</b>	3	3	2	2	2	2
1-Low, 2 -Medium, 3-High.						

ME23ET402		VIRTUAL INSTRUMENTATION					Version: 1.0				
(COMMON TO ALL BRANCHES)											
Programme & Branch		M.E. EMBEDDED SYSTEM TECHNOLOGIES					CP	L	T	P	C
							3	3	0	0	3
<b>Course Objectives:</b>											
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.										
<b>UNIT-I</b>		<b>FUNDAMENTALS OF VIRTUAL INSTRUMENTATION</b>					<b>9</b>				
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)											
<b>UNIT-II</b>		<b>PROGRAMMING STRUCTURES</b>					<b>9</b>				
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).											
<b>UNIT- III</b>		<b>DATA ACQUISITION AND INTERFACING STANDARDS</b>					<b>9</b>				
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).											
<b>UNIT - IV</b>		<b>ADVANCED PROGRAMMING</b>					<b>9</b>				
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)											
<b>UNIT-V</b>		<b>CASE STUDIES</b>					<b>9</b>				
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).											
<b>Total: 45 PERIODS</b>											
<b>Course Outcomes:</b>						<b>BLOOM'S Taxonomy</b>					
<b>Upon completion of this course, the students will be able to:</b>											
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 s	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 VIEW, 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 Programming, 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 Application, CRC Press, 2000

**WEB REFERENCES:**

<https://mycourses.aalto.fi/course/view.php?id=32114>

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

**ONLINE COURSES:**

<https://nielit.gov.in/calicut/calicut/content/online-course-labview-industrial-applications>

<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 and PSOs						
CO	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
<b>AVG</b>	2	2.5	2.4	2.75	2	2
1-Low, 2 -Medium, 3-High.						

ME23ET403	EMBEDDED PROCESSOR DEVELOPMENT				Version: 1.0				
(COMMON TO ALL BRANCHES)									
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES				CP	L	T	P	C
					3	3	0	0	3
<b>Course Objectives:</b>									
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.								
<b>UNIT-I</b>	<b>EMBEDDED CONCEPTS</b>				<b>9</b>				
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)									
<b>UNIT-II</b>	<b>ARM ARCHITECTURE AND OVERVIEW OF CORTEX</b>				<b>9</b>				
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)									
<b>UNIT- III</b>	<b>CORTEX-M3/M4 PROGRAMMING</b>				<b>9</b>				
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).									
<b>UNIT - IV</b>	<b>UNIFIED MODELING LANGUAGE</b>				<b>9</b>				
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).									
<b>UNIT-V</b>	<b>EMBEDDED SOFTWARE DEVELOPMENT TOOLS AND RTOS</b>				<b>9</b>				
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).									
<b>Total: 45 PERIODS</b>									
<b>Course Outcomes:</b>					<b>BLOOM'S</b>				
<b>Upon completion of this course, the students will be able to:</b>					<b>Taxonomy</b>				



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, Chris 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.

**WEB REFERENCES:**

<https://www.tutorialspoint.com/uml/index.htm>

<https://www.arm.com/architecture>

**ONLINE COURSES:**

[https://onlinecourses.nptel.ac.in/noc22\\_cs93](https://onlinecourses.nptel.ac.in/noc22_cs93)

[https://onlinecourses.nptel.ac.in/noc19\\_cs48/](https://onlinecourses.nptel.ac.in/noc19_cs48/)

**VIDEO REFERENCES:**

<https://www.youtube.com/watch?v=3OmyM4-zuQw>

<https://www.youtube.com/watch?v=uFhDGagZzjs>

[https://www.youtube.com/watch?v=t5SuR0rbAxA&list=PLrgz73xxhUkPBK2de3CuRb7F3zKh\\_sqUp](https://www.youtube.com/watch?v=t5SuR0rbAxA&list=PLrgz73xxhUkPBK2de3CuRb7F3zKh_sqUp)

Mapping of COs with POs and PSOs						
CO	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	
<b>AVG</b>	2.33	3	2.4	2	2.75	3
1-Low, 2 -Medium, 3-High.						



ME23ET404		AUTOMOTIVE EMBEDDED SYSTEM					Version: 1.0				
(COMMON TO ALL BRANCHES)											
Programme & Branch		M.E. EMBEDDED SYSTEM TECHNOLOGIES					CP	L	T	P	C
							3	3	0	0	3
<b>Course Objectives:</b>											
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.										
<b>UNIT-I</b>		<b>BASIC ELECTRONIC ENGINE CONTROL SYSTEMS</b>					<b>9</b>				
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).											
<b>UNIT-II</b>		<b>SENSORS AND ACTUATORS FOR AUTOMOTIVES</b>					<b>9</b>				
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).											
<b>UNIT- III</b>		<b>VEHICLE MANAGEMENT SYSTEMS</b>					<b>9</b>				
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).											
<b>UNIT - IV</b>		<b>ONBOARD DIAGNOSTICS AND TELEMATICS</b>					<b>9</b>				
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)											
<b>UNIT-V</b>		<b>ELECTRIC VEHICLES</b>					<b>9</b>				
Electric vehicles (L2)-Components(L2)- Plug-in Electrical Vehicle(L2)- Charging station(L2) - Aggregator(L2) - Autonomous vehicles(L2)											
										<b>Total: 45 PERIODS</b>	
<b>Course Outcomes:</b>										<b>BLOOM'S</b>	
<b>Upon completion of this course, the students will be able to:</b>										<b>Taxonomy</b>	
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									L3 - Apply	

	with ECU	
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

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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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<a href="https://onlinecourses.nptel.ac.in/noc21_ee112/">https://onlinecourses.nptel.ac.in/noc21_ee112/</a>

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<a href="https://www.youtube.com/watch?v=V004WUdpHeA&amp;list=PLIYm0-ZdZRLYSylFinxkspWmcgNvbtl">https://www.youtube.com/watch?v=V004WUdpHeA&amp;list=PLIYm0-ZdZRLYSylFinxkspWmcgNvbtl</a>
<a href="https://www.youtube.com/watch?v=L2HbpEMfryM&amp;list=PLp6ek2hDcoNCROoQbG05xNfiBEY7492Vn">https://www.youtube.com/watch?v=L2HbpEMfryM&amp;list=PLp6ek2hDcoNCROoQbG05xNfiBEY7492Vn</a>

Mapping of COs with POs and PSOs						
CO	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
<b>AVG</b>	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				
(COMMON TO ALL BRANCHES)						
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3
<b>Course Objectives:</b>						
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.					
<b>UNIT-I</b>	<b>ARTIFICIAL NEURAL NETWORK &amp; FUZZY LOGIC:</b>	<b>9</b>				
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.						
<b>UNIT-II</b>	<b>GENETIC ALGORITHM</b>	<b>9</b>				
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						
<b>UNIT- III</b>	<b>HYBRID CONTROL SCHEMES</b>	<b>9</b>				
Fuzzification and rule base using ANN-Neuro-fuzzy systems-ANFIS-Optimization of membership function and rule base using Genetic Algorithm and Particle Swarm Optimization...						
<b>UNIT - IV</b>	<b>AUTOMATION</b>	<b>9</b>				
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.						
<b>UNIT-V</b>	<b>INTELLIGENT CONTROLLER FOR AUTOMATION APPLICATION</b>	<b>9</b>				
Applications of Intelligent controllers in Industrial Monitoring, optimization, and control- Smart Appliances- Automation concept for Electrical vehicle- Intelligent controller and Automation for Power Systems.						
<b>Total: 45 PERIODS</b>						
<b>Course Outcomes:</b> <b>Upon completion of this course, the students will be able to:</b>					<b>BLOOM'S Taxonomy</b>	
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
<b>REFERENCE BOOKS:</b>		
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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<b>ONLINE COURSES:</b>		
<a href="https://onlinecourses.nptel.ac.in/noc21_ge07/">https://onlinecourses.nptel.ac.in/noc21_ge07/</a>		
<a href="https://nptel.ac.in/courses/117105084">https://nptel.ac.in/courses/117105084</a>		
<b>VIDEO REFERENCES:</b>		
<a href="https://www.youtube.com/watch?v=xwUKQcT1bKc&amp;list=PLbRMhDVUMngeASctgzkLEIpgFNZmWwqRI">https://www.youtube.com/watch?v=xwUKQcT1bKc&amp;list=PLbRMhDVUMngeASctgzkLEIpgFNZmWwqRI</a>		
<a href="https://www.youtube.com/watch?v=IZWTduVCrf8&amp;list=PLBEDalwGmREACEgLEgEefy6PXRN5aZCW_">https://www.youtube.com/watch?v=IZWTduVCrf8&amp;list=PLBEDalwGmREACEgLEgEefy6PXRN5aZCW_</a>		
<a href="https://www.youtube.com/watch?v=xbYgKoG4x2g&amp;list=PL3EA65335EAC29EE8">https://www.youtube.com/watch?v=xbYgKoG4x2g&amp;list=PL3EA65335EAC29EE8</a>		

Mapping of COs with POs and PSOs						
CO	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
<b>AVG</b>	2.4	1.75	2.2	2.2	3	1.67
1-Low, 2 -Medium, 3-High.						

ME23ET406		UNMANNED AERIAL VEHICLE			Version: 1.0				
(COMMON TO ALL BRANCHES)									
Programme & Branch		M.E. EMBEDDED SYSTEM TECHNOLOGIES			CP	L	T	P	C
		3	3	0	0	3			
<b>Course Objectives:</b>									
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								
<b>UNIT-I</b>		<b>INTRODUCTION TO UAV</b>			<b>9</b>				
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)									
<b>UNIT-II</b>		<b>THE DESIGN OF UAV SYSTEMS</b>			<b>9</b>				
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).									
<b>UNIT- III</b>		<b>HARDWARE FOR UAVs</b>			<b>9</b>				
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)									
<b>UNIT - IV</b>		<b>COMMUNICATION PAYLOADS AND CONTROLS</b>			<b>9</b>				
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)									
<b>UNIT-V</b>		<b>THE DEVELOPMENT OF UAV SYSTEMS</b>			<b>9</b>				
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).									
							<b>Total: 45 PERIODS</b>		
<b>Course Outcomes:</b>							<b>BLOOM'S</b>		
<b>Upon completion of this course, the students will be able to:</b>							<b>Taxonomy</b>		
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			

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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
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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. Fauset, "Fundamentals of Neural Networks, Architecture, Algorithms, and Applications", Pearson Education, 2008

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[https://www.youtube.com/watch?v=Sfg7cbfSUdc&list=PL\\_Vndgv2m9Hzifu5K32-BY5ILAI8Z7IGE](https://www.youtube.com/watch?v=Sfg7cbfSUdc&list=PL_Vndgv2m9Hzifu5K32-BY5ILAI8Z7IGE)

Mapping of COs with POs and PSOs						
CO	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
<b>AVG</b>	2.5	3	2.6	3	3	2.4
1-Low, 2 -Medium, 3-High.						



ME23ET407	DSP-BASED SYSTEM DESIGN				Version: 1.0				
(COMMON TO ALL BRANCHES)									
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES				CP	L	T	P	C
					3	3	0	0	3
<b>Course Objectives:</b>									
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								
<b>UNIT-I</b>	<b>REPRESENTATION OF DSP SYSTEM</b>				<b>9</b>				
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).									
<b>UNIT-II</b>	<b>DSP ALGORITHMS</b>				<b>9</b>				
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).									
<b>UNIT- III</b>	<b>SYSTEM ARCHITECTURE</b>				<b>9</b>				
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)									
<b>UNIT - IV</b>	<b>ARCHITECTURE ANALYSIS ON PROGRAMMABLE HARDWARE</b>				<b>9</b>				
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).									
<b>UNIT-V</b>	<b>SYSTEM INTERFACING</b>				<b>9</b>				
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).									
<b>Total: 45 PERIODS</b>									
<b>Course Outcomes:</b>								<b>BLOOM'S</b>	
<b>Upon completion of this course, the students will be able to:</b>								<b>Taxonomy</b>	
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

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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.
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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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[https://www.youtube.com/watch?v=0ENnxVXEv\\_U&list=PL0zRYVm0a65cU4xstihnbnrCPHenmJJ7f](https://www.youtube.com/watch?v=0ENnxVXEv_U&list=PL0zRYVm0a65cU4xstihnbnrCPHenmJJ7f)

Mapping of COs with POs and PSOs						
CO	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
<b>AVG</b>	2.67	3	3	2.33	3	2.67
1-Low, 2 -Medium, 3-High.						

ME23ET408		MACHINE LEARNING AND DEEP LEARNING			Version : 1.0				
(COMMON TO ALL BRANCHES)									
Programme & Branch		M.E. EMBEDDED SYSTEM TECHNOLOGIES			CP	L	T	P	C
					3	0	0	0	3
<b>Course Objectives:</b>									
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.								
<b>UNIT-I</b>		<b>LEARNING PROBLEMS AND ALGORITHMS</b>			<b>9</b>				
Various paradigms of learning problems(L2), Supervised, Semi-supervised and Unsupervised algorithms(L2)									
<b>UNIT-II</b>		<b>NEURAL NETWORKS</b>			<b>9</b>				
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)									
<b>UNIT- III</b>		<b>MACHINE LEARNING – FUNDAMENTALS &amp; FEATURE SELECTIONS &amp; CLASSIFICATIONS</b>			<b>9</b>				
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).									
<b>UNIT - IV</b>		<b>DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS</b>			<b>9</b>				
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).									
<b>UNIT-V</b>		<b>DEEP LEARNING: RNNS, AUTOENCODERS AND GANS</b>			<b>9</b>				
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).									
<b>Total : 45 PERIODS</b>									
<b>Course Outcomes:</b>								<b>BLOOM'S Taxonomy</b>	
<b>Upon completion of this course the students will be able to:</b>									
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		

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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.
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**VIDEO REFERENCES:**

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Mapping of COs with POs and PSOs						
CO	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	
<b>AVG</b>	2.42	3	2.57		3	
1-Low, 2 -Medium, 3-High.						



**Open Elective  
Courses I & II**

*Beyond Knowledge*

ME23ET501	IoT FOR SMART SYSTEMS	Version : 1.0				
(COMMON TO ALL BRANCHES)						
Programme & Branch	M.E. EMBEDDED SYSTEM TECHNOLOGIES	CP	L	T	P	C
		3	3	0	0	3
<b>Course Objectives:</b>						
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					
<b>UNIT-I</b>	<b>INTRODUCTION TO INTERNET OF THINGS</b>	<b>9</b>				
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).						
<b>UNIT-II</b>	<b>IOT ARCHITECTURE</b>	<b>9</b>				
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).						
<b>UNIT- III</b>	<b>PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT PROTOCOLS:</b>	<b>9</b>				
NFC, SCADA and RFID, Zigbee, MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIE, GSM, CDMA, LTE, GPRS, small cell(L2). <b>Wireless technologies for IoT:</b> WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems-Recent trends. (L2)						
<b>UNIT - IV</b>	<b>IOT PROCESSORS</b>	<b>9</b>				
<b>Services/Attributes:</b> Big-Data Analytics for IOT, Dependability, Interoperability, Security, Maintainability. (L2)						
<b>Embedded processors for IOT :</b> Introduction to Python programming(L2) -Building IOT with RASPBERRY PI and Arduino(L3)						
<b>UNIT-V</b>	<b>CASE STUDIES</b>	<b>9</b>				
Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense(L3)						
					<b>Total : 45 PERIODS</b>	
<b>Course Outcomes:</b>					<b>BLOOM'S Taxonomy</b>	
At the end of this course, the students will have the ability to						
CO1	Analyze the concepts of IoT and its present developments.				L3 - Apply	
CO2	Compare and contrast different platforms and infrastructures available for IoT				L2 - UnderstandS	
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	
<b>REFERENCE BOOKS:</b>						
1.	ArshdeepBahga and VijaiMadiseti : 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.	Linyang 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 Madiseti , ArshdeepBahga, “Internet of Things (A Hands on-Approach)”, 2014.
10.	Zach Shelby, Carsten Bormann, “6LoWPAN: The Wireless Embedded Internet”, John Wiley and sons, 2009.
11.	Lars T.Berger and Krzysztof Iniewski, “Smart Grid applications, communications and security”, Wiley, 2015.
12.	JanakaEkanayake, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama and Nick Jenkins, “ Smart Grid Technology and Applications”, Wiley, 2015.
13.	UpenaDalal, “Wireless Communications & Networks,Oxford,2015.

#### WEB REFERENCES:

<https://archive.nptel.ac.in/courses/106/105/106105166/>

<https://www.geeksforgeeks.org/architecture-of-internet-of-things-iot/>

#### ONLINE COURSES:

[https://onlinecourses.nptel.ac.in/noc22\\_cs53/](https://onlinecourses.nptel.ac.in/noc22_cs53/)

<https://www.udemy.com/course/internet-of-things-iot-fundamentals>

#### VIDEO REFERENCES:

[https://www.youtube.com/watch?v=WUYAjxnwjU4&list=PLE7VH8RC\\_N3bpVn-e8QzOAHziEgmjQ2qE](https://www.youtube.com/watch?v=WUYAjxnwjU4&list=PLE7VH8RC_N3bpVn-e8QzOAHziEgmjQ2qE)

<https://www.youtube.com/watch?v=urUBLmXFKI0&list=PLgMDNELGJ1CaBrefq-0eYatfOnoncW0y->

<https://www.youtube.com/watch?v=hdZzNOQV5vU>

Mapping of COs with POs and PSOs						
CO	PO					
	1	2	3	4	5	6
CO1	1	2	1			
CO2		2				
CO3	1	2		1	3	
CO4	2		3	3	3	3
CO5	3	2	3	3	3	3
<b>AVG</b>	1.75	2	2.33	2.33	3	2
1-Low, 2 -Medium, 3-High.						

ME23ET502		MACHINE LEARNING AND DEEP LEARNING			Version : 1.0				
(COMMON TO ALL BRANCHES)									
Programme & Branch		M.E. EMBEDDED SYSTEM TECHNOLOGIES			CP	L	T	P	C
					3	0	0	0	3
<b>Course Objectives:</b>									
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.								
<b>UNIT-I</b>		<b>LEARNING PROBLEMS AND ALGORITHMS</b>			<b>9</b>				
Various paradigms of learning problems(L2), Supervised, Semi-supervised and Unsupervised algorithms(L2)									
<b>UNIT-II</b>		<b>NEURAL NETWORKS</b>			<b>9</b>				
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)									
<b>UNIT- III</b>		<b>MACHINE LEARNING – FUNDAMENTALS &amp; FEATURE SELECTIONS &amp; CLASSIFICATIONS</b>			<b>9</b>				
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).									
<b>UNIT - IV</b>		<b>DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS</b>			<b>9</b>				
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).									
<b>UNIT-V</b>		<b>DEEP LEARNING: RNNS, AUTOENCODERS AND GANS</b>			<b>9</b>				
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).									
<b>Total : 45 PERIODS</b>									
<b>Course Outcomes:</b>								<b>BLOOM'S Taxonomy</b>	
<b>Upon completion of this course the students will be able to:</b>									
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:**

<https://archive.nptel.ac.in/courses/106/106/106106139/>

<https://archive.nptel.ac.in/courses/106/106/106106202/>

**ONLINE COURSES:**

<https://nptel.ac.in/courses/117105084>

[https://onlinecourses.nptel.ac.in/noc23\\_ee87/](https://onlinecourses.nptel.ac.in/noc23_ee87/)

**VIDEO REFERENCES:**

<https://www.youtube.com/watch?v=KshIEHQn5ZM>

<https://www.youtube.com/watch?v=TIFFfLejkcA>

[https://www.youtube.com/watch?v=4TC5s\\_xNKSs&list=PLYqSpQzTE6M9gCgajvQbc68Hk\\_JKGBAYT&index=2](https://www.youtube.com/watch?v=4TC5s_xNKSs&list=PLYqSpQzTE6M9gCgajvQbc68Hk_JKGBAYT&index=2)

Mapping of COs with POs and PSOs						
CO	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	
<b>AVG</b>	2.42	3	2.57		3	
1-Low, 2 -Medium, 3-High.						

ME23ET503		RENEWABLE ENERGY AND GRID INTEGRATION			Version : 1.0				
(COMMON TO ALL BRANCHES)									
Programme & Branch		M.E. EMBEDDED SYSTEM TECHNOLOGIES			CP	L	T	P	C
					3	0	0	0	3
<b>Course Objectives:</b>									
1	To provide knowledge about the different types of renewable energy technologies								
2	To provide knowledge on standalone operation, grid connected operation of renewable energy systems								
<b>UNIT-I</b>		<b>INTRODUCTION</b>			<b>9</b>				
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)									
<b>UNIT-II</b>		<b>SOLAR PHOTOVOLTAICS</b>			<b>9</b>				
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).									
<b>UNIT- III</b>		<b>PHOTOVOLTAIC SYSTEM DESIGN</b>			<b>9</b>				
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).									
<b>UNIT - IV</b>		<b>WIND ENERGY CONVERSION SYSTEMS</b>			<b>9</b>				
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).									
<b>UNIT-V</b>		<b>OTHER RENEWABLE ENERGY SOURCES</b>			<b>9</b>				
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).									
<b>Total : 45 PERIODS</b>									
<b>Course Outcomes:</b>								<b>BLOOM'S Taxonomy</b>	
<b>Upon completion of this course the students will be able to:</b>									
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	
<b>REFERENCE BOOKS:</b>									
1.	S.N.Bhadra, D. Kasta, & S. Banerjee "Wind Electrical Systems", Oxford University Press, 2009.								

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, 2006..

**WEB REFERENCES:**

[https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA-ETSAP\\_Tech\\_Brief\\_Power\\_Grid\\_Integration\\_2015.pdf](https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA-ETSAP_Tech_Brief_Power_Grid_Integration_2015.pdf)

<https://www.nrel.gov/docs/fy15osti/63033.pdf>

**ONLINE COURSES:**

<https://www.coursera.org/learn/renewable-power-electricity-systems>

<https://nptel.ac.in/courses/103103206>

**VIDEO REFERENCES:**

[https://www.youtube.com/watch?v=mh51mAUexK4&list=PLwdnzIV3ogoXUifhvYB65ILJCZ74o\\_fAk](https://www.youtube.com/watch?v=mh51mAUexK4&list=PLwdnzIV3ogoXUifhvYB65ILJCZ74o_fAk)

<https://www.youtube.com/watch?v=cGHIV0EavaQ>

Mapping of COs with POs and PSOs						
CO	PO					
	1	2	3	4	5	6
CO1	3		2	2	2	1
CO2	3		2	3	3	3
CO3	3		2	3	3	3
CO4	3		2	3	3	2
CO5	3		2	2	2	1
<b>AVG</b>	3		2			

1-Low, 2 -Medium, 3-High.

*Beyond Knowledge*



ME23ET504		SMART GRID				Version : 1.0			
(COMMON TO ALL BRANCHES)									
Programme & Branch		M.E. EMBEDDED SYSTEM TECHNOLOGIES			CP	L	T	P	C
					3	0	0	0	3
<b>Course Objectives:</b>									
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								
<b>UNIT-I</b>		<b>INTRODUCTION TO SMART GRID</b>				<b>9</b>			
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).									
<b>UNIT-II</b>		<b>SMART GRID TECHNOLOGIES</b>				<b>9</b>			
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)									
<b>UNIT- III</b>		<b>SMART METERS AND ADVANCED METERING INFRASTRUCTURE</b>				<b>9</b>			
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).									
<b>UNIT - IV</b>		<b>POWER QUALITY MANAGEMENT IN SMART GRID</b>				<b>9</b>			
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).									
<b>UNIT-V</b>		<b>HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS</b>				<b>9</b>			
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).									
<b>Total : 45 PERIODS</b>									
<b>Course Outcomes:</b>								<b>BLOOM'S Taxonomy</b>	
<b>Upon completion of this course the students will be able to:</b>									
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
<b>REFERENCE BOOKS:</b>		
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.	
<b>WEB REFERENCES:</b>		
<a href="https://www.researchgate.net/publication/224078022_Power_Quality_and_EM_C_in_Smart_Grid">https://www.researchgate.net/publication/224078022_Power_Quality_and_EM_C_in_Smart_Grid</a>		
<a href="https://amity.edu/icactm/Proceeding/Paper%20Index%20Content/24%20T4%20P9%20ID%209.pdf">https://amity.edu/icactm/Proceeding/Paper%20Index%20Content/24%20T4%20P9%20ID%209.pdf</a>		
<b>ONLINE COURSES:</b>		
<a href="https://onlinecourses.nptel.ac.in/noc21_ee68">https://onlinecourses.nptel.ac.in/noc21_ee68</a>		
<a href="https://onlinecourses.nptel.ac.in/noc23_ee124/">https://onlinecourses.nptel.ac.in/noc23_ee124/</a>		
<b>VIDEO REFERENCES:</b>		
<a href="https://www.youtube.com/watch?v=KgVFJnmJvKk&amp;list=PLSJzHGpGe6lP5biCvZrtQdHf80tnSXRBr">https://www.youtube.com/watch?v=KgVFJnmJvKk&amp;list=PLSJzHGpGe6lP5biCvZrtQdHf80tnSXRBr</a>		
<a href="https://archive.nptel.ac.in/noc/courses/noc20/SEM2/noc20-ee65/">https://archive.nptel.ac.in/noc/courses/noc20/SEM2/noc20-ee65/</a>		

Mapping of COs with POs and PSOs						
CO	PO					
	1	2	3	4	5	6
CO1	3	2		2	2	2
CO2	3		2	2		2
CO3	2		1			2
CO4	1			3	3	1
CO5		2	2	2	2	3
<b>AVG</b>	2.25	2	1.66	2.25	2.3	2

1-Low, 2 -Medium, 3-High.

**Note:**

Syllabus for courses offered from 2<sup>nd</sup> to 4th Semester will be added after the approval of Board of Studies (BoS) and Academic Council (AC) in due course.



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