KSR College of Engineering

AN AUTONOMOUS INSTITUTION

NAAC ACCREDITED A++ | NBA ACCREDITED PROGRAMMES

25 Years KSRCE 2001 – 2026 Celebrating Academic Excellence

M.E. - EMBEDDED SYSTEM TECHNOLOGIES

REGULATIONS 2024

(Academic Year 2024-25 Onwards)

Curriculum & Syllabus

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215

(Autonomous)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

(REGULATIONS 2024)

Vision of the Institution

IV	To become a globally renowned institution in Engineering and Management, committed to providing holistic education that fosters research, innovation, and sustainable development.

Mission of the Institution

IM 1	Deliver value-based quality education through modern pedagogy and experiential learning.
IM 2	Enrich Engineering and Managerial Skills through cutting-edge laboratories to meet evolving global demands.
IM 3	Empower research and innovation by integrating collaboration, social responsibility, and commitment to sustainable development.

Vision of the Department

DV	To produce competent Electrical and Electronics Engineers driving sustainable solutions through quality education and research.

Mission of the Department

DM 1	Provide transformative education in Electrical and Electronics Engineering by integrating modern pedagogy and technology-enhanced learning.
DM 2	Deliver holistic, value-driven education through cutting-edge laboratory facilities that meet the evolving needs of global industries.
DM 3	Promote collaborative and interdisciplinary research to develop sustainable solutions.

Programme Educational Objectives (PEOs): M.E. - Embedded System Technologies

The graduates of the programme will be able to

PEO 1	**Technical Excellence:** Design and develop Embedded system automation based on dedicated ICs that have computation, networking, and control capacity.
PEO 2	**Research and Innovation:** Conduct research and apply innovative problem-solving techniques, leading to the creation of cutting-edge embedded systems that address complex challenges in industry and academia, thereby contributing to technological progress.
PEO 3	**Career Development:** Exhibit leadership qualities and ethical practices, positioning themselves as experts in the field of embedded systems while continuously pursuing professional development opportunities to stay abreast of technological advancements.

Chairman (BoS)

Programme Outcomes (POs) of M.E. - Embedded System Technologies

Program Outcomes (POs)	
PO1	An ability to independently carry out research/investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4	**Technical Excellence:** Design and develop Embedded system automation based on dedicated ICs that have computation, networking and control capacity.
PO5	**Research and Innovation:** Develop skills in professional software languages, modeling and analysis tools, communication protocols and computation platforms to drive innovative research and advance the design of automated systems.

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215

Chairman (BoS)

	K.S.R. COLLEGE OF ENGINEERING (Autonomous) Approved by AICTE and Affiliated to Anna University, Chennai Accredited by NAAC ('A++' Grade) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	Curriculum PG R - 2024
Department	Department of Electrical and Electronics Engineering	
Programme	M.E. - Embedded System Technologies	

SEMESTER – I

S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	P	SL	Tot.	C= T/30	CA	ES	Tot.
THEORY COURSES												
1	MA24T17	Applied Mathematics (Common to PE, ET & CU)	FC	45	15	0	60	120	4	40	60	100
2	RM24T09	Research Methodology and IPR	RMC	45	0	0	45	90	3	40	60	100
3	ET24T11	Design of Embedded Systems	PCC	45	0	0	45	90	3	40	60	100
4	ET24T12	Software for Embedded Systems	PCC	45	0	0	45	90	3	40	60	100
5	-	*Professional Elective – I*	*PEC*	*45*	*0*	*0*	*45*	*90*	*3*	*40*	*60*	*100*
6	-	Professional Elective – II	PEC	45	0	0	45	90	3	40	60	100
LABORATORY COURSES												
7	ET24P11	Embedded System Laboratory – I	PCC	0	0	60	0	60	2	60	40	100
8	ET24P12	Embedded Programming Laboratory	PCC	0	0	60	0	60	2	60	40	100
			TOTAL	**270**	**15**	**120**	**285**	**690**	**23**	**800**		

SEMESTER – II

S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	P	SL	Tot.		CA	ES	Tot.
THEORY COURSES												
1	ET24T21	Real Time Operating System	PCC	45	0	0	45	90	3	40	60	100
2	ET24T22	Embedded System Networking	PCC	45	0	0	45	90	3	40	60	100
3	ET24T23	Embedded Control for Electric Drives	PCC	45	0	0	45	90	3	40	60	100
4	ET24T24	IoT for Smart Systems	PCC	45	0	0	45	90	3	40	60	100
5	--	Professional Elective – III	PEC	45	0	0	45	90	3	40	60	100
6	--	Professional Elective – IV	PEC	45	0	0	45	90	3	40	60	100
	LABORATORY COURSES											
7	ET24P21	Embedded System Laboratory – II	PCC	0	0	60	0	60	2	60	40	100
	EMPLOYABILITY ENHANCEMENT COURSES											
8	ET24P22	Technical Presentation	EEC	0	0	30	0	30	1	60	40	100
			TOTAL	**270**	**0**	**90**	**270**	**630**	**21**	**800**		

Chairman (BoS)
K.S.R. College of Engineering

SEMESTER – III													
S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	P	SL	Tot.	C= T/30	CA	ES	Tot.
THEORY COURSES													
1	ET24T31	RISC Processor Architecture and Programming	PCC	45	0	0	45	90	3	40	60	100
2	ET24T32	Embedded Product Development	PCC	45	0	0	45	90	3	40	60	100
3	--	Professional Elective – V	PEC	45	0	0	45	90	3	40	60	100
4	--	Open Elective	OEC	45	0	0	45	90	3	40	60	100
EMPLOYABILITY ENHANCEMENT COURSES													
5	ET24P31	Project Work Phase – I	EEC	0	0	180	0	180	6	60	40	100
AUDIT COURSES													
6	--	Audit Course	AC	30	0	0	0	30	0	100	--	100
TOTAL				**210**	**0**	**180**	**180**	**570**	**18**	**500**		

SEMESTER – IV												
S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	P	SL	Tot.	C= T/30	CA	ES	Tot.
EMPLOYABILITY ENHANCEMENT COURSES												
1	ET24P41	Project Work Phase – II	EEC	0	0	360	0	360	12	60	40	100
TOTAL				**0**	**0**	**360**	**0**	**360**	**12**	**100**		

TOTAL NO. OF CREDITS: 74

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 74

Note: PCC-Professional Core Courses, PEC-Professional Elective Courses, OEC- Open Elective Courses, EEC-Employability Enhancement Courses, AC- Mandatory Courses, FC-Foundation Courses, RMC - Research Methodology and IPR Courses

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses

	K.S.R. COLLEGE OF ENGINEERING (Autonomous) Approved by AICTE and Affiliated to Anna University, Chennai Accredited by NAAC ('A++' Grade) K.S.R. Kalvi Nagar, Tiruchengode - 637 215	Curriculum PG R - 2024
Department	Department of Electrical and Electronics Engineering	
Programme	M.E. -Embedded System Technologies	

FOUNDATION COURSES (FC)

S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	P	SL	Tot.	C= T/30	CA	ES	Tot.
1.	MA24T17	Applied Mathematics	FC	45	15	0	60	120	4	40	60	100
			TOTAL	45	15	0	60	120	4	100		

PROFESSIONAL CORE COURSES (PCC)

S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	P	SL	Tot.	C= T/30	CA	ES	Tot.
1.	ET24T11	Design of Embedded Systems	PCC	45	0	0	45	90	3	40	60	100
2.	ET24T12	Software for Embedded Systems	PCC	45	0	0	45	90	3	40	60	100
3.	ET24P11	Embedded System Laboratory – I	PCC	0	0	60	0	60	2	60	40	100
4.	ET24P12	Embedded Programming Laboratory	PCC	0	0	60	0	60	2	60	40	100
5.	ET24T21	Real Time Operating System	PCC	45	0	0	45	90	3	40	60	100
6.	ET24T22	Embedded System Networking	PCC	45	0	0	45	90	3	40	60	100
7.	ET24T23	Embedded Control for Electric Drives	PCC	45	0	0	45	90	3	40	60	100
8.	ET24T24	IoT for Smart Systems	PCC	45	0	0	45	90	3	40	60	100
9.	ET24P21	Embedded System Laboratory – II	PCC	0	0	60	0	60	2	60	40	100
10.	ET24T31	RISC Processor Architecture and Programming	PCC	45	0	0	45	90	3	40	60	100
11.	ET24T32	Embedded Product Development	PCC	45	0	0	45	90	3	40	60	100
			TOTAL	360	0	180	360	900	30	1100		

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	SL	P	Tot.	C= T/30	CA	ES	Tot.
1.	RM24T09	Research Methodology and IPR	RMC	45	0	45	0	90	3	40	60	100
			TOTAL	45	0	45	0	90	3	100		

Chairman (BoS)

K.S.R. College of Engineering. Tiruchengode. Centre for Academic Courses

EMPLOYABILITY ENHANCEMENT COURSES (EEC)													
S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	P	SL	Tot.	C= T/30	CA	ES	Tot.
1.	ET24P22	Technical Presentation	EEC	0	0	30	0	30	1	60	40	100
2.	ET24P31	Project Work Phase – I	EEC	0	0	180	0	180	6	60	40	100
3.	ET24P41	Project Work Phase – II	EEC	0	0	360	0	360	12	60	40	100
			TOTAL	0	0	570	0	570	19	300		

PROFESSIONAL ELECTIVE – I & II (SEMESTER I)												
S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	P	SL	Tot.	C= T/30	CA	ES	Tot.
1.	ET24E01	Wireless and Mobile Communication	PEC	45	0	0	45	90	3	40	60	100
2.	ET24E02	Robotics and Automation	PEC	45	0	0	45	90	3	40	60	100
3.	ET24E03	Embedded Processor Development	PEC	45	0	0	45	90	3	40	60	100
4.	ET24E04	System Design using Microcontroller (Common to PE & ET)	PEC	45	0	0	45	90	3	40	60	100
5.	ET24E05	Intelligent Control and Automation	PEC	45	0	0	45	90	3	40	60	100
6.	ET24E06	Renewable Energy and Grid Integration	PEC	45	0	0	45	90	3	40	60	100
7.	ET24E07	Electric Vehicles and Power Management	PEC	45	0	0	45	90	3	40	60	100
8.	ET24E08	Unmanned Aerial Vehicle	PEC	45	0	0	45	90	3	40	60	100
9.	ET24E09	DSP Based System Design	PEC	45	0	0	45	90	3	40	60	100
			TOTAL	405	0	0	405	810	27			900

PROFESSIONAL ELECTIVE – III & IV (SEMESTER II)												
S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	P	SL	Tot.	C= T/30	CA	ES	Tot.
1.	ET24E10	Automotive Embedded System	PEC	45	0	0	45	90	3	40	60	100
2.	ET24E11	Computer Vision	PEC	45	0	0	45	90	3	40	60	100
3.	ET24E12	Multimedia Communication	PEC	45	0	0	45	90	3	40	60	100
4.	ET24E13	Embedded Networking and Automation of Electrical System	PEC	45	0	0	45	90	3	40	60	100
5.	ET24E14	Smart System Design	PEC	45	0	0	45	90	3	40	60	100
6.	ET24E15	Embedded Computing	PEC	45	0	0	45	90	3	40	60	100
7.	ET24E16	Embedded Systems Security	PEC	45	0	0	45	90	3	40	60	100
8.	ET24E17	Machine Learning and Deep Learning	PEC	45	0	0	45	90	3	40	60	100
			TOTAL	360	0	0	360	720	24			800

Chairman (BoS)

PROFESSIONAL ELECTIVE – V (SEMESTER III)													
S. No.	**Course Code**	**Course Title**	**Category**	**Periods / Semester**					**Credit**	**Max. Marks**		
				L	**T**	**P**	**SL**	**Tot.**	**C= T/30**	**CA**	**ES**	**Tot.**
1.	ET24E18	Reconfigurable Processor and SoC Design	PEC	45	0	0	45	90	3	40	60	100
2.	ET24E19	MEMS and NEMS Technology	PEC	45	0	0	45	90	3	40	60	100
3.	ET24E20	Entrepreneurship Development	PEC	45	0	0	45	90	3	40	60	100
4.	ET24E21	Embedded System for Biomedical Applications	PEC	45	0	0	45	90	3	40	60	100
5.	ET24E22	Python Programming for Machine Learning	PEC	45	0	0	45	90	3	40	60	100
6.	ET24E23	VLSI Design and Reconfigurable Architecture	PEC	45	0	0	45	90	3	40	60	100
7.	PE24E16	Smart Grid (Common to PE & ET)	PEC	45	0	0	45	90	3	40	60	100
8.	PE24E22	Virtual Instrumentation System (Common to PE & ET)	PEC	45	0	0	45	90	3	40	60	100
			TOTAL	**360**	**0**	**0**	**360**	**720**	**24**			**800**

AUDIT COURSES (SEMESTER III)												
S. No.	**Course Code**	**Course Title**	**Category**	**Periods / Semester**					**Credit**	**Max. Marks**		
				L	**T**	**P**	**SL**	**Tot.**	**C= T/30**	**CA**	**ES**	**Tot.**
1.	AX24A01	Disaster Management	AC	30	0	0	30	60	0	100	--	100
2.	AX24A02	Value Education	AC	30	0	0	30	60	0	100	--	100
3.	AX24A03	Constitution of India	AC	30	0	0	30	60	0	100	--	100
4.	AX24A04	Indian Knowledge System	AC	30	0	0	30	60	0	100	--	100
			TOTAL	**120**	**0**	**0**	**120**	**240**	**0**	**---**		

Chairman (BoS)

OPEN ELECTIVES OFFERED BY OTHER PG PROGRAMMES												
S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	P	SL	Tot.	C= T/30	CA	ES	Tot.
1.	PE24O01	Switching Concepts and Power Semiconductor Devices	OEC	45	0	0	45	90	3	40	60	100
2.	PE24O02	Smart Grid Technology	OEC	45	0	0	45	90	3	40	60	100
3.	PE24O03	Renewable Energy Technology	OEC	45	0	0	45	90	3	40	60	100
4.	PE24O04	Energy Management and Conservation	OEC	45	0	0	45	90	3	40	60	100
5.	CM24O01	Energy Efficient Buildings	OEC	45	0	0	45	90	3	40	60	100
6.	CM24O02	Economics and Finance Management in Construction	OEC	45	0	0	45	90	3	40	60	100
7.	CM24O03	Stress management	OEC	45	0	0	45	90	3	40	60	100
8.	ST24O01	Principles of Sustainable Development	OEC	45	0	0	45	90	3	40	60	100
9.	ST24O02	Failure Analysis of Structures	OEC	45	0	0	45	90	3	40	60	100
10.	ST24O03	Smart materials and Smart Structures	OEC	45	0	0	45	90	3	40	60	100
11.	CU24O01	Principles of Multimedia	OEC	45	0	0	45	90	3	40	60	100
12.	CU24O02	IoT for Smart Systems	OEC	45	0	0	45	90	3	40	60	100
13.	CU24O03	MEMS and NEMS	OEC	45	0	0	45	90	3	40	60	100
14.	CU24O04	Introduction to Cognitive Radio Network	OEC	45	0	0	45	90	3	40	60	100

OPEN ELECTIVES OFFERED TO OTHER PG PROGRAMMES												
S. No.	Course Code	Course Title	Category	Periods / Semester					Credit	Max. Marks		
				L	T	P	SL	Tot.	C= T/30	CA	ES	Tot.
1.	ET24O01	Embedded Systems	OEC	45	0	0	45	90	3	40	60	100
2.	ET24O02	Embedded Control	OEC	45	0	0	45	90	3	40	60	100
3.	ET24O03	Embedded Automation	OEC	45	0	0	45	90	3	40	60	100

Chairman (BoS)

SUMMARY

Name of the Programme: M.E. & Embedded System Technologies							
S. No	Subject area	Credits Per Semester				Credits Total	Percentage Credits
		I	II	III	IV		
1	FC	4	-	-	-	4	5.41
2	PCC	10	14	6	-	30	40.54
3	PEC	6	6	3	-	15	20.27
4	RMC	3	-	-	-	3	4.05
5	OEC	-	-	3	-	3	4.05
6	EEC	-	1	6	12	19	25.68
7	Audit Course	-	-	√	-	-	-
	Total Credit	23	21	18	12	74	100

Chairman (BoS)

MA24T17	APPLIED MATHEMATICS	Category	L	T	P	SL	C
		FC	45	15	0	60	4

SEMESTER - I (M.E. Common to PED, CS & EMBEDDED SYSTEMS)

PREREQUISITE:
Students should have the strong foundation in Mathematical Concepts including Linear Algebra, Probability theory and Statistics, familiarity with Mathematical modeling and Numerical methods techniques.

OBJECTIVES:
To equip students to apply matrix decomposition methods, translate real-world problems into linear programming problems , analyze discrete and continuous random variables, analyze the queuing systems and solve boundary value problems in ordinary differential equations .

UNIT - I	MATRIX THEORY	(12)

Matrix factorizations – The Cholesky decomposition – QR factorization – Least squares method – Singular value decomposition - Toeplitz matrices and some applications.

UNIT - II	LINEAR PROGRAMMING PROBLEMS	(12)

Formulation of LPP – Graphical Method – Simplex Method – Big M Method – Two Phase Simples Method - Dual Simplex method.

UNIT - III	ONE DIMENSIONAL RANDOM VARIABLE	(12)

One dimensional Random Variable - Discrete and continuous random Variables –Probability mass function and probability density function - Expectations –Moments - Moment generating functions and their properties - Binomial, Poisson, Uniform, exponential and Normal distributions.

UNIT - IV	QUEUING MODELS	(12)

Characteristics of Queuing Models – Kendall's notations - Little's formula - (M/M/1) : (∞/FIFO) Single Server with infinite capacity – (M/M/C) : (∞/FIFO) Multi Server with infinite capacity – (M/M/1) : (N/FIFO)Single Server with finite capacity - (M/M/C) : (N/FIFO)Multi server with finite capacity

UNIT - V	COMPUTATIONAL METHODS IN ENGINEERING	(12)

Boundary Value Problems for ODE – Classification of P.D.E. – Solution of Laplace and Poisson Equations – Liebmann's Iteration Process – Solution of Heat Conduction Equation by Bender Schmidt Explicit Formula and Crank Nicolson Implicit Scheme – Solution of Wave Equation.

Lecture = 45, Tutorial = 15, Self Learning = 60 ; Total = 120 Periods

COURSE OUTCOMES: At the end of the course, the students will be able to

COs	Course Outcome	Cognitive Level
CO1	Apply the Cholesky , singular value , least square methods to decomposition matrices effectively.	Apply
CO2	Apply linear programming methods to obtain optimum solutions .	Apply
CO3	Solve the one dimensional random variable and Standard distributions.	Apply
CO4	Analyze and interpret the key features of various queuing systems.	Analyze
CO5	Set up and solve boundary value problems for ODEs.	Apply

TEXT BOOKS :

1. Johnson R. A. and Gupta C. B., "Miller & Freund's Probability and Statistics for Engineers", Pearson Education, 8th Edition, 2015.
2. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.

Chairman (BoS)

REFERENCES :

1. Bronson, R., "Schaum's Outline Series of Matrix Operations", McGraw-Hill Education, 2nd Edition, 2011.
2. Hamdy A Taha., " Operations research. An introduction,", Pearson Edition, 10th Edition, 2017.
3. Donald Gross and Carl M.Harris, "Fundamentals of Queuing Theory," John wiley and sons, 4th Edition, 2013.
4. Dr.P.Kandasamy, Dr.Thilagavathyand Dr.K.Gunavathy, "Numerical Methods", S.Chand & Company Ltd, 3rd Edition, 2003.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	2	-	2
CO2	3	-	2	-	2
CO3	3	-	2	-	2
CO4	3	-	2	-	2
CO5	3	-	2	-	2

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

Chairman (BoS)

RM24T09	RESEARCH METHODOLOGY AND IPR	Category	L	T	P	SL	C
		RMC	45	0	0	45	3

(Common to ALL)

PREREQUISITE:

Basic understanding of research methodology and general awareness of legal and innovation-related frameworks.

OBJECTIVE:

- To equip learners with the knowledge and skills to design and conduct research, analyze data effectively, and understand the fundamentals of intellectual property rights and patent processes.

UNIT - I	RESEARCH DESIGN	(9)

Overview of research process and design – Use of secondary and exploratory data to answer the research question, Qualitative research, Observation studies – Experiments and surveys.

UNIT - II	DATA COLLECTION AND SOURCES	(9)

Measurements: Measurement scales – Questionnaires and instruments – Sampling and Methods. Data – Preparing, Exploring, Examining and Displaying.

UNIT - III	DATA ANALYSIS AND REPORTING	(9)

Overview of multivariate analysis – Hypotheses testing and measures of association – Presenting insights and findings using written reports and oral presentation.

UNIT - IV	INTELLECTUAL PROPERTY RIGHTS	(9)

Intellectual Property – The concept of IPR, Evolution and development of the concept of IPR, IPR development process, Trade secrets, Utility models, IPR & Biodiversity, Role of WIPO and WTO in IPR establishments, Right of property, Common rules of IPR practices, Types and features of IPR agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT - V	PATENTS	(9)

Patents – objectives and benefits of patent – Concept, features of patent, Inventive step, Specification – Types of patent application, process E-filling – Examination of patent – Grant of patent, Revocation, Equitable Assignments. Licenses – Licensing of related patents – Patent agents – Registration of patent agents.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
COs	Course Outcome	Cognitive Level
CO1	Develop a suitable research process to solve real-time problems.	Apply
CO2	Apply appropriate methods to collect qualitative and quantitative data for analysis.	Apply
CO3	Apply appropriate statistical tools to analyze data and solve research problems.	Apply
CO4	Describe the types and features of intellectual property and its role in IPR establishment.	Understand
CO5	Illustrate the patent procedures, E-filling, register of patents, and licensing of patents.	Understand

TEXT BOOKS:	
1	Cooper Donald, R., Schindler Pamela, S., and Sharma, J.K., "Business Research Methods", Tata McGraw Hill Education, Eleventh Edition, 2012.
2	Catherine J. Holland, Intellectual Property: Patents, Trademarks, Copyrights, Trade Secrets, Entrepreneur Press, 2007.
REFERENCES:	
1	David Hunt, Long Nguyen, Matthew Rodgers, Patent Searching: Tools & Techniques, Wiley, 2007.
2	The Institute of Company Secretaries of India, Statutory body under an Act of Parliament, Professional Programme Intellectual Property Rights, Law and Practice, September 2013.

Mapping of COs with POs and PSOs					
COs/ POs	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	3	3	-	-	3
CO2	3	3	-	-	3
CO3	3	3	-	-	3
CO4	3	3	-	-	3
CO5	3	3	-	-	3
1 - Low, 2 - Medium, 3 - High					

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

ET24T11	DESIGN OF EMBEDDED SYSTEMS	Category	L	T	P	SL	C
		PCC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of digital electronics, microprocessors/microcontrollers, and C programming is essential to understand embedded system design and development concepts.

OBJECTIVE:

- To enable students to design, develop, and analyze embedded systems using real-time operating systems and hardware/software co-design techniques.

UNIT – I	INTRODUCTION TO EMBEDDED SYSTEMS	(9)

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

UNIT – II	EMBEDDED NETWORKING BY PROCESSORS	(9)

Embedded Networking: Introduction, I/O Device Ports & Buses – Multiple interrupts and interrupt service mechanism – Serial Bus communication protocols – RS232 standard – RS485 – USB – Inter Integrated Circuits (I2C) – CAN Bus – Wireless protocol based on Wifi, Bluetooth, Zigbee – Introduction to Device Drivers.

UNIT – III	RTOS BASED EMBEDDED SYSTEM DESIGN	(9)

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

UNIT – IV	MODELLING WITH HARDWARE/SOFTWARE DESIGN APPROACHES	(9)

Modeling embedded systems – Embedded software development approach – Overview of UML modeling with UML, UML diagrams – Hardware/Software Partitioning, Co-Design Approaches for System Specification and modeling – CoSynthesis – Features Comparing Single-processor Architectures and Multi-Processor Architectures – Design approach on parallelism in Uniprocessors and Multiprocessors.

UNIT – V	EMBEDDED SYSTEM APPLICATION DEVELOPMENT	(9)

Objective, need, different phases and 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.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Demonstrate the functionalities of processor internal blocks, with their requirement.	Apply
CO2	Recognize the Bus standards chosen based on interface overheads without sacrificing processor performance.	Apply
CO3	Describe the role and features of the RT operating system, that makes multitask execution possible by processors.	Apply
CO4	Illustrate that using multiple CPUs based on either hardcore or softcore helps data overhead management with processing speed reduction for uC execution.	Apply
CO5	Recommend Embedded consumer product design based on phases of product development.	Apply

TEXT BOOKS:

1	Rajkamal, "Embedded System: Architecture, Programming, Design", TMH, 2011.
2	Peckol, "Embedded System Design", John Wiley & Sons, 2010.

REFERENCES:

1	Rajiv Chopra, "Advanced Computer Architecture", S. Chand, 2010.
2	Elicia White, "Making Embedded Systems", O'Reilly Series, SPD, 2011.
3	Bruce Powel Douglass, Real-Time UML Workshop for Embedded Systems, Elsevier, 2011.
4	Lyla B.Das, "Embedded Systems: An Integrated Approach", Pearson, 2013.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	-	3	-	2
CO2	2	-	1	-	2
CO3	2	2	2	-	2
CO4	2	-	3	-	2
CO5	2	-	1	-	2

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

ET24T12	SOFTWARE FOR EMBEDDED SYSTEMS	Category	L	T	P	SL	C
		PCC	45	0	0	45	3

PREREQUISITE:

A fundamental understanding of computer operation and basic logic development is required, along with prior exposure to programming concepts in any language.

OBJECTIVE:

- To equip students with foundational skills in C and Python programming, focusing on embedded system applications and Linux-based development tools.

UNIT – I	BASIC C PROGRAMMING	(9)

Typical C Program Development Environment – Introduction to C Programming – Structured Program Development in C – Data Types and Operators – C Program Control – C Functions – Introduction to Arrays.

UNIT – II	EMBEDDED C	(9)

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

UNIT – III	C PROGRAMMING TOOL-CHAIN IN LINUX	(9)

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

UNIT – IV	PYTHON PROGRAMMING	(9)

Introduction – Parts of Python Programming Language – Control Flow Statements – Functions – Strings Lists – Dictionaries – Tuples and Sets.

UNIT – V	MODULES, PACKAGES AND LIBRARIES IN PYTHON	(9)

Python Modules and Packages – Creating Modules and Packages – Practical Example – Libraries for Python – Library for Mathematical functionalities and Tools – Numerical Plotting Library – GUI Libraries for Python – Imaging Libraries for Python – Networking Libraries.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Demonstrate C programming and its salient features for embedded systems.	Understand
CO2	Deliver insight into various programming languages/software compatible with embedded process development with improved design & programming skills.	Apply
CO3	Develop knowledge of C programming in a Linux environment.	Apply
CO4	Possess the ability to write Python programming for Embedded applications.	Apply
CO5	Have improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded programming skills.	Apply

TEXT BOOKS:

1	Paul Deitel and Harvey Deitel, 'C How to Program', Eighth Edition, Pearson Education Limited, 2016.
2	Michael J.Pont, 'Embedded C', Addison-Wesley, An imprint of Pearson Education, 2002.

REFERENCES:

1	Gowrishankar, S. and Veena, A., 'Introduction to Python Programming', CRC Press, Taylor & Francis Group, 2019.
2	Noel Kalicharan, 'Learn to Program with C', Apress Inc., 2015.
3	Steve Oualline, 'Practical C programming', O'Reilly Media, 1997.
4	William Von Hagen, 'The Definitive Guide to GCC', Second Edition, Apress Inc., 2006.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	-	-	2	-	2
CO2	1	-	1	-	2
CO3	-	2	-	-	2
CO4	1	-	1	-	2
CO5	-	-	2	-	2

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode, Centre for Academic Courses

ET24P11	EMBEDDED SYSTEM LABORATORY – I	Category	L	T	P	SL	C
		PCC	0	0	60	0	2

PREREQUISITE:

Basic knowledge of digital electronics, logic circuits, and C/Assembly programming is required to understand microcontroller architecture and programming.

OBJECTIVE:

- To develop skills in programming and interfacing 8-bit and PIC microcontrollers using both Assembly and C, for real-time embedded applications.

LIST OF EXPERIMENTS:

1.	Programming with 8-bit Microcontrollers # Assembly programming.
2.	Programming with 8-bit Microcontrollers # C programming.
3.	I/O Programming with 8-bit Microcontrollers.
4.	I/O Interfacing: Serial port programming/ LCD/Sensor Interfacing.
5.	Programming with PIC Microcontrollers - Assembly and C programming.
6.	I/O Programming with PIC Microcontrollers.
7.	I/O Interfacing: PWM Generation/ Motor Control/ADC/DAC/ LCD/Sensor Interfacing.
8.	8051/other 8-bit Microcontrollers with peripherals; IDE, Board Support Software Tools / Compiler/others.
9.	8051 Microcontrollers with peripherals; IDE, Board Support Software Tools/C Compiler/others.
10.	8051 Microcontrollers with peripherals; Board Support Software Tools, peripherals with interface.
11.	PIC Microcontrollers with peripherals; IDE, Board Support Software Tools/C Compiler/others.
12.	PIC Microcontrollers with peripherals; Board Support Software Tools, peripherals with interface.

PRACTICAL: 60, TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level	Exp.
CO1	Develop and debug basic Assembly and C programs on 8-bit microcontrollers.	Apply	1, 2
CO2	Perform I/O programming and interface serial ports, LCDs, and sensors with 8-bit microcontrollers.	Apply	3, 4
CO3	Write and test Assembly and C programs for PIC microcontrollers.	Apply	5
CO4	Implement I/O interfacing techniques like PWM, motor control, ADC, DAC, and sensor connections on PIC microcontrollers.	Apply	6, 7, 8
CO5	Utilize IDEs and board support tools for programming and interfacing peripherals with 8051 and PIC microcontrollers.	Apply	9, 10, 11, 12

Chairman (BoS)

K.S. Centre for Academic Courses, College of Engineering, Tiruchengode

REFERENCES:	
1.	Mohamammad Ali Mazidi and Mazidi '8051 Microcontroller and Embedded Systems', Pearson Education, Second Edition, 2007.
2.	Mohammad Ali Mazidi, Rolind Mckinley and Danny Causey, 'PIC Microcontroller and Embedded Systems' Pearson Education, Second Edition, 2009.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	1	2	1	2
CO2	-	-	1	1	2
CO3	2	3	1	1	2
CO4	2	-	2	1	2
CO5	-	-	1	1	2

1- Low, 2- Medium, 3- High

LIST OF EQUIPMENT (For a Batch of 30 Students)

S. No.	Description of Equipment	Quantity
1.	Stepper Motors and Interface	3 Nos.
2.	8-bit CISC/RISC microcontroller compatible ADC interface unit	3 Nos.
3.	8-bit CISC/RISC microcontroller compatible DAC interface unit	3 Nos.
4.	BLDC motor & interface	2 Nos.
5.	CRO	1 No.
6.	Desktop computer/Laptop	06 Nos.
7.	PIC microcontrollers/any other RISC 8-bit microcontroller with peripherals: IDE, Board Support Software Tools, Assembler, C Compiler/suitable open-source software	6 Nos.
8.	Sensors and Interfacing	6 Nos.
9.	8051 Microcontrollers/any other CISC 8-bit microcontroller with peripherals; IDE, Board Support Software Tools, Assembler, C Compiler/suitable open source software	10 Nos.

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode, Centre for Academic Courses

ET24P12	EMBEDDED PROGRAMMING LABORATORY	Category	L	T	P	SL	C
		PCC	0	0	60	0	2

PREREQUISITE:

A basic understanding of digital electronics, logic design, and programming fundamentals in C or Python is required to work with hardware and simulation tools.

OBJECTIVE:

- To enable students to program and simulate embedded systems using higher-level languages, open-source platforms, and industry-standard simulation tools.

LIST OF EXPERIMENTS:

1.	Programming in Higher-Level Languages/Open-Source Platforms.
2.	Programming with Arduino Microcontroller Board.
3.	HDL Programming in FPGA processors.
4.	Programming and Simulation in Simulators/Tools/others using Proteus/ORCAD.
5.	Programming and Simulation in Simulators /Tools/others using MATLAB/Others.

PRACTICAL:60, TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level	Exp.
CO1	Apply programming concepts and syntax to develop applications in higher-level languages.	Apply	1
CO2	Design and develop embedded system applications using Arduino IDE.	Apply	2
CO3	Simulate HDL code for implementing digital logic designs in FPGA processors.	Apply	3
CO4	Develop and simulate electronic circuits using Proteus/ORCAD software.	Apply	4
CO5	Develop programs to simulate dynamic systems and control mechanisms using MATLAB.	Apply	5

REFERENCES:

1.	Jonathan W. Valvano' 'Embedded Systems: Introduction to the MSP432 Microcontroller', Createspace Independent Publication, First Edition, 2015.
2.	Richard H. Barnett, Sarah Cox, Larry O'Cull 'Embedded C Programming and the ATMEL AVR', Cengage Learning, Second Edition, 2012.

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses

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

LIST OF EQUIPMENT (For a Batch of 30 Students)

S. No.	Description of Equipment	Quantity
1.	Simulation Tools Proteus / ORCAD	5 Nos.
2.	Arduino Boards with peripherals: IDE, Board Support Software Tools/ Compiler/others.	10 Nos.
3.	C/C++/Java/Embedded C/Embedded Java / Compilers & Platforms / Cloud	20 Nos.
4.	Desktop Computer/Laptop.	06 Nos.
5.	FPGA Processor Boards with Board Support Tools and Interface.	3 No.
6.	Simulation Tools MATLAB/any other suitable simulation software packages for programming /open-source simulators.	5 No.

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637 215. Centre for Academic Courses

ET24T21	REAL TIME OPERATING SYSTEM	Category	L	T	P	SL	C
		PCC	45	0	0	45	3

PREREQUISITE:

A fundamental knowledge of operating systems, process management, and basic programming in C/C++ is essential for understanding real-time and embedded OS concepts.

OBJECTIVE:

- To provide students with the skills to design, analyze, and develop real-time applications using RTOS and embedded operating system platforms.

UNIT - I	REVIEW OF OPERATING SYSTEMS	(9)

Basic principles – Operating system structures – System calls – Files – Processes – Design and implementation of processes – Communication between processes – Introduction to Distributed operating systems – Embedded operating systems.

UNIT - II	OVERVIEW OF RTOS	(9)

RTOS Task and Task state – Multithreaded Preemptive scheduler – Process Synchronization – Message queues – Mailboxes – pipes– Critical section – Semaphores – Classical synchronization problem – Deadlocks.

UNIT - III	REAL-TIME MODELS AND LANGUAGES	(9)

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

UNIT - IV	REALTIME KERNEL	(9)

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

UNIT - V	APPLICATION DEVELOPMENT	(9)

Discussions on Basics of Linux supportive RTOS – uCOS – CExecutive for development of RTOS Application – Case study.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Recognize operating system structures and types.	Understand
CO2	Insight into scheduling, and disciplining of various processes execution.	Apply
CO3	Exemplify knowledge of various RTOS support modeling.	Understand
CO4	Demonstrate commercial RTOS Suite features to work on real-time process design.	Understand
CO5	Improved employability and entrepreneurship capacity due to knowledge upgradation on recent trends in RTOS and embedded automation design.	Apply

Chairman (BoS)

TEXT BOOKS:	
1.	Silberschatz, Galvin, Gagne, 'Operating System Concepts', Sixth Edition, John Wiley, 2003.
2.	Charles Crowley, 'Operating Systems: A Design Oriented approach', McGraw Hill, 1997.
REFERENCES:	
1.	Raj Kamal, 'Embedded Systems- Architecture, Programming and Design', Tata McGraw Hill, 2006.
2.	Karim Yaghmour,'Building Embedded Linux System', O'reilly Publication, 2003.
3.	Mukesh Sighal and Shi, N.G., 'Advanced Concepts in Operating System', McGraw Hill, 2000.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	-	1	2	2
CO2	-	-	2	2	2
CO3	2	-	2	2	2
CO4	2	2	3	2	2
CO5	-	-	1	2	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengodu 637215 – Centre for Academic Courses

ET24T22	EMBEDDED SYSTEM NETWORKING	Category	L	T	P	SL	C
		PCC	45	0	0	45	3

PREREQUISITE:

A basic understanding of microcontrollers, digital communication protocols, and fundamentals of computer networks is required for learning embedded networking and automation systems.

OBJECTIVE:

- To equip students with knowledge and skills for designing embedded communication interfaces, wired/wireless networks, and automation systems, including SCADA integration.

UNIT - I	EMBEDDED PROCESS COMMUNICATION WITH INSTRUMENT BUS	(9)

Embedded networking: Introduction – Cluster of instruments in System: Introduction to bus protocols – comparison of bus protocols – RS 232C, RS 422, RS 485 and USB standards –Embedded Ethernet– MOD bus, LIN bus and CAN bus.

UNIT - II	EMBEDDED ETHERNET	(9)

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

UNIT - III	WIRELESS EMBEDDED NETWORKING	(9)

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

UNIT - IV	BUILDING SYSTEM AUTOMATION	(9)

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

UNIT - V	COMMUNICATION FOR LARGE ELECTRICAL SYSTEM AUTOMATION	(9)

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

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode, Centre for Academic Courses

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Recognize the different bus communication protocols used for embedded networking.	Understand
CO2	Explain the basic concepts of embedded networking.	Understand
CO3	Apply the embedded networking concepts in wireless networks.	Apply
CO4	Relate different data acquisition concepts.	Apply
CO5	Build system automation for different applications.	Apply

TEXT BOOKS:

1. Mohammad Ilyas, Imad Mahgoub, 'Handbook of sensor Networks: Compact wireless and wired sensing systems', CRC Press,2004.
2. Peter W.Gofton, 'Understanding Serial Communication', Sybes International, 2000.

REFERENCES:

1. Jan Axelson, 'Embedded Ethernet and Internet Complete', Penram Publications, 2003.
2. Krzysztof Iniewski, 'Smart Grid, Infrastructure and Networking',TMcGH,2012.
3. James Northcote-Green, 'Robert Wilson, Control and Automation of Electrical Power Distribution Systems', CRC, Taylor and Francis, 2006.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	1	2	-	2	2
CO2	-	2	-	2	2
CO3	3	2	2	2	2
CO4	2	-	3	2	2
CO5	3	-	3	2	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering. Tiruchengode-637215. Centre for Academic Courses

ET24T23	EMBEDDED CONTROL FOR ELECTRIC DRIVES	Category	L	T	P	SL	C
		PCC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of electrical machines, power electronics, and microcontroller programming is essential to understand motor control and embedded drive systems.

OBJECTIVE:

- To enable students to design, control, and optimize electric drives using embedded systems, AI techniques, and real-time applications.

UNIT - I	INTRODUCTION ELECTRICAL DRIVES	(9)

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

UNIT - II	OVERVIEW OF EMBEDDED PROCESSOR	(9)

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

UNIT - III	INDUCTION MOTOR CONTROL	(9)

Types-Speed control methods – PWM techniques – VSI fed three-phase induction motor – Fuzzy logic-based speed control for three phase induction motor – FPGA based three phase induction motor control.

UNIT - IV	BLDC MOTOR CONTROL	(9)

Overview of BLDC Motor – Speed control methods – PWM techniques – ARM processor based BDLC motor control – ANN for BLDC Motor control and operation.

UNIT - V	SRM MOTOR CONTROL	(9)

Overview of SRM Motor – Speed control methods – PWM techniques – FPGA-based SRM motor control – DNN for SRM Motor control and operation.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Interpret the significance of embedded control of electrical drives	Understand
CO2	Deliver insight into various control strategies for electrical drives.	Understand
CO3	Develop knowledge of Machine learning and optimization techniques for motor control.	Apply
CO4	Develop embedded system solutions for real-time applications such as Electric vehicles and UAVs.	Apply
CO5	Improved Employability and entrepreneurship capacity due to knowledge gradation on recent trends in embedded system skills required for motor control strategy.	Apply

TEXT BOOKS:

1. Krishnan, R., 'Electric Motor Drives: Modeling, Analysis and Control', Prentice-Hall of India Pvt. Ltd., New Delhi, 2010.
2. Vedam Subramanyam, 'Electric Drives: Concepts and Applications', Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2002.

REFERENCES:

1. Venkataratnam, K., 'Special Electrical Machines', Universities Press, 2014.
2. Steve Furber, 'ARM System on Chip Architecture', Addision Wesley, 2010.
3. Ron Sass, Anderew G.Schmidt, 'Embedded System design with platform FPGAs: Principles and Practices', Elsevier, 2010.
4. Steve Kilts, 'Advanced FPGA Design: Architecture, Implementation, and Optimization', Willey, 2007.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	1	-	2	2	2
CO2	1	1	3	2	2
CO3	2	-	-	2	2
CO4	1	2	3	2	2
CO5	-	-	-	2	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637 215 - Centre for Academic Courses

ET24T24	IoT FOR SMART SYSTEMS	Category	L	T	P	SL	C
		PCC	45	0	0	45	3

PREREQUISITE:

Basic understanding of embedded systems, computer networks, and programming fundamentals is required to explore IoT architectures and applications effectively.

OBJECTIVE:

- To provide students with the knowledge and skills to design, implement, and analyze IoT systems across diverse domains using modern technologies and platforms.

UNIT - I	INTRODUCTION TO INTERNET OF THINGS	(9)

Overview, Hardware and software requirements for IOT – Sensor and actuators – Technology drivers, Business drivers, Typical IoT applications – Trends and implications.

UNIT - II	IOT ARCHITECTURE	(9)

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

UNIT - III	PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT,PROTOCOLS	(9)

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

UNIT - IV	IoT PROCESSORS	(9)

Services/Attributes: Big-Data Analytics for IoT – Dependability – Interoperability – Security, Maintainability. Embedded processors for IoT: Introduction to Python programming – Building IoT with RASPERRY PI and Arduino.

UNIT - V	CASE STUDIES	(9)

Industrial IoT – Home Automation – Smart Cities, Smart Grid connected vehicles – Electric vehicle charging, Environment, Agriculture – Productivity Applications – IoT Defense.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Deliberate the concepts of IoT and its present developments.	Understand
CO2	Compare and contrast different platforms and infrastructures available for IoT.	Understand
CO3	Elucidate different protocols and communication technologies used in IoT.	Understand
CO4	Apply big data analytics and programming of IoT.	Apply
CO5	Implement IoT solutions for smart applications.	Apply

Chairman (BoS)

TEXT BOOKS:	
1.	Arshdeep Bahga, Vijai Madisetti, 'A Hands-on Approach: Internet of Things', Universities Press, 2015.
2.	Oliver Hersent, David Boswarthick, 'Omar Elloumi', The Internet of Things, Wiley, 2016.
REFERENCES:	
1.	Samuel Greengard, 'The Internet of Things', The MIT Press, 2015.
2.	Adrian McEwen, Hakim Cassimally, 'Designing the Internet of Things', Wiley,2014.
3.	Jean-Philippe Vasseur, Adam Dunkels, 'Interconnecting Smart Objects with IP: The Next Internet', Morgan Kuffmann Publishers, 2010.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	1	1	2	2	2
CO2	-	2	-	2	2
CO3	1	2	-	2	2
CO4	2	-	3	2	2
CO5	3	2	3	2	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

ET24P21	EMBEDDED SYSTEM LABORATORY – II	Category	L	T	P	SL	C
		PCC	0	0	60	0	2

PREREQUISITE:

Fundamentals of microcontrollers, embedded C programming, and digital interfacing concepts are essential for advanced embedded system development using ARM, Raspberry Pi, Arduino, and DSP platforms.

OBJECTIVE:

- To enable students to program, interface, and develop real-time applications using advanced embedded processors and RTOS environments.

LIST OF EXPERIMENTS:

1.	Programming ARM processor:ARM7/ARM9/ARM Cortex – Study on In-circuit emulators, cross compilers and debuggers.
2.	I/O Programming with ARM processor: ARM7/ARM9/ARM Cortex Microcontrollers. I/O Interfacing: Timers / Interrupts / Serial port programming / PWM Generation /Motor Control / ADC / DAC /LCD /RTC Interfacing /Sensor Interfacing.
3.	Programming with Raspberry Pi Microcontroller Board: Study on in-circuit emulators, cross compilers and debuggers.
4.	I/O Programming with Arduino, Raspberry Pi Microcontroller Boards I/O Interfacing: Timers /Interrupts /Serial port programming / PWM Generation / Motor Control / ADC / DAC / LCD /RTC Interfacing /Sensor Interfacing / IoT Applications.
5.	Programming with DSP processors.
6.	Study of one type of Real-Time Operating Systems (RTOS).

PRACTICAL: 60, TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level	Exp.
CO1	Develop and debug programs on ARM processors (ARM7/ARM9/Cortex) using in-circuit emulators and cross-compilers.	Apply	1
CO2	Perform I/O programming and peripheral interfacing with ARM-based microcontrollers.	Apply	2
CO3	Interface and control timers, interrupts, serial ports, PWM, ADC/DAC, and sensors using Raspberry Pi and Arduino.	Apply	3
CO4	Implement embedded applications and IoT projects using Raspberry Pi and Arduino platforms.	Apply	4
CO5	Program and analyze DSP processors and RTOS functionalities for real-time embedded system development.	Apply	5, 6

Chairman (BoS)

K.S. College of Engineering, Tiruchengode, Centre for Academic Courses

REFERENCES:	
1.	Amos Gilat, 'MATLAB: An Introduction with Applications', Wiley, Fourth Edition, 2012.
2.	Farzin Asadi, 'Simulation of Power Electronics Circuits with MATLAB®/Simulink®, Design, Analyze, and Prototype Power Electronics', Apress Berkeley, CA, First Edition, 2022.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	1	2	-	2
CO2	-	-	2	-	2
CO3	2	3	2	-	2
CO4	2	-	2	-	2
CO5	-	-	2	-	2

1 - Low, 2 - Medium, 3 - High

LIST OF EQUIPMENT (For a Batch of 30 Students)

S. No.	Description of Equipment	Quantity
1.	ARM7 / ARM9/ARM Cortex/ any other ARM higher-end processor with peripherals; IDE, Board Support Software Tools, Assembler, C Compiler/suitable open-source software	5 Nos.
2.	Arduino Boards with peripherals IDE, Board Support Software Tools / Compiler/others	10 Nos.
3.	Raspberry Pi Boards with peripherals; IDE, Board Support Software Tools /Compiler/others	5 Nos.
4.	DSP Processor Boards with Board Support Tools & Interfaces	5 Nos.
5.	LCD Interface	2 Nos.
6.	Sensors and Interfacing	6 sets
7.	Stepper Motors and Interface	3 Nos.
8.	BLDC motor & Interface	2 Nos.
9.	Real Time Operating Systems (RTOS)- Any open source RTOS/ VXWorks/ Keil/ Android/Tiny OS/ RT Linux	1 No.
10.	Desktop computer/Laptop	06 Nos.

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses

ET24P22	TECHNICAL PRESENTATION	Category	L	T	P	SL	C
		EEC	0	0	30	0	1

PREREQUISITE:

Students should grasp core technical concepts, research methods, and report writing to effectively prepare and deliver technical presentations.

OBJECTIVE:

- To develop students' ability to explore, analyze, and communicate technical topics through literature review, problem-solving, report writing, and professional presentations.

The students should adhere to the following Guidelines:

1. The students have to refer to the journals and conference proceedings and collect the published literature.
2. By mutual discussions with the faculty in-charge, the student can decide on a topic related to the area/topic.
3. The student is expected to collect at least 20 such research papers published in the last 5 years.
4. Using OHP / PowerPoint, the student has to make a presentation for 20 minutes followed by 10-minute discussion.
5. The student has to make five presentations in the semester.
6. The student has to write a technical report for about 30 - 50 pages (Title page, One-page Abstract, Review of Research paper under various sub-headings, concluding remarks, and list of references). The technical report has to be submitted to the course coordinator one week before the final presentation, after the approval of the faculty in-charge.

PRACTICAL: 30, TOTAL: 30 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

Course Outcome	Description	Bloom's Taxonomy Level
CO1	Familiarize the problems in general areas of interest to the student.	Understand
CO2	Identify the area/problem by referring to journals, conference proceedings, etc.	Understand
CO3	Develop the collective skills between theoretical knowledge and real-time problems.	Understand
CO4	Gain knowledge on the problem by presentation and review.	Understand
CO5	Acquire ideas on report writing and presentation.	Understand

Chairman (BoS)

Mapping of COs with POs and PSOs					
COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	2
CO2	2	3	3	3	2
CO3	2	3	3	3	2
CO4	2	3	3	3	2
CO5	2	3	3	3	2

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

ET24T31	RISC PROCESSOR ARCHITECTURE AND PROGRAMMING	Category	L	T	P	SL	C
		PCC	45	0	0	45	3

PREREQUISITE:

- Basic knowledge of digital electronics and C programming is essential, along with familiarity with microprocessor fundamentals.

OBJECTIVE:

- To provide in-depth understanding of AVR and ARM microcontroller architectures and their application in real-time embedded systems.

UNIT - I	AVR MICROCONTROLLER ARCHITECTURE	(9)

Architecture – memory organization – addressing modes – I/O Memory – EEPROM – I/O Ports – SRAM –Timer – UART – Interrupt Structure – Serial Communication with PC – ADC/DAC Interfacing.

UNIT - II	ARM ARCHITECTURE AND PROGRAMMING	(9)

Arcon RISC Machine – Architectural Inheritance – Core & Architectures – The ARM Programmer's model – Registers – Pipeline – Interrupts – ARM organization – ARM processor family – Co-processors. Instruction set – Thumb instruction set – Instruction cycle timings.

UNIT - III	ARM APPLICATION DEVELOPMENT	(9)

Introduction to RT implementation with ARM – Exception Handling – Interrupts – Interrupt handling schemes – Firmware and bootloader – Free RTOS Embedded Operating Systems concepts – example on ARM core like ARM9 processor.

UNIT - IV	MEMORY PROTECTION AND MANAGEMENT	(9)

Protected Regions – Initializing MPU, Cache, and Write Buffer – MPU to MMU – Virtual Memory – Page Tables – TLB-Domain and Memory Access Permission – Fast Context Switch Extension.

UNIT - V	DESIGN WITH ARM MICROCONTROLLERS	(9)

Assembler Rules and Directives – Simple ASM/C programs – Hamming Code – Division and Negation – Simple Loops – Look-up table – Block copy – subroutines – Application.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode. Centre for Academic Courses

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Describe the programmer's model of the ARM processor and create and test assembly-level programming.	Understand
CO2	Develop ARM-based programs by applying knowledge of processor architecture, register sets, and pipeline operations.	Apply
CO3	Apply RTOS concepts and exception/interrupt handling techniques to develop embedded applications on ARM-based systems.	Apply
CO4	Examine memory protection mechanisms and virtual memory management techniques using MPU/MMU in ARM architectures.	Apply
CO5	Design, implement, and evaluate assembler-based solutions by applying knowledge of directives, error detection, block copying, and subroutine development for embedded applications.	Apply

TEXT BOOKS:

1. Steve Furber, ARM system on chip architecture, Addision Wesley, 2000.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System Developer's Guide Designing and Optimizing System Software', Elsevier, 2007.

REFERENCES:

1. Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, AVR Microcontroller and Embedded Systems using Assembly and C", Pearson Education, 2014.
2. Trevor Martin, The Insider's Guide to The Philips ARM7-Based Microcontrollers.
3. Mukesh Sighal and Shi, N.G., Advanced Concepts in Operating System, McGraw Hill, 2000.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	-	1	2	2
CO2	2	-	2	2	2
CO3	2	-	2	2	2
CO4	2	2	3	2	2
CO5	2	-	1	2	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

ET24T32	EMBEDDED PRODUCT DEVELOPMENT	Category	L	T	P	SL	C
		PCC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of design principles, engineering fundamentals, and introductory manufacturing processes. Familiarity with embedded systems is an added advantage.

OBJECTIVE:

- To understand, plan, and apply product development techniques from concept to commercialization using strategic, systematic, and technical approaches.

UNIT - I	CONCEPTS OF PRODUCT DEVELOPMENT	(9)

Need for PD – Generic product Development Process Phases – Product Development Process Flows- Product – Development organization structures – Strategic importance of Product Planning process – Product Specifications – Target Specifications – Plan and establish product specifications: integration of customer, designer, material supplier and process planner, Competitor and customer – Understanding customer and behavior analysis. Concept Generation – Five Step Method – Basics of Concept selection – Creative thinking – creativity and problem solving – creative thinking methods – generating design concepts – systematic methods – for designing – functional decomposition – physical decomposition.

UNIT - II	INTRODUCTION TO APPROACHES IN PRODUCT DEVELOPMENT	(9)

Product development management – establishing the architecture – creation – Product Architecture changes – variety – component standardization, clustering -geometric layout development – Fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications – Portfolio Architecture – competitive benchmarking – Approach for the benchmarking process – Design for manufacturing – Industrial Design – Robust Design – Prototype basics – Principles of prototyping – Planning for prototypes – Economic & Cost Analysis –Testing Methodologies.

UNIT - III	INDUSTRIAL DESIGN STRATEGIES	(9)

Role of Integrating: CAE, CAD, CAM tools for Simulating product performance and manufacturing processes electronically – Basics on reverse engineering – Reverse engineering strategies – Finding reusable software components – Recycling real-time embedded software – based approach and its logical basics – Incorporating reverse engineering for consumer product development – Case study on DeskJet Printer.

UNIT - IV	ELECTRONIC PRODUCT DEVELOPMENT STAGES	(9)

Product Development Stages – Embedded product modeling: Linear, Iterative, Prototyping, Spiral - Selection of Sensor, Voltage Supply, Power supply protection, Grounding and noise elimination methods, Thermal Protection with heat management – PCB design steps – Software design and testing method – documentation.

UNIT - V	EMBEDDED PRODUCTS DESIGN	(9)

Creating general Embedded System Architecture (with Case study example: Mobile Phone / Desk Jet Printer/Robonoid as a product) – Architectural Structures – Criteria in selection of Hardware & Software: Components, processors, input/output interfaces & connectors, ADC System, Memory, choosing Bus Communication Standards, Criteria in selection of Embedded OS/Device Drivers, Need for Developing with IDE, Translation.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

COURSE OUTCOMES:
At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Apply systematic methods to generate and select innovative product concepts	Apply
CO2	Apply different product development approaches such as architecture design and prototyping	Apply
CO3	Apply CAE, CAD, and CAM tools for product performance simulation	Apply
CO4	Apply electronic product development stages, including sensor selection, PCB design, and power supply protection	Apply
CO5	Apply embedded system architectures and apply criteria for selecting hardware, software components, and communication standards in embedded product design	Apply

TEXT BOOKS:

1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development", McGraw –Hill International Edns.1999/ Tata McGraw Education, ISBN-10-007-14679-9.
2. R.G. Kaduskar and V.B. Baru, "Electronic Product Design", Wiley, 2014.
3. George E. Dieter, Linda C. Schmidt, "Engineering Design", McGraw-Hill International Edition, Fourth Edition, 2009, ISBN 978-007-127189-9.
4. Stephen Armstrong, Engineering and Product Development Management ; The Holistic Approach, Cambridge University Press (CUP), 2014.

REFERENCES:

1. Rajkamal, 'Embedded System Architecture, Programming, Design', TMH,2011.
2. Kevin Otto and Kristin Wood, "Product Design and Development", Fourth Edition, 2009.
3. Product Design Techniques in Reverse Engineering and New Product Development, Pearson Education(LPE), 2001.
4. Yousef Haik, T. M. M. Shahin, "Engineering Design Process", Second Edition Reprint, Cengage Learning, 2010, ISBN 0495668141
5. Clive L. Dym, Patrick Little, "Engineering Design: A Project-based Introduction", Third Edition, John Wiley & Sons, 2009.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	1	2	3	2	2
CO2	2	3	2	2	2
CO3	2	-	2	2	2
CO4	3	1	1	2	2
CO5	1	3	3	2	2

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses

ET24P31	PROJECT WORK PHASE – I	Category	L	T	P	SL	C
		EEC	0	0	180	0	6

PREREQUISITE:

Fundamental knowledge of engineering concepts, design principles, and prior completion of core departmental subjects.

OBJECTIVE:

- To initiate and develop a structured approach for identifying, planning, and designing a feasible engineering project through research and preliminary implementation.

The students should adhere the following Guidelines:

1. Every student shall have a supervisor who is the member of the faculty of the institution. Identification of student and his faculty supervisor has to be completed within the first two weeks from the day of beginning of third semester.
2. In consultation with the supervisor, the problem has to be selected.
3. The projects undertaken span a diverse range of topics; including theoretical, simulation and experimental studies preferably it can be a collaborative project with industry.
4. Student has to perform a literature survey to review current knowledge and developments in the chosen technical area.
5. Student has to prepare a detailed action plan for conducting the investigation analytically, computationally and experimentally.
6. A detailed study of the problem and its financial implications and hazards has to be studied.
7. The methodology to tackle this problem can be studied and analyzed.
8. A project report has to be submitted at the end of the semester as per guidelines given by the college.
9. Final project presentation and viva voce by the assessment board will be done at the end of that semester.
10. The extension of same project should be continued in the Phase - II.

PRACTICAL: 180, TOTAL: 180 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Ability to identify and define a real-world engineering problem.	Apply
CO2	Demonstrate effective project planning and time management skills.	Understand
CO3	Apply theoretical knowledge to practical design and development.	Analyze
CO4	Develop technical documentation and presentation skills.	Apply
CO5	Collaborate effectively within a team to meet project milestones.	Apply

Chairman (BoS)

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

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215. Centre for Academic Courses

ET24P41	PROJECT WORK PHASE – II	Category	L	T	P	SL	C
		EEC	0	0	360	0	12

PREREQUISITE:

Fundamental knowledge of engineering concepts, design principles, and prior completion of core departmental subjects.

OBJECTIVE:

- Empower students to solve real-world problems through innovative projects, enhancing technical, communication and entrepreneurial skills.

The students should adhere the following Guidelines:

1. The supervisor allotted for project Phase I will continue to supervise project phase II.
2. As per methodology suggested in Phase I, the project can be implemented.
3. Outcome of implementation can be studied and each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, results, discussions with conclusion and industry certificate (If applicable).
4. This final report shall be in type written form as specified in the guidelines.
5. The project report should be evaluated jointly by external and internal examiners.

PRACTICAL: 360, TOTAL: 360 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Implement the proposed system using appropriate tools and techniques.	Apply
CO2	Integrate different modules to achieve a functional project solution.	Apply
CO3	Examine the performance of the developed system through testing.	Analyze
CO4	Investigate the developed system by considering the relevant performance parameter.	Analyze
CO5	Demonstrate technical and communication skills through documentation and presentation.	Apply

Chairman (BoS)

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

Chairman (BoS)

ET24E01	WIRELESS AND MOBILE COMMUNICATION	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of communication systems, electromagnetic wave propagation, and digital signal processing is essential to understand mobile communication concepts.

OBJECTIVE:

- To provide students with a comprehensive understanding of cellular systems, radio propagation, CDMA, and IP mobility in wireless communication networks.

UNIT - I	THE CELLULAR CONCEPT	(9)

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

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

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

UNIT - III	MOBILE RADIO PROPAGATION	(9)

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

UNIT - IV	WIDEBAND CODE DIVISION MULTIPLE ACCESS	(9)

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

UNIT - V	IP MOBILITY FRAMEWORK	(9)

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

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Describe the principles of cellular communication.	Understand
CO2	Exemplify the concepts of mobile radio propagation.	Understand
CO3	Perceive the wireless network's different types of MAC protocols.	Apply
CO4	Discuss Equalization and Diversity.	Understand
CO5	Build the Wireless multiple access and IP.	Apply

TEXT BOOKS:

1. Theodore S. Rappaport, 'Wireless Communications, Principles', Practice, Second Edition, PHI, 2002.
2. Andrea Goldsmith, 'Wireless Communications', Cambridge University Press, 2005.

REFERENCES:

1. Kaveh Pah Laven and P. Krishna Murthy, 'Principles of Wireless Networks', Pearson Education, 2002.
2. Gottapu Sasibhushana Rao, 'Mobile Cellular Communication', Pearson Education, 2012.
3. Kamilo Feher, 'Wireless Digital Communications', PHI, 1999
4. Sanjeev Kumar, 'Wireless and Mobile Communication', New Age International, 2008.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	-	2
CO2	3	3	2	-	2
CO3	3	3	2	-	2
CO4	-	-	-	-	2
CO5	-	-	-	-	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215. Centre for Academic Courses

ET24E02	ROBOTICS AND AUTOMATION	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Fundamentals of mechanics, electronics, and programming are essential to understand the design and control of robotic and automation systems.

OBJECTIVE:

- To equip students with the knowledge and skills to design, program, and apply robotic systems using automation principles and embedded technologies.

UNIT - I	INTRODUCTION TO ROBOTICS & AUTOMATION	(9)

Overview of Robotics and Automation – Principles and Strategies of Automation System – Hardware and Software for Automation – Embedded Processors for Automation – Different Types of Robots – Various Generations of Robots – Asimov's Laws of Robotics – Key Components of a Robot – Design Criteria for selection of a robot – Role of embedded system in Robotics and automation – Recent trends.

UNIT - II	SENSORS AND DRIVE SYSTEMS	(9)

Hydraulic, Pneumatic and Electric Drive Systems – Understanding how motor power, current torque, friction coefficient affects the design of a robot – Determination of motor HP and gearing ratio – Variable Speed Arrangements. Sensors – Classification based on sensing type (including Optical, Acoustic, Magnetic) – Proximity Sensors – Ranging Sensors – Speed & Displacement Sensors – Tactile Sensors – Vision sensors – Smart Sensors – MEMS sensors.

UNIT - III	MANIPULATORS AND GRIPPERS	(9)

Introduction to Manipulators – Joints and Degrees of Freedom – Construction of Manipulators – Manipulator Dynamics and Force Control – Electronic and Pneumatic Manipulator Control Circuits – End Effectors – Various Types of Grippers – Design Considerations.

UNIT – IV	KINEMATICS AND PATH PLANNING	(9)

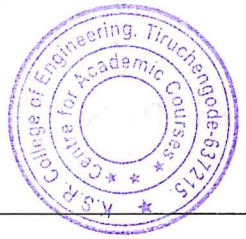
Kinematic Equations – Forward and Inverse Kinematics – Solution of Inverse Kinematics Problem – Jacobian-based Velocity Kinematics– Various Path Planning Algorithms – Hill Climbing Techniques – Robot Operating System – Simulation and modeling of a simple path planning application.

UNIT - V	CASE STUDIES	(9)

Robot Cell Design – Humanoid Robot – Robots in healthcare applications – Robot Machine Interface – Robots in Manufacturing and Non-Manufacturing Applications – Self-balancing robots – Micro/nano robots.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)



COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Choose suitable embedded boards for robots.	Understand
CO2	Demonstrate the concepts of robotics and automation and the working of robots.	Apply
CO3	Describe the function of sensors and actuators in the robot.	Understand
CO4	Develop a program to use a robot for a typical application.	Apply
CO5	Apply and improve employability and entrepreneurship capacity due to knowledge upgradation on Embedded system-based robot development.	Apply

TEXT BOOKS:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., 'Industrial Robotics', Mc Graw-Hill Singapore, 2017.
2. Ghosh, 'Control in Robotics and Automation: Sensor Based Integration', Allied Publishers, Chennai,2009.

REFERENCES:

1. Deb. S.R., 'Robotics Technology and Flexible Automation', John Wiley, USA 1992.
2. Klafter R.D., Chimielewski T.A., Negin M., 'Robotic Engineering - An Integrated Approach', Prentice Hall of India, New Delhi, 1994.
3. Mc Kerrow P.J. 'Introduction to Robotics', Addison Wesley, USA, 1991.
4. Issac Asimov 'Robot', Ballantine Books, New York, 1986.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	-	-	2
CO2	3	3	-	-	2
CO3	3	2	-	-	2
CO4	3	2	-	-	2
CO5	3	2	2	-	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215.

ET24E03	EMBEDDED PROCESSOR DEVELOPMENT	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

A Basic understanding of microcontrollers, C programming, and computer architecture is necessary to grasp embedded systems, ARM architecture, and modeling with UML.

OBJECTIVE:

- To enable students to design and program embedded systems using ARM Cortex processors and model system behavior using UML and RTOS-based approaches.

UNIT - I	EMBEDDED CONCEPTS	(9)

Introduction to embedded systems, Application Areas, Categories of embedded systems, Overview of embedded system architecture, Specialties of embedded systems, recent trends in embedded systems, Architecture of embedded systems, Hardware architecture, Software architecture, Application Software, Communication Software, Development and debugging Tools.

UNIT - II	ARM ARCHITECTURE AND OVERVIEW OF CORTEX	(9)

Background of ARM Architecture, Architecture Versions, Processor Naming, Instruction Set Development, Thumb-2 and Instruction Set Architecture. Overview of Cortex-M3. Cortex-M3 Basics: Registers, General Purpose Registers, Stack Pointer, Link 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. 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.

UNIT - III	CORTEX-M3/M4 PROGRAMMING	(9)

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

UNIT – IV	UNIFIED MODELING LANGUAGE	(9)

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

UNIT - V	UNIFIED MODELING LANGUAGE	(9)

The compilation process – libraries – porting kernels – C extensions for embedded systems – emulation and debugging techniques – RTOS – System design using RTOS.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Demonstrate basic concepts of embedded systems.	Understand
CO2	Build ARM architecture.	Understand
CO3	Understand C language and assembly programming.	Apply
CO4	Build and compile Object orientation for programming and C++.	Apply
CO5	Create software modeling.	Apply

TEXT BOOKS:

1. David Seal 'ARM Architecture Reference Manual', Addison Wesley, England; Morgan Kaufmann Publisher, 2001.
2. Andrew N Sloss, Dominic Symes, Chris Wright, 'ARM System Developer's Guide Designing and Optimizing System Software', Elsevier, 2006.

REFERENCES:

1. Cortex-M series-ARM Reference Manual.
2. Ajay Deshmukh, 'Microcontroller -Theory & Applications', Tata McGraw Hill.
3. Joseph Yiu,'The Definitive Guide to the ARM Cortex-M3', Elsevier Inc., Second Edition, 2010.
4. Marwedel P, 'Embedded System Design', 2021.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	3	1	-	2
CO2	3	3	3	-	2
CO3	3	3	2	-	2
CO4	3	3	3	-	2
CO5	2	3	3	-	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215

ET24E04	SYSTEM DESIGN USING MICROCONTROLLER	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

(Common to ET & PE)

PREREQUISITE:

Basic knowledge of digital electronics, microcontroller fundamentals, and C/Assembly programming is essential to work with PIC and ARM-based systems.

OBJECTIVES:

- To develop the ability to design, interface, and program embedded applications using PIC and ARM microcontrollers for real-time control and data acquisition.

UNIT - I	PIC MICROCONTROLLER	(9)

Architecture – Memory organization – Addressing modes – Instruction set – PIC programming in Assembly & C – I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, practice in MP-LAB.

UNIT - II	ARM ARCHITECTURE	(9)

Architecture – Memory organization – Addressing modes – The ARM Programmer's model – Registers – Pipeline – Interrupts – Coprocessors – Interrupt Structure.

UNIT - III	PERIPHERALS OF PIC AND ARM MICROCONTROLLER	(9)

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

UNIT – IV	ARM MICROCONTROLLER PROGRAMMING	(9)

ARM General Instruction set – Thumb instruction set – Introduction to DSP on ARM – Implementation example of Filters.

UNIT - V	DESIGN WITH PIC AND ARM MICROCONTROLLERS	(9)

PIC implementation – Generation of Gate signals for converters and Inverters – Motor Control – Controlling DC/AC appliances – Measurement of frequency – Standalone Data Acquisition System – ARM Implementation – Simple ASM/C programs – Loops – Look up table – Block copy – subroutines – Hamming Code.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Describe the basics and requirements of processor functional blocks.	Understand
CO2	Observe the specialty of RISC processor Architecture.	Apply
CO3	Incorporate I/O hardware interface of processor-based automation for consumer applications with peripherals.	Apply
CO4	Incorporate the I/O software interface of a processor with peripherals.	Apply
CO5	Elaborate the recent trends in commercial embedded processors.	Apply

Chairman (BoS)

TEXT BOOKS:	
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.
REFERENCES:	
1.	Muhammad Ali Mazidi, Rolin D. McKinlay, Danny Causey 'PIC Microcontroller and Embedded Systems using Assembly and C for PIC18', Pearson Education, 2008.
2.	John Iovine, 'PIC Microcontroller Project Book', McGraw-Hill, 2000.
3.	ARM Architecture Reference Manual, LPC213x User Manual.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	1	-	2	-	2
CO2	1	-	3	-	2
CO3	1	-	1	-	2
CO4	1	-	-	-	2
CO5	1	-	2	-	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode, Centre for Academic Courses

ET24E05	INTELLIGENT CONTROL AND AUTOMATION	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic understanding of control systems, programming, and mathematical foundations such as linear algebra and probability is essential for learning intelligent control techniques.

OBJECTIVE:

- To enable students to design and apply intelligent control strategies using ANN, fuzzy logic, and optimization algorithms for automation and industrial applications.

UNIT - I	ARTIFICIAL NEURAL NETWORK AND FUZZY LOGIC	(9)

Artificial Neural Network: Learning with ANNs, single-layer networks, multi-layer perceptrons, Back propagation algorithm (BPA) ANNs for identification, ANNs for control, and Adaptive neuro controller.

Fuzzy Logic Control: Introduction, fuzzy sets, fuzzy logic, fuzzy logic controller design, Fuzzy Modelling & identification, Adaptive Fuzzy Control Design.

UNIT - II	GENETIC ALGORITHM	(9)

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

UNIT - III	HYBRID CONTROL SCHEMES	(9)

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

UNIT – IV	AUTOMATION	(9)

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

UNIT - V	INTELLIGENT CONTROLLER FOR AUTOMATION APPLICATION	(9)

Applications of intelligent controllers in industrial monitoring, optimization and control – Smart appliances – Automation concept for electrical vehicles – Intelligent controller and automation for power systems.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Describe the basic architectures of NN and Fuzzy logic.	Understand
CO2	Design and implement GA algorithms and know their limitations.	Apply
CO3	Explain and evaluate hybrid control schemes.	Apply
CO4	Interpret the significance of Automation concepts.	Apply
CO5	Develop the intelligent controller for automation applications.	Apply

TEXT BOOKS:

1. Laurene V.Fausett, 'Fundamentals of Neural Networks, Architecture, Algorithms, and Applications', Pearson Education, 2008.
2. Timothy J.Ross, 'Fuzzy Logic with Engineering Applications', Wiley, Third Edition, 2010.

REFERENCES:

1. David E.Goldberg, 'Genetic Algorithms in Search, Optimization, and Machine Learning', Pearson Education, 2009.
2. Miller, W.T. Sutton, R.S. and Webrose, P.J., 'Neural Networks for Control', MIT Press, 1996.
3. ChanchalDey and Sunit Kumar Sen, 'Industrial Automation Technologies', First Edition,CRC Press, 2022.
4. Jovan Pehcevski, 'Intelligent Control and Automation', Barnes and Noble, 2022.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	1	1	1	-	2
CO2	2	2	3	-	2
CO3	3	2	2	-	2
CO4	3	2	2	-	2
CO5	3	-	3	-	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215. Centre for Academic Courses

ET24E06	RENEWABLE ENERGY AND GRID INTEGRATION	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of electrical machines, power electronics, and energy systems is required to understand renewable energy integration and control techniques.

OBJECTIVE:

- To provide students with the ability to design, analyze, and integrate renewable energy systems like solar and wind into the grid using modern control and storage technologies.

UNIT - I	INTRODUCTION	(9)

Introduction to renewable energy systems – Environmental aspects of electric energy conversion – Impacts of renewable energy penetration to grid – Grid Codes in India and other countries – Basic power electronic converters for renewable energy integration to grid – Qualitative analysis – Boost and buck-boost converters – Three-phase AC voltage controllers – AC-DC-AC converters – PWM inverters, Grid Interactive Inverters – Matrix converters.

UNIT - II	PHOTOVOLTAIC ENERGY CONVERSION SYSTEMS	(9)

Introduction – Photo Voltaic (PV) effect, Solar Cell, Types – Equivalent circuit of PV cell, PV cell characteristics (I/V and P/V) for variation of insolation, temperature and shading effect – Stand-alone PV system – Grid connected PV system – Design of PV system: load calculation, array sizing, Selection of converter/inverter, battery sizing.

UNIT - III	WIND ENERGY CONVERSION SYSTEMS	(9)

Introduction, Power contained in wind, Efficiency limit in wind, types of wind turbines – Wind control strategies – Power curve, and Operating area, Types of wind generators system based on electrical machines – Induction Generator and Permanent Magnet Synchronous Generator (PMSG) – Grid connected Single and Double output system – Self-excited operation of Induction Generator and Variable Speed PMSG.

UNIT – IV	MPPT TECHNIQUES IN SOLAR AND WIND SYSTEMS	(9)

Case studies of PV – Maximum Power Point Tracking (MPPT) and Wind Energy system.

UNIT - V	HYBRID STORAGE SYSTEMS AND GRID MANAGEMENT	(9)

Energy Storage systems – Need for Hybrid Systems, Features of Hybrid Systems, Range and types of Hybrid systems (Wind-Diesel, PV-Diesel and Wind-PV).

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering. Tiruchengode-637215. Centre for Academic Courses

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Relate the power generation of different renewable energy sources to grid impact and grid codes.	Understand
CO2	Elucidate the design principles of solar energy management systems.	Apply
CO3	Explicate the power conversion system of wind generators.	Apply
CO4	Describe the different Maximum PowerPoint Tracking Techniques.	Apply
CO5	Build a grid-connected and stand-alone renewable energy management system.	Apply

TEXT BOOKS:

1.	Bhadra, S.N., Kastha, D., Banerjee S, 'Wind Electrical Systems', Oxford University Press, 2009.
2.	Haitham Abu-Rub, Mariusz Malinowski and Kamal Al-Haddad, 'Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications', IEEE Press and John Wiley and Sons Ltd. Press, 2014.

REFERENCES:

1.	Rashid. M.H., 'Power Electronics Handbook', Academic Press, 2001.
2.	Rai. G.D, 'Non-conventional Energy Sources', Khanna Publishers, 1993.
3.	Gray, L. Johnson, 'Wind Energy System', Prentice Hall Linc, 1995.
4.	Khan, B.H., 'Non-Conventional Energy sources', Tata McGraw-Hill Publishing Company, New Delhi, 2018.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	1	2	1	-	2
CO2	1	1	2	-	2
CO3	2	-	1	-	2
CO4	1	2	1	-	2
CO5	3	3	2	-	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637 215.

ET24E07	ELECTRIC VEHICLES AND POWER MANAGEMENT	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

A basic understanding of electrical machines, power electronics, and energy storage systems is essential for learning electric vehicle technologies and drive systems.

OBJECTIVE:

- To equip students with the knowledge to design, analyze, and implement electric vehicle systems, including powertrains, drives, and energy storage solutions.

UNIT - I	ELECTRIC VEHICLES AND VEHICLE MECHANICS	(9)

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings – Comparisons of EV with internal combustion engine vehicles – Fundamentals of vehicle mechanics.

UNIT - II	ARCHITECTURE OF EVs AND POWER TRAIN COMPONENTS	(9)

Architecture of EVs and HEVs – Plug-in hybrid electric vehicles (PHEV) – Power train components and sizing, gears, clutches, transmission and brakes.

UNIT - III	POWER ELECTRONICS AND MOTOR DRIVES	(9)

Electric drive components – Power electronic switches – Four-quadrant operation of DC drives – Induction motor and Permanent Magnet Synchronous Motor-based vector control operation – Switched Reluctance Motor (SRM) drives – EV motor sizing.

UNIT - IV	BATTERY ENERGY STORAGE SYSTEM	(9)

Battery Basics – Different types – Battery Parameters – Battery life and safety impacts – Battery modeling – Design of battery for large vehicles.

UNIT - V	ALTERNATIVE ENERGY STORAGE SYSTEMS	(9)

Introduction to fuel cell – Types, operation, and characteristics – Proton Exchange Membrane (PEM) fuel cell for E-mobility – Hydrogen storage systems – Super capacitors for transportation applications.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Describe the concept of electric vehicles and energy storage systems.	Understand
CO2	Explore the workings and components of electric vehicles and hybrid electric vehicles.	Understand
CO3	Discuss the principles of power converters and electrical drives.	Understand
CO4	Describe the operation of storage systems such as batteries and super capacitors.	Understand
CO5	Explore the various energy storage systems based on fuel cells and hydrogen storage.	Understand

Chairman (BoS)

TEXT BOOKS:	
1.	Iqbal Hussain, 'Electric and Hybrid Vehicles: Design Fundamentals', CRC Press, Taylor & Francis Group, Second Edition, 2011.
2.	Ali Emadi, Mehrdad Ehsani, John M.Miller, 'Vehicular Electric Power Systems', Marcel dekker, Inc., Special 63 Indian Edition, 2010.
REFERENCES:	
1.	Mehrdad Ehsani, Yimin Gao, Sebastian E. Gay, Ali Emadi, 'Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design', CRC Press, 2004.
2.	C.C. Chan and K.T. Chau, 'Modern Electric Vehicle Technology', OXFORD University Press, 2001.
3.	Wie Liu, 'Hybrid Electric Vehicle System Modeling and Control', John Wiley & Sons, Second Edition, 2017.
4.	J. G. Cowan, 'Power Management of Electrical Vehicles,' McGraw-Hill, 1st Edition, 2020.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	-	2
CO2	3	3	3	-	2
CO3	3	3	3	-	2
CO4	3	3	3	-	2
CO5	3	3	3	-	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215. Centre for Academic Courses

ET24E08	UNMANNED AERIAL VEHICLE	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of aerodynamics, embedded systems, and control systems is required to understand UAV design, hardware integration, and flight control.

OBJECTIVE:

- To enable students to design, develop, and test UAV systems with applications in areas like agriculture, defense, and disaster management.

UNIT - I	INTRODUCTION TO UAV	(9)

Overview and background – History of UAV – Classification – Societal impact and future outlook Unmanned Aerial System (UAS) components – Models and prototypes – System Composition – applications.

UNIT - II	THE DESIGN OF UAV SYSTEMS	(9)

Introduction to design and selection of the system – Aerodynamics and airframe configurations – Characteristics of aircraft types – Design standards – Regulatories and regulations – Design for stealth – Control surfaces – Specifications.

UNIT - III	HARDWARE FOR UAVS	(9)

Real-Time Embedded Processors for UAVS – sensors – Servos – Accelerometer – Gyros – Actuators – Power Supply – Integration, installation, configuration, and testing – MEMS/NEMS sensors and actuators for UAVS – Autopilot – AGL.

UNIT - IV	COMMUNICATION PAYLOADS AND CONTROLS	(9)

Payloads – Telemetry – tracking – Aerial photography – Controls – PID feedback – Radio control frequency range – Modems – Memory system – Simulation – Ground test – Analysis – Troubleshooting.

UNIT - V	THE DEVELOPMENT OF UAV SYSTEMS	(9)

Waypoints Navigation – Ground control software – System ground testing – System in-flight testing – Mini, Micro and Nano UAVS – Case study: Agriculture – health – surveying – Disaster management and defense.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Leve
CO1	Identify and describe various hardware components used in UAV systems.	Understand
CO2	Determine preliminary design requirements for unmanned aerial vehicles.	Apply
CO3	Design and develop a UAV system based on specified requirements.	Apply
CO4	Identify and integrate various subsystems of an unmanned aerial vehicle.	Apply
CO5	Design micro aerial vehicle systems, considering practical limitations.	Apply

Chairman (BoS)

TEXT BOOKS:	
1.	Austin, 'Unmanned Aircraft Systems UAV Design, Development and Deployment', Wiley, 2010.
2.	Paul G Fahlstrom, Thomas J Gleason, 'Introduction to UAV Systems', UAV Systems, Inc, 1998.
REFERENCES:	
1.	Dr. Armand J. Chaput, 'Design of Unmanned Air Vehicle Systems', Lockheed Martin Aeronautics Company, 2001.
2.	Kimon P. Valavanis, 'Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy', Springer, 2007.
3.	Robert C. Nelson, 'Flight Stability and Automatic Control', McGraw-Hill, Inc, 1998.
4.	Correll, N., Hayes, B., Martin, R., & Khatib, O. 'Introduction to Autonomous Robots: Mechanics, Control, Decision Making, and Algorithms'. MIT Press, 2017.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	1	3	2	-	2
CO2	3	3	3	-	2
CO3	3	3	3	-	2
CO4	-	-	2	-	2
CO5	3	-	3	-	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

ET24E09	DSP BASED SYSTEM DESIGN	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Fundamental knowledge of digital signal processing, computer architecture, and programming in C or assembly is essential to understand and implement DSP systems.

OBJECTIVE:

- To equip students with the ability to analyze, design, and implement high-performance DSP systems on programmable hardware platforms.

UNIT - I	REPRESENTATION OF DSP SYSTEM	(9)

Single Core and Multicore, Architectural requirement of DSPs – High throughput, low cost, low power, small code size, embedded applications. Representation of digital signal processing systems – Block diagrams, signal flow graphs, data-flow graphs, dependence graphs. Techniques for enhancing computational throughput – Parallelism and pipelining.

UNIT - II	DSP ALGORITHMS	(9)

DSP algorithms – Convolution, Correlation, FIR/IIR filters, FFT, adaptive filters, sampling rate converters, DCT, decimator, expander, and filter banks. DSP applications. Computational characteristics of DSP algorithms and applications, numerical representation of signals – Word length effect and its impact, carry free adders, multiplier.

UNIT - III	SYSTEM ARCHITECTURE	(9)

Introduction, Basic architectural features, DSP computational building blocks, bus architecture and memory, data addressing capabilities, address generation unit, programmability and program execution, and features for external interfacing. VLIW architecture. Basic performance issues in pipelining, simple implementation of MIPS, instruction level parallelism, dynamic scheduling, dynamic hardware prediction, and memory hierarchy. Study of fixed point and floating-point DSP architectures.

UNIT - IV	ARCHITECTURE ANALYSIS ON PROGRAMMABLE HARDWARE	(9)

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

UNIT - V	SYSTEM INTERFACING	(9)

Examples of Digital Signal Processing algorithms suitable for parallel architectures such as GPUs and Multi GPUS. Interfacing: Introduction, synchronous serial interface code, a codec interface circuit, ADC interface.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Evaluate DSP systems using various methods.	Understand
CO2	Design algorithms suitable for different DSP applications.	Apply
CO3	Explain various architectures of DSP systems.	Understand
CO4	Implement DSP systems in programmable hardware.	Apply
CO5	Interface DSP systems with various peripherals.	Apply

TEXT BOOKS:

1. Chassaing, 'Digital Signal Processing and Application with C6713 and C6416 DSK', A Wiley Interscience Publication, 2017.
2. Peter Pirsch John, 'Architectures for Digital Signal Processing', Weily, 2007.

REFERENCES:

1. Sen M Kuo, Woon Seng S Gan, 'Digital Signal Processors', Upper Saddle River, Pearson /Prentice Hall, 2002.
2. Nasser Kehtarnavaz,'Digital Signal Processing System Design: LabVIEW-Based Hybrid Programming', Academic Press, 2008.
3. Keshab K Parhi, 'VLSI Digital Signal Processing Systems: Design and Implementation', Wiley, Student Edition, 1999.
4. Smith, S. W. 'Digital Signal Processing: A Practical Guide for Engineers and Scientists', First Edition, Elsevier, 2003.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	-	-	2
CO2	3	3	3	-	2
CO3	3	3	-	-	2
CO4	3	2	3	-	2
CO5	2	2	3	-	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

College of Engineering, Tiruchengode-637215. Centre for Academic Courses K.S.R.

ET24E10	AUTOMOTIVE EMBEDDED SYSTEM	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of automotive systems, electronics, microcontrollers, and embedded programming is essential to understand electronic vehicle control and diagnostics.

OBJECTIVE:

- To enable students to design, analyze, and integrate electronic control, diagnostics, and communication systems in modern and electric vehicles.

UNIT - I	BASIC OF ELECTRONIC ENGINE CONTROL SYSTEMS	(9)

Overview of Automotive systems, fuel economy, air-fuel ratio, emission limits, and vehicle performance; Automotive microcontrollers – Electronic control Unit – Hardware and software selection and 37 requirements for Automotive applications – Open-source ECU – RTOS – Concept for Engine management; Introduction to AUTOSAR and Introduction to Society SAE – Functional safety ISO 26262 – Simulation and modeling of automotive system components.

UNIT - II	SENSORS AND ACTUATORS FOR AUTOMOTIVES	(9)

Review of sensors – Sensor's interface to the ECU, Conventional sensors and actuators, Modern sensors and actuators – Lidar Sensor – Smart sensors – MEMs/NEMs sensors and actuators for automotive applications.

UNIT - III	VEHICLE MANAGEMENT SYSTEMS	(9)

Electronic engine control – Engine mapping, air/fuel ratio spark timing control strategy, fuel control, electronic ignition – Adaptive cruise control – Speed control – Anti-locking braking system – Electronic suspension – Electronic steering, Automatic wiper control – Body control system; vehicle system schematic for interfacing with EMS, ECU. Energy management system for electric vehicles – Battery management system, Power management system – Electrically assisted power steering system adaptive lighting system – Safety and collision avoidance.

UNIT - IV	ONBOARD DIAGNOSTICS AND TELEMATICS	(9)

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

UNIT - V	ELECTRIC VEHICLES	(9)

Electric vehicles – Components – Plug-in Electrical Vehicle – Charging station – Aggregators – Fuel cells/Solar powered vehicles – Autonomous vehicles.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Insight into the significance of the role of embedded systems for automotive applications.	Understand
CO2	Illustrate the need, selection of sensors and actuators, and interfacing with ECU.	Apply
CO3	Develop the Embedded concepts for vehicle management and control systems.	Apply
CO4	Demonstrate the need for Electrical Vehicles and able to apply the embedded system technology for various aspects of EVs.	Apply
CO5	Describe the embedded systems design and its application in automotive systems.	Apply

TEXT BOOKS:

1. William B. Ribbens, 'Understanding Automotive Electronics', Elsevier Hand Book, 2012.
2. Ali Emedi, Mehrdedehsani, John M Miller, 'Vehicular Electric power system- land, Sea, Air and Space Vehicles', Marcel Decker, 2004.

REFERENCES:

1. Vlacic, L.Parent, M.Harahima, F. 'Intelligent Vehicle Technologies', SAE International, 2001.
2. Jack Erjavec, JeffArias, 'Alternate Fuel Technology-Electric, Hybrid, and Fuel Cell Vehicles', Cengage,2012.
3. Ronald K. Jurgen Chiltons, 'Electronic Engine Control Technology Guide to Fuel Injection' SAE International, Second Edition, 2002.
4. Tom Denton, 'Automotive Electricals / Electronics System and Components', Third Edition, 2004.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	-	2
CO2	2	3	2	-	2
CO3	3	3	3	-	2
CO4	3	3	3	-	2
CO5	3	3	3	-	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

ET24E11	COMPUTER VISION	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of programming (preferably Python), linear algebra, and signal processing is essential to understand and implement computer vision techniques.

OBJECTIVE:

- To enable students to apply computer vision and image processing techniques using OpenCV for real-world applications in areas like surveillance, healthcare, and automation.

UNIT - I	INTRODUCTION TO COMPUTER VISION	(9)

Digital image processing – Various fields that use image processing – Fundamental steps in digital image processing – Components of an image processing system. Applications of computer vision – Recent research in computer vision. Introduction to computer vision and basic concepts of image formation: introduction and goals – Image formation and radiometry – Geometric transformation – Geometric camera models – Image reconstruction from a series of projections.

UNIT - II	IMAGE PROCESSING CONCEPTS AND IMAGE FEATURES	(9)

Image processing concepts: Fundamentals – Image transforms – Image filtering – Colour image processing – Mathematical morphology – Image segmentation. Image descriptors and features: Texture descriptors – Colour features – Edge detection – Object boundary and shape representation – Interest or cornet point detectors – histogram-oriented gradients – Scale-invariant feature transform.

UNIT - III	IMAGE PROCESSING WITH OPEN CV	(9)

Introduction to OpenCV and Python: setting up OpenCV – Image basics in OpenCV – Handling files and images – constructing basic shapes in OpenCV. Image processing in OpenCV: image processing techniques – Constructing and building histograms – Thresholding techniques.

UNIT - IV	OBJECT DETECTION	(9)

Models and types – The importance of object detection. The working: inputs and outputs – Basic structure – Model architecture overview – Object detection on the edge. Use cases and applications: video surveillance – Self-driving cars. Embedded boards: Connecting cameras to embedded boards – Simple algorithms for processing images and videos.

UNIT - V	APPLICATIONS AND CASE STUDIES	(9)

Applications: Machine learning algorithms and their applications in medical image segmentation – Motion estimation and object tracking – Face and facial expression recognition – Image fusion. Case studies: Face detection – Object tracing – Eye tracking – Handwriting recognition with hog.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
COs	Course Outcome	Cognitive Level
CO1	Discuss the major concepts and techniques in computer vision and image processing.	Understand
CO2	Infer known principles of the human visual system.	Apply
CO3	Establish a thorough knowledge of open CV.	Apply
CO4	Develop real-life Computer vision applications.	Apply
CO5	Build design of a Computer Vision System for a specific problem.	Apply

TEXT BOOKS:	
1.	Rafael C Gonzalez and Richard E Woods, 'Digital Image Processing', Pearson Education Limited, Fourth Edition (Global Edition), 2018.
2.	Manas Kamal Bhuyan, 'Computer Vision and Image Processing - Fundamentals and Applications', CRC Press, 2020.

REFERENCES:	
1.	Alberto Fernandez Villan, 'Mastering OpenCV 4 with Python', Packet Publishing, 2019.
2.	Adrian Rosebrock, 'Practical Python and Open CV: Case Studies', Py Image Search, Third Edition, 2016.
3.	David L. Poole and Alan K. Mackworth, 'Artificial Intelligence: Foundations of Computational Agents', Cambridge University Press, 2017.
4.	Jan Erik Solem, 'Programming Computer Vision with Python: Tools and algorithms for analyzing images', O'Reilly Media, 2012.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	-	2
CO2	2	2	2	-	2
CO3	3	3	3	-	2
CO4	3	3	3	-	2
CO5	3	3	3	-	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode, Centre for Academic Courses

ET24E12	MULTIMEDIA COMMUNICATION	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

A basic understanding of digital signal processing, data communication, and computer networks is required to learn multimedia data handling and compression techniques.

OBJECTIVE:

- To equip students with the knowledge of multimedia representation, compression, transmission, and synchronization for effective communication over various networks.

UNIT - I	INTRODUCTION TO MULTIMEDIA COMMUNICATIONS	(9)

Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles, Text, images, audio and video.

UNIT - II	COMPRESSION TECHNIQUES FOR TEXT AND IMAGE	(9)

Text and image compression, compression principles, text compression – Run length, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression – GIF, TIFF and JPEG.

UNIT - III	COMPRESSION TECHNIQUES FOR AUDIO AND VIDEO	(9)

Audio and video compression, audio compression – Principles, DPCM, ADPCM, Adaptive and Linear predictive coding, code-excited LPC, Perceptual coding, MPEG and Dolby coders video compression, video compression principles.

UNIT - IV	STANDARDS AND FRAMEWORK	(9)

Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework.

UNIT - V	SYNCHRONIZATION AND MANAGEMENT	(9)

Notion of synchronization, presentation requirements, a reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, and process management techniques.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Deploy the right multimedia communication models.	Apply
CO2	Apply QoS to multimedia network applications with efficient routing techniques.	Apply
CO3	Solve the security threats in multimedia networks.	Apply
CO4	Develop real-time multimedia network applications.	Apply
CO5	Improve synchronization and manage the multimedia systems.	Understand

TEXT BOOKS:

1.	Jerry D. Gibson, 'Multimedia Communications', Department of Electrical Engineering Southern Methodist University, Texas, 2019.
2.	Mario Marques da Silva, 'Multimedia Communications and Networking', Taylor and Francis Group, 2012.

REFERENCES:

1.	Fred Halsall, 'Multimedia Communications', Pearson Education, 2001.
2.	Raif Steinmetz, Klara Nahrstedt, 'Multimedia: Computing, Communications and Applications',Pearson Education, 2002.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	-	1	1	2
CO2	2	-	1	1	2
CO3	3	-	-	1	2
CO4	2	-	-	1	2
CO5	2	-	-	1	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215 Centre for Academic Courses

ET24E13	EMBEDDED NETWORKING AND AUTOMATION OF ELECTRICAL SYSTEM	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of electrical measurements, microcontrollers, embedded systems, and communication protocols is essential to understand smart grid automation and instrumentation.

OBJECTIVE:

- To equip students with the skills to design, network, and automate smart energy systems using embedded technologies, communication protocols, and smart metering solutions.

UNIT - I	BUILDING SYSTEM AUTOMATION	(9)

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

UNIT - II	EMBEDDED NETWORKING OF INSTRUMENT CLUSTER	(9)

Embedded Networking: Introduction – Cluster of instruments in the system – Comparison of bus protocols – RS 232C – Embedded ethernet – MOD bus and CAN bus, LIN bus – Introduction to WSN – Commercially available sensor nodes – Zigbee protocol – Network Topology Energy efficient MAC protocols – SMAC – Data Centric routing Applications of sensor networks – Database perspective on sensor networks – IoT applications.

UNIT - III	AUTOMATION OF SUBSTATION	(9)

Substation automation – Distribution SCADA system principles – Role of PMU,RTU, IEDs, BUS for smart Substation automation – Introduction to the role of IEC 61850, IEEEC37.118 std – Interoperability and IEC 61850 – Challenges of substations in smart grid – Challenges of energy storage and distribution systems monitoring – Communication challenges in monitoring electric utility asset.

UNIT - IV	METERING OF SMART GRID	(9)

Characteristics of smart grid – Generation by renewable energy sources based on solar grid – Challenges in smart grid and microgrids – Electrical measurements with AMI – Smart meters for EV plug-in electric vehicles power management – Home area net metering and Demand-side energy management applications.

UNIT - V	SMART METERS FOR PQ MONITORING	(9)

Power quality issues of grid-connected renewable energy sources – Smart meters for power quality monitoring and control – Power quality issues – Surges – Flicker – Inter harmonics – Transients – Power Quality Benchmarking – Power Quality Meters – Meter data management in smart grid – Communication-enabled Power Quality metering.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Validate criteria of choice of sensors, and components to build meters.	Apply
CO2	Deliberate the demand for BUS communication protocols is introduced.	Understand
CO3	Discuss the needs and standards in substation automation.	Understand
CO4	Deployment of PAN for metering networked commercial applications.	Apply
CO5	Realize the improved employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded networked communications.	Understand

TEXT BOOKS:

1.	Krzysztof Iniewski, 'Smart Grid, Infrastructure & Networking', TMcGH, 2012.
2.	Robert Faludi, 'Building Wireless Sensor Networks', O'Reilly, 2011.

REFERENCES:

1.	Robert Wilson, 'Control and automation of electrical power distribution systems', James Northcote-Green, CRC, Taylor and Francis, 2006.
2.	Mohammad Ilyas and Imad Mahgoub, 'Handbook of sensor Networks: Compact wireless and wired sensing systems', CRC Press, 2005.
3.	Shih-Lin Wu, Yu-Chee Tseng, 'Wireless Ad Hoc Networking, PAN, LAN, SAN', Auerbach Publication, 2012.
4.	Sanjay Gupta, 'Virtual Instrumentation, LABVIEW', TMH, New Delhi, 2003.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	1	2	3	1
CO2	1	-	2	3	1
CO3	3	1	2	3	1
CO4	2	-	2	3	1
CO5	2	1	2	3	1

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode, Centre for Academic Courses

ET24E14	SMART SYSTEM DESIGN	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic understanding of embedded systems, microcontrollers, communication protocols, and sensor interfacing is required to design and implement smart systems and applications.

OBJECTIVE:

- To enable students to design, implement, and integrate smart embedded systems for applications in automation, energy management, wearables, and robotics.

UNIT - I	INTRODUCTION	(9)

Overview of a smart system – Design Requirements – Hardware and software selection and co-design – Smart sensors and Actuators – Communication protocols used in smart systems – Data Analytics: Need and Types – Open-source Analytics Platform for embedded systems (IFTTT & Thing speak) – Smart Microcontrollers – Embedded system for Smart card design and development – Recent trends.

UNIT - II	HOME AUTOMATION	(9)

Home Automation – Design Considerations: Control Unit, Sensing Requirements, Communication, Data Security – System Architecture – Essential Components – Linux and Raspberry Pi – Design and Real-Time implementation.

UNIT - III	SMART APPLIANCES AND ENERGY MANAGEMENT	(9)

Energy Management: Demand-side Load Management: Energy scheduling – Significance of smart appliances in energy management – Embedded and Integrated Platforms for Energy Management – Smart Meters: Significance, Architecture and Energy Measurement Technique – Smart Networks for Embedded Appliances – Security Considerations.

UNIT - IV	SMART WEARABLE DEVICES	(9)

Application of smart wearables in healthcare and activity monitoring – Functional requirements – Selection of body sensors, Hardware platform, OS and Software platform – Selection of suitable communication protocol. Case Study: Design of a wearable, collecting heart-beat, temperature and monitoring health status using a smartphone application.

UNIT - V	EMBEDDED SYSTEMS AND ROBOTICS	(9)

Robots and Controllers components – Aerial Robotics – Mobile Robot Design – Three-Servo Ant Robot – Autonomous Hex copter System.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637 215. Centre for Academic Courses

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Recognize the concepts of smart system design and its present developments.	Understand
CO2	Illustrate different embedded open-source and cost-effective techniques for developing solutions for real-time applications.	Understand
CO3	Acquire knowledge of different platforms and Infrastructure for Smart system design.	Apply
CO4	Infer about smart appliances and energy management concepts.	Understand
CO5	Apply and improve Employability and entrepreneurship capacity due to knowledge upgradation on embedded system technologies.	Apply

TEXT BOOKS:

1.	Thomas Braunl, 'Embedded Robotics', Springer, 2003.
2.	Grimm, Christoph, Neumann, Peter, Mahlknech and Stefan, 'Embedded Systems for Smart Appliances and Energy Management', Springer, 2013.

REFERENCES:

1.	Raj Kamal, 'Embedded Systems - Architecture, Programming and Design', McGraw-Hill, 2008.
2.	Nilanjan Dey, Amartya Mukherjee, 'Embedded Systems and Robotics with Open-Source Tools', CRC press, 2016.
3.	Karim Yaghmour, 'Embedded Android', O'Reilly, 2013.
4.	Steven Goodwin, 'Smart Home Automation with Linux and Raspberry Pi', Apress, 2013.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	-	3	2	2	2
CO2	2	-	-	2	2
CO3	-	-	-	2	2
CO4	-	-	-	2	2
CO5	-	-	-	2	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengodu-637215, Centre for Academic Courses

ET24E15	EMBEDDED COMPUTING	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of embedded systems, computer networks, and object-oriented programming (preferably Java) is required to develop secure distributed real-time applications.

OBJECTIVE:

- To equip students with the skills to develop and integrate secure, networked, and distributed embedded applications using Java, Android, and smart card technologies.

UNIT - I	NETWORK INFRASTRUCTURE	(9)

Broad Band Transmission facilities –Open Interconnection standards – Networking devices Network diagram –Network management – Network Security – Cluster computers.

UNIT - II	JAVA TECHNOLOGY FOR EMBEDDED SYSTEMS	(9)

Basic concepts of Java – IO streaming – Object serialization – Networking – Threading – RMI – distributed databases – Advantages and limitations of the Internet – Web architecture for embedded systems – Security model for embedded systems.

UNIT - III	SMART CARD TECHNIQUES	(9)

Smart Card basics – Java card technology overview – Java card Types – Card components Smart Card Microcontrollers – Contactless cards – Smartcard operating systems – Smart card Security Techniques.

UNIT - IV	ANDROID FRAMEWORK	(9)

Android SDK – Access to Hardware – Frame work development – Peer-to-Peer communication – Android security design and architecture – Case study.

UNIT - V	DEVELOPING DISTRIBUTED REAL-TIME SYSTEM APPLICATIONS	(9)

Developing MATLAB Real-Time Targets – Using the xPC Target – Building various distributed Real-Time applications.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Describe the JAVA concepts and internet-based communication to establish a decentralized control mechanism of the system.	Understand
CO2	Interpret the software and hardware architecture for distributed computing.	Understand
CO3	Develop a solution for smart cards.	Apply
CO4	Develop Apps based on Android SDK.	Apply
CO5	Deliberate recent trends in the embedded system computing environment.	Understand

Chairman (BoS)

TEXT BOOKS:	
1.	Wolfgang Rankl and Wolfgang Effing, 'Smart Card Handbook', John Wiley & Sons Limited, Third Edition, 2003.
2.	Reto Meier, 'Professional Android application development', Wiley Publishing, Inc., 2009.
REFERENCES:	
1.	Joshua, 'Android hacker's Handbook', John Wiley &Sons, 2014.
2.	Dietel & Dietel, 'JAVA how to program', Prentice Hall, 1999.
3.	Sape Mullender, 'Distributed Systems', Addison-Wesley, 1993.
4.	Amitava Gupta, Anil Kumar Chandra and Peter Luksch, 'Real-Time and Distributed Real-Time Systems Theory and Applications', CRC Press, International Standard Book Number-13: 978-1-4665-9849-2 (eBook - PDF), 2016.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	-	1	2	2
CO2	2	3	2	2	2
CO3	3	1	2	2	2
CO4	3	1	2	2	2
CO5	2	1	2	2	2

1- Low, 2- Medium, 3- High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215. Centre for Academic Courses

ET24E16	EMBEDDED SYSTEMS SECURITY	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Students should have foundational knowledge of embedded systems, computer architecture, and basic cryptographic principles to understand security threats and countermeasures in embedded environments.

OBJECTIVE:

- To provide students with the ability to design and implement security mechanisms for embedded systems using cryptographic protocols and secure architecture principles.

UNIT - I	BACKGROUND AND INTRODUCTION	(9)

Computer and Network Security Concepts: Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services – Security Mechanisms – Fundamentals of Security Design Principles – Attack Surfaces and Attack Trees – A Model for Network Security. Introduction to Number Theory: Divisibility and the Division Algorithm – The Euclidean Algorithm – Modular Arithmetic – Prime Numbers – Fermet's and Euler's Theorems – Testing for Primality – The Chinese Remainder Theorem – Discrete Logarithms.

UNIT - II	SYMMETRIC CIPHERS	(9)

Classical Encryption Techniques: Symmetric Cipher Model – Substitution Techniques – Transposition Techniques. Block Ciphers and the Data Encryption Standard (DES): Traditional Block Cipher Structure – The Data Encryption Standard – A DES Example – Strength of DES. Advanced Encryption Standard: Finite Field Arithmetic – AES Structure – AES Transformation Functions – AES Key Expansion – An AES Example – AES Implementation.

UNIT - III	EMBEDDED SYSTEMS SECURITY	(9)

Embedded Security Trends – Security Policies – Security Threats. System Software Considerations: The Role of Operating System – Microkernel versus Monolithic – Core Embedded OS Security Requirements – Access Control and Capabilities – Hypervisors and System Virtualization – I/O Virtualization – Remote Management – Assuring Integrity of the TCB.

UNIT - IV	EMBEDDED CRYPTOGRAPHY AND DATA PROTECTION PROTOCOLS	(9)

The One-time Pad – Cryptographic Modes – Block Ciphers – Authenticated Encryption – Public Key Cryptography – Key Agreement – Public Key Authentication – Elliptic Curve Cryptography – Cryptographic Hashes – Message Authentication Codes – Random Number Generation – Key Management for Embedded Systems – Cryptographic Certifications. Data Protection Protocols for Embedded Systems: Data-in-Motion Protocols – Data-at-Rest Protocols. Emerging Applications: Embedded Network Transactions – Automotive Security – Secured Android.

UNIT - V	PRACTICAL EMBEDDED SYSTEM SECURITY	(9)

Network Communications Protocols and Built-in Security – Security Protocols and Algorithms – The Secured Socket Layer – Embedded Security – Wireless – Application-Layer and Client/Server Protocols – Choosing and Optimizing Cryptographic Algorithms for Resource-Constrained Systems – Hardward based security.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Enlighten the significance of security.	Understand
CO2	Recognize the major concepts and techniques related to cryptography.	Understand
CO3	Demonstrate thorough knowledge of the aspects of embedded System Security.	Understand
CO4	Delivers insight into the role of security aspects during data transfer and communication.	Understand
CO5	Applying the security algorithms for real-time applications.	Apply

TEXT BOOKS:

1. William Stallings, 'Cryptography and Network Security Principles and Practice', Global Edition, Pearson Education Limited, Eighth Edition, 2023.
2. David Kleidermacher and Mike Kleidermacher, 'Newnes Embedded Systems Security-Practical Methods for Safe and Secure Software and Systems Development', 2012.

REFERENCES:

1. Timothy Stapko, Newnes (an imprint of Elsevier), 'Practical Embedded Security-Building Secure Resource-Constrained Systems', 2008.
2. David Kleidermacher and Mike Kleidermache, 'Embedded Systems Security: Building a Trustworthy Internet of Things', Elsevier Science and Technology Books, 2017.
3. David Kleidermacher and Mike Kleidermacher, 'Embedded Systems Security: Practical Methods for Safe and Secure Software and Systems Development', Second Edition, CRC Press, 2020.
4. Jonathan Katz and Yehuda Lindell, 'Introduction to Modern Cryptography: Principles and Protocols', Cambridge University Press, 2007.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	3	2	-
CO2	3	-	3	2	-
CO3	3	-	3	2	-
CO4	3	-	3	2	-
CO5	3	-	3	2	-

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R College of Engineering, Tiruchengode, Centre for Academic Courses

ET24E17	MACHINE LEARNING AND DEEP LEARNING	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Students should have prior understanding of linear algebra, probability, and programming in Python to grasp learning algorithms and neural network architectures effectively.

OBJECTIVE:

- To equip students with theoretical and practical knowledge in machine learning and deep learning for building intelligent models and solving real-world data problems.

UNIT - I	LEARNING PROBLEMS AND ALGORITHMS	(9)

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

UNIT - II	NEURAL NETWORKS	(9)

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

UNIT - III	MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS	(9)

Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1-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.

UNIT - IV	DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS	(9)

Feed-forward networks, Activation functions, backpropagation in CNN, optimizers, batch normalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs.

UNIT - V	DEEP LEARNING: RNNS, AUTOENCODERS AND GANS	(9)

State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text, Auto encoders: Convolutional Auto encoders, Denoising auto encoders, Variational auto encoders, GANs: The discriminator, generator, DCGANs.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215. Centre for Academic Courses

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Categorize various machine learning algorithms.	Understand
CO2	Compare and contrast the types of neural network architectures, and activation functions.	Apply
CO3	Apply pattern association techniques using neural networks.	Apply
CO4	Elaborate on various terminologies related to pattern recognition and architectures of convolutional neural networks.	Apply
CO5	Integrate classification techniques and advanced neuralnetwork architectures such as RNN, Auto encoders, and GANs.	Apply

TEXT BOOKS:

1. Jang, J. S. R., Sun, C. T., Mizutani, E. 'Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence', PHI Learning, 2012.
2. Deep Learning, Ian Good fellow, 'Yoshua Bengio and Aaron Courville', MIT Press, ISBN: 9780262035613, 2016.

REFERENCES:

1. Shai Shalev-Shwartz and Shai Ben-David 'Understanding Machine Learning', Cambridge University Press. 2017.
2. Jang, J.S.R, Sun, C.T,Mizutani, E., 'Neuro-Fuzzy and Soft Computing - A Computational', Upper Saddle River, NJ: Prentice Hall, 1997.
3. Vinod Chandra S.S, Anand Hareendran S. 'Approach to Learning and Machine Intelligence', PHI learning, First Edition, 2012.
4. Christopher Bishop, 'Pattern Recognition and Machine Learning', Springer, 2006.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	3	2	2
CO2	3	-	3	2	2
CO3	3	-	3	2	2
CO4	3	-	3	2	2
CO5	3	-	3	2	2

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R College of Engineering, Centre for Academic Courses

ET24E18	RECONFIGURABLE PROCESSOR AND SoC DESIGN	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic understanding of digital electronics, embedded systems, and microprocessor architecture, along with familiarity in HDL programming and system design principles.

OBJECTIVE:

- To explore and apply concepts of reconfigurable computing, FPGA technologies, and SoC architectures for advanced embedded system applications.

UNIT - I	INTRODUCTION	(9)

Introduction to reconfigurable processor – Reconfigurable Computing – Programming elements and Programming Tools for Reconfigurable Processors, ASIC design flow – Hardware/Software Co-design – FPAA Architecture overview – Recent trends in Reconfigurable Processor & SoC.

UNIT - II	FPGA TECHNOLOGIES	(9)

FPGA Programming technology – Alternative FPGA architectures: MUX Vs LUT based logic blocks – CLB Vs LAB Vs Slices – Fast carry chains- Embedded RAMs – Routing for FPGAs – Circuits and Architectures for Low-Power FPGAs – Physical Design.

UNIT - III	FPGA ARCHITECTURE	(9)

FPGA architecture overview – Challenges of FPGA processor design – Opportunities of FPGA processor design – Designing Soft-Core Processors – Designing Hardcore Processors – hardware/software co-simulation– FPGA to multi-core embedded computing – FPGA-based on-board computer system.

UNIT - IV	RECONFIGURABLE SOC PROCESSORS	(9)

SoC Overview – Architecture and applications of Virtex II pro, Zynq-7000, Excalibur, Cyclone V - A7, E5 - FPSLIC – Multicore SoCs.

UNIT - V	RECONFIGURABLE PROCESSOR AND SOC APPLICATIONS	(9)

Reconfigurable processor-based DC motor control – digital filter design – mobile phone development – High Speed Data Acquisition – Image Processing application – controller implementation for mobile robot – Crypto-processor.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode, Centre for Academic Courses

COURSE OUTCOMES:
At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Apply hardware/software co-design principles and programming tools to develop efficient reconfigurable processor-based systems.	Apply
CO2	Implement FPGA programming techniques and select appropriate FPGA architectures to design low-power, high-performance logic circuits.	Apply
CO3	Apply the concept of FPGA technology and understand FPGA architectures.	Apply
CO4	Interpret the operation of SoC processor.	Understand
CO5	Develop and implement reconfigurable processor-based solutions for applications such as motor control, digital filtering, and image processing.	Apply

TEXT BOOKS:

1. Nurmi, Jari (Ed.), Processor Design System-On-Chip Computing for ASICs and FPGAs, Springer, 2007.
2. Ian Grout, Digital system design with FPGAs and CPLDs, Elsevier, 2008.

REFERENCES:

1. Joao Cardoso, Michael Hubner, Reconfigurable Computing: From FPGAs to Hardware/Software Codesign, Springer, 2011.
2. Ron Sass and Andrew G. Schmidt, Embedded System design with platform FPGAs: Principles and Practices, Elsevier, 2010.
3. Steve Kilts, Advanced FPGA Design: Architecture, Implementation, and Optimization, Wiley, 2007.
4. Pierre-Emmanuel Gaillardon, Reconfigurable Logic: Architecture, Tools, and Applications, 1st Edition, CRC Press, 2015.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	-	-	-	-
CO2	2	2	3	-	-
CO3	2	-	2	2	-
CO4	2	1	3	-	-
CO5	2	-	-	-	3

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

ET24E19	MEMS AND NEMS TECHNOLOGY	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of semiconductor physics, materials science, and microfabrication techniques; understanding of mechanical and electrical system fundamentals.

OBJECTIVE:

- To understand the principles, fabrication methods, and applications of micro and nano-electro-mechanical systems (MEMS and NEMS).

UNIT - I	INTRODUCTION TO MEMS AND NEMS	(9)

Overview of Micro electro mechanical systems and Nano Electro mechanical systems, devices and technologies, Laws of scaling – Survey of materials – Smart Sensors – Applications of MEMS and NEMS.

UNIT - II	MICRO-MACHINING AND MICROFABRICATION TECHNIQUES	(9)

Photolithography – Film deposition, Etching Processes – wafer bonding – Bulk micro machining, silicon surface micro machining – LIGA process.

UNIT - III	MICRO SENSORS AND MICRO ACTUATORS	(9)

Transduction mechanisms in different energy domain – Micro machined capacitive, Piezoelectric, Piezoresistive and Electromechanical and thermal sensors/actuators and applications.

UNIT - IV	NEMS TECHNOLOGY	(9)

Atomic scale precision engineering – Nano Fabrication techniques – NEMS in measurement, sensing, actuation and systems design.

UNIT - V	MEMS and NEMS APPLICATION	(9)

Introduction to Micro/Nano Fluids and applications – Bio MEMS- Optical NEMS – Micro and Nano motors – Recent trends in MEMS and NEMS.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengodu-637215

COURSE OUTCOMES:
At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Explain the material properties and the significance of MEMS and NEMS for industrial automation.	Understand
CO2	Demonstrate knowledge delivery on micromachining and microfabrication.	Understand
CO3	Apply the fabrication mechanism for MEMS sensor and actuators.	Apply
CO4	Apply the concepts of MEMS and NEMS to models, simulate and process the sensors and actuators.	Apply
CO5	Apply concepts of micro/nano fluids and MEMS/NEMS technologies to analyze and design systems for biomedical, optical and nano-scale applications.	Apply

TEXT BOOKS:

1. Chang Liu, "Foundations of MEMS", Pearson International Edition, 2006.
2. Marc. F. Madou, "Fundamentals of micro fabrication" CRC Press, Second Edition, 2002.

REFERENCES:

1. M.H.Bao "Micromechanical transducers: Pressure sensors, accelerometers and gyroscopes", Elsevier, Newyork, 2000.
2. Maluf, Nadim "An introduction to Micro Electro-Mechanical Systems Engineering, AR Tech house, Boston, 2000.
3. Mohamed Gad-el-Hak "MEMS Handbook," Edited by CRC Press 2002.
4. Sabrie Soloman "Sensors Handbook", McGraw-Hill, 1998.
5. Tai Ran Hsu, "MEMS and Microsystems: design, manufacture, and Nanoscale" 2nd Edition, John Wiley & Sons, Inc., Hoboken, New Jersey, 2008.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	-
CO2	3	3	2	2	2
CO3	3	3	3	2	2
CO4	3	3	3	3	2
CO5	3	2	3	3	3

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R College of Engineering, Centre for Academic Courses

ET24E20	ENTREPRENEURSHIP DEVELOPMENT	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic understanding of management principles, economics, and business processes, along with awareness of socio-economic factors influencing industries.

OBJECTIVE:

- To develop entrepreneurial skills and knowledge for identifying opportunities, preparing business plans, and launching and managing successful ventures.

UNIT - I	INTRODUCTION TO ENTREPRENEURSHIP	(9)

Meaning & Evolution of term: Entrepreneurship – Factors influencing entrepreneurship: psychological, social, economic, and environmental factors. Characteristics – Entrepreneur types: According to Type of Business, Use of Technology, According to Motivation, According to Growth, According to Stages, New generations of entrepreneurship – Women entrepreneurship.

UNIT - II	ENTREPRENEURIAL MOTIVATION & ENVIRONMENT	(9)

Motivation – Maslow's theory – Herjburg's theory – McGragor's Theory – McClelland's Need – Achievement Theory. Entrepreneurial environment in India : Culture & Society, Values / Ethics, Risk-taking behavior – Entrepreneurial Development Programmes (EDPs) Role – Relevance and Achievement of EDPs in India.

UNIT - III	BUSINESS PLAN PREPARATION AND MANAGEMENT	(9)

Plan Preparation: Sources of Product – Pre Feasibility Study – Ownership - Capital Budgeting – Project Profile Preparation. Management: Creativity and entrepreneurship – Innovation and inventions – Feasibility Report Preparation and Evaluation Criteria – Decision making and Problem Solving.

UNIT - IV	ORGANISATION ASSISTANCE	(9)

Assistance to an entrepreneur – New Ventures – Financial assistance by different agencies : MSME Act for Small Scale Industries , National Small Industries Corporation (NSIC) – Government Stores Purchase scheme (e-tender process) – Excise exemptions and concessions – Quality Standards with special reference to ISO – Directorate General of Supplies and Disposals.

UNIT - V	RULES AND LEGISLATION	(09)

Applicability of Legislation – Legal formalities in setting up of SSIs Business Laws – Governmental Setup in promoting small industries, financial institutions – The Industrial Employment (Standing Orders) Act, 1946 – Environment (Protection) Act, 1986 – The sale of Goods Ac, 1950 – Industrial Dispute Act 1947.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215. Centre for Academic Courses

COURSE OUTCOMES:		
Upon completion of the course, the students will be able to:		
COs	**Course Outcome**	**Cognitive Level**
CO1	Understanding the basics of entrepreneurship and its types.	Understand
CO2	Understanding the existing theories of entrepreneurial management and analyzing the ethics and risk factors for startups.	Apply
CO3	Formulate a basic business plan and its management.	Understand
CO4	Understanding the concepts of getting financial assistance for startups.	Understand
CO5	Correlating the use of the different Government initiatives and different support organizations for supporting Entrepreneurship ideas.	Apply

TEXT BOOKS:

1	Havinal, Veerbhadrappa, "Management and Entrepreneurship", New Age International Publications, 2020.
2	R.D. Hisrich, "Entrepreneurship", Tata McGraw-Hill, New Delhi, 2018.
3	N.V.R. Naidu & T. Krishna Rao "Management and Entrepreneurship" I.K international Publishing House, New Delhi, 2016.
4	Anita Goyal, Karl T Ulrich, Steven D Eppinger, "Product Design and Development", Tata McGraw-Hill Education, 4th Edition,2009.

REFERENCES:

1	Steven Fisher, Ja-nae' Duane, "The Startup Equation-A Visual Guidebook for Building Your Startup", Indian Edition, McGraw-Hill Education India Pvt. Ltd, 2016.
2	Prasanna Chandra, "Projects – Planning, Analysis, Selection, Implementation, and Reviews", Tata McGraw-Hill, 8th edition, 2017
3	Bolton, B., & Thompson, J. L. "The entrepreneur: The all-in-one entrepreneur-leader-manager". *New York: Routledge* , 2015.
4	Casson, M., & Godley, "A, Entrepreneurship and historical explanation", Proceedings of CEHR, Vol. V, New York: Palgrave Macmillan, 2020.
5	S.Khanka, "Entrepreneurial Development", S. Chand and Company Limited, New Delhi, Revised Edition, 2013.

Mapping of Cos with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	-	1
CO2	3	3	3	-	2
CO3	3	2	2	-	1
CO4	3	3	3	-	2
CO5	3	2	3	-	2

Chairman (BoS)

K.S. College of Engineering, Tiruchengode Centre for Academic Courses

ET24E21	EMBEDDED SYSTEM FOR BIOMEDICAL APPLICATIONS	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of human physiology, electronic circuits, and embedded systems; familiarity with signal processing and sensor technologies is beneficial.

OBJECTIVE:

- To understand and apply embedded system technologies in the design and development of biomedical diagnostic and therapeutic devices.

UNIT - I	INTRODUCTION TO BIOMEDICAL ENGINEERING	(9)

Origin of bio potential and its propagation – Resting and Action Potential – Bio signals: characteristics, Types of electrodes – Types of transducers and applications – Bio-amplifiers – Types of recorders – components of a biomedical system.

UNIT - II	WEARABLE HEALTH DEVICES	(9)

Concepts of wearable technology in health care – Components of wearable devices – Biosensors – Blood glucose sensors – Head worn – Hand worn – Body worn – pulse oxymeter – Cardiac pacemakers – Hearing aids and its recent advancements – Wearable artificial kidney.

UNIT - III	EMBEDDED SYSTEM FOR MEDICAL IMAGE PROCESSING	(9)

Introduction to embedded image processing – ASIC vs FPGA – memory requirement – power consumption – parallelism – Design issues in VLSI implementation of Image processing algorithms – interfacing. Hardware implementation of image processing algorithms: Segmentation and compression

UNIT - IV	EMBEDDED SYSTEM FOR DIAGNOSTIC APPLICATIONS	(9)

ICCU patient monitoring system: ECG, EEG, EMG acquisition system – MRI scanner – CT scanner – Sonography.

UNIT - V	CASE STUDY	(9)

Respiratory measurement using spirometer – IPPB unit for monitoring respiratory parameters – ventilators – Defibrillator – Glucometer – Heart – Lung machine.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Demonstrate the fundamental art of biomedical engineering.	Understand
CO2	Illustrate about wearable health devices and its importance.	Understand
CO3	Implement image processing applications using software and hardware.	Apply
CO4	Compare various embedded diagnostic applications.	Understand
CO5	Illustrate the concepts of biomedical equipments.	Understand

Chairman (BoS)

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.
2. John G. Webster, "Medical Instrumentation Application and Design", Third Edition, Wiley India Edition, 2007

REFERENCES:

1. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw Hill, New Delhi, Third Edition, 2014.
2. L.A Geddes and L.E. Baker, Principles of Applied Biomedical Instrumentation, Third Edition, John Wiley and Sons, Reprint 2008.
3. Richard S. Cobbold, Transducers for Biomedical Measurements; Principle and applications-John Wiley and sons, 1992.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	1	2	3	2	2
CO2	2	3	2	2	2
CO3	2	-	2	2	2
CO4	3	1	1	2	2
CO5	1	3	3	2	2

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215. Centre for Academic Courses

ET24E22	PYTHON PROGRAMMING FOR MACHINE LEARNING	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic understanding of programming logic, data structures, and mathematics (especially linear algebra and probability); familiarity with embedded systems is an added advantage.

OBJECTIVE:

- To enable students to apply machine learning techniques using Python and implement models on embedded platforms for intelligent system development.

UNIT - I	INTRODUCTION TO MACHINE LEARNING AND PYTHON	(9)

Introduction to Machine Learning: Significance, Advantage and Applications – Categories of Machine Learning – Basic Steps in Machine Learning: Raw Data Collection, Pre-processing, Training a Model, Evaluation of Model, Performance Improvement

Introduction to Python and its significance – Difference between C, C++ and Python Languages; Compiler and Interpreters – Python3 Installation & Running – Basics of Python Programming Syntax: Variable Types, Basic Operators, Reading Input from User – Arrays/List, Dictionary and Set – Conditional Statements – Control Flow and loop control statements

UNIT - II	PYTHON FUNCTIONS AND PACKAGES	(9)

File Handling: Reading and Writing Data – Errors and Exceptions Handling – Functions & Modules – Package Handling in Python – Pip Installation and Exploring Functions in python package – Installing the Numpy Library and exploring various operations on Arrays: Indexing, Slicing, Multi-Dimensional Arrays, Joining Numpy Arrays, Array intersection and Difference, Saving and Loading Numpy Arrays – Introduction to SciPy Package & its functions – Introduction to Object Oriented Programming with Python

UNIT - III	IMPLEMENTATION OF MACHINE LEARNING USING PYTHON	(9)

Description of Standard Datasets: Coco, ImageNet, MNIST (Handwritten Digits) Dataset, Boston Housing Dataset – Introducing the concepts of Regression – Linear, Polynomial and Logistic Regression with analytical understanding - Introduction to SciPy Package & its functions – Python Application of Linear Regression and Polynomial Regression using SciPy – Interpolation, Overfitting and Under fitting concepts & examples using SciPy.

UNIT - IV	CLASSIFICATION AND CLUSTERING CONCEPTS OF ML	(9)

Introduction to ML Concepts of Clustering and Classification – Types of Classification Algorithms – Support Vector Machines (SVM) - Decision Tree - Random Forest – Introduction to ML using scikit-learn – Using scikit-learn, loading a sample dataset, Learning & prediction, interpolation & fitting, Multiclass fitting - Implementation of SVM using Blood Cancer Dataset, Decision Tree using data from csv.

Types of Clustering Algorithms & Techniques – K-means Algorithm, Mean Shift Algorithm & Hierarchical Clustering Algorithm – Introduction to Python Visualization using Matplotlib: Plotting 2 dimensional, 3-dimensional graphs; formatting axis values; plotting multiple rows of data in same graph – Implementation of K-means Algorithm and Mean Shift Algorithm using Python.

UNIT - V	INTRODUCTION TO NEURAL NETWORKS AND EMBEDDED MACHINE LEARNING	(9)

Introduction to Neural Networks & Significance – Neural Network Architecture – Single Layer Perceptron & Multi-Layer Perceptron (MLP) – Commonly Used Activation Functions - Forward Propagation, Back Propagation, and Epochs – Gradient Descent – Introduction to Tensor flow and

Chairman (BoS)

Keras ML Python packages – Implementation of MLP Neural Network on Iris Dataset – Introduction to Convolution Neural Networks – Implementation of Digit Classification using MNIST Dataset.

ML for Embedded Systems: Comparison with conventional ML – Challenges & Methods for Overcoming – TinyML and Tensor flow Lite for Microcontrollers – on-Board AI – ML Edge Devices: Arduino Nano BLE Sense, Google Edge TPU and Intel Movidius.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

COURSE OUTCOMES:
At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Develop skill in system administration and network programming by learning Python.	Apply
CO2	Demonstrating understanding in concepts of Machine Learning and its implementation using Python	Understand
CO3	Relate to use Python's highly powerful processing capabilities for primitives, modelling etc	Understand
CO4	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design	Understand
CO5	Apply the concepts acquired over the advanced research/employability skills	Apply

TEXT BOOKS:

1. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2021.
2. Mark Lutz, Learning Python, Powerful OOPs, O'reilly, 2020.

REFERENCES:

1. Andreas C. Müller, Sarah Guido, Introduction to Machine Learning with Python, O'Reilly, 2016.
2. Sebastian Raschka, Vahid Mirjalili, Python Machine Learning, Third Edition, Packt, December 2019.
3. Zelle, John M. "Python Programming: An Introduction to Computer Science", Franklin Beedle & Associates, 2020.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	-	-	2	-	3
CO2	3	1	3	-	3
CO3	2	2	2	-	3
CO4	3	2	3	-	2
CO5	-	-	-	-	3

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

ET24E23	VLSI DESIGN AND RECONFIGURABLE ARCHITECTURE	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of digital logic design, computer architecture, and FPGA fundamentals. Exposure to C/C++ or HDL (VHDL/Verilog) is beneficial.

OBJECTIVE:

- To understand and apply reconfigurable computing techniques and architectures for high-performance and adaptive systems.

UNIT - I	RECONFIGURABLE COMPUTING HARDWARE	(9)

Logic-computational fabric, Array and interconnect-Extended logic Configuration – Reconfigurable processing fabric architectures – RPF integration into traditional computing systems – Operating system support for reconfigurable computing – Evolvable FPGA.

UNIT - II	MAPPING DESIGNS INTO RECONFIGURABLE PLATFORMS	(9)

Structural mapping- integrated mapping- mapping for heterogeneous resources-Placement problem – clustering- simulated annealing – partition-based placement – analytical placement - partitioning for granularity partitioning of parallel programs – instance specific design.

UNIT - III	COMPUTATIONAL ARCHITECTURES FOR FPGA	(9)

Precision analysis for fixed point computation – Distributed arithmetic for FPGA – CORDIC architectures for FPGA – Boolean satisfiability – SAT solvers.

UNIT - IV	OPTICAL RECONFIGURATION MODELS	(9)

Simulation and scalability – Models, Basic algorithmic techniques – optical models – complexities of optical models – run time reconfigurability – Design and implementation.

UNIT - V	MULTI-CORE ARCHITECTURES	(9)

Multi core and many core architectures-state of the art multi core operating systems-parallelism and performance analysis.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Enlighten the principles of computational fabric and its role.	Understand
CO2	Address the challenges of mapping for heterogeneous resources.	Apply
CO3	Explain the integration of distributed arithmetic and CORDIC architectures into FPGA-based systems.	Understand
CO4	Develop practical skills in the design and implementation of optical computing systems.	Apply
CO5	Describe the role of multi-core operating systems.	Understand

Chairman (BoS)

TEXT BOOKS:

1. Scott Hauck, Andre Dehon, "Reconfigurable computing: the theory and practice of FPGA-based computation", Morgan Kaufmann publishers, First Edition, 2008.
2. Ramachandran Vaidhyanathan and Jerry. L. Trahan "Dynamic Reconfiguration: Architectures and Algorithms", Kluwer Academic publishers, First Edition, 2013.

REFERENCES:

1. C. Bobda, "Introduction to Reconfigurable Computing: Architectures, Algorithms and Applications", Springer, First Edition, 2007.
2. Andras Vajda, "Programming many core chips", Springer, First Edition, 2011.
3. Maya B.Gokhale, Paul S. Graham Reconfigurable Computing Accelerating Computation with Field-Programmable Gate Arrays, First Edition, 2005.
4. Nikoloas Voros, et Al. "Applied Reconfigurable Computing: Architectures, Tools and Applications" Springer, First Edition, 2018.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	3
CO2	2	3	3	3	2
CO3	3	3	3	3	3
CO4	2	2	3	2	3
CO5	3	3	3	2	3

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215 Centre for Academic Courses

PE24E16	SMART GRID	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

(Common to PE & ET)

PREREQUISITE:

Fundamental knowledge of electrical power systems, power generation and distribution, along with a basic understanding of communication networks and control systems.

OBJECTIVE:

- To provide students with comprehensive knowledge of smart grid technologies, infrastructure, and their role in modernizing and optimizing the power system.

UNIT - I	INTRODUCTION TO SMART GRID	(9)

Evolution of Electric Grid – Concept, Definitions and Need for Smart Grid – Smart grid drivers, functions, opportunities, challenges and benefits – Difference between conventional & Smart Grid – Concept of Resilient & Self-Healing Grid – Present development & International policies in Smart Grid – Diverse perspectives from experts and global Smart Grid initiatives.

UNIT - II	SMART GRID TECHNOLOGIES	(9)

Technology Drivers – Smart energy resources – Smart substations – Substation Automation – Feeder Automation – Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control – Distribution systems: DMS, Volt/VAr control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, V2G, G2V.

UNIT - III	SMART METERS AND ADVANCED METERING INFRASTRUCTURE	(9)

Introduction to Smart Meters – Advanced Metering infrastructure (AMI) drivers and benefits – Phasor measurement Unit (PMU) – Intelligent Electronic Devices (IED) & their application for monitoring & protection.

UNIT - IV	POWER QUALITY MANAGEMENT IN SMART GRID	(9)

Power Quality and EMC in Smart Grid – Power Quality issues of Grid connected Renewable Energy Sources – Power Quality Conditioners for Smart Grid – Web based Power Quality monitoring – Power Quality Audit.

UNIT - V	HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS	(9)

Local Area Network (LAN) – House Area Network (HAN) – Wide Area Network (WAN) – Broadband over Power line (BPL) – IP based Protocols – Basics of Web Service and CLOUD Computing to make Smart Grids smarter – Cyber Security for Smart Grid.

LECTURE: 45, SELF LEARNING = 45, TOTAL = 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215

COURSE OUTCOMES:
At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Illustrate the fundamentals of the smart grid system	Understand
CO2	Describe about structural units in embedded processor architecture.	Understand
CO3	Outline the various types of smart meters and advanced metering infrastructure.	Understand
CO4	Explain the concept of power quality management issues in the Smart Grid.	Understand
CO5	Describe the features of high-performance computing for smart grid applications.	Understand

TEXT BOOKS:

1. Janaka Ekanayake, Smart grid: Technology and applications, Wiley publication, First Edition, 2012.
2. Wayne wolf, Computers as components: Principles of embedded computing system design, Morgan Kaufmann publishers, Third Edition, 2012.

REFERENCES:

1. Stuart Borlase, Smart Grid: Infrastructure, Technology and Solutions, CRC Press, First Edition, 2012.
2. James Momoh, Smart grid: Fundamentals of Design and Analysis, Wiley publication, First Edition, 2012.
3. Buchholz, Bernd M., Styczynski, Zbigniew, Smart Grids – Fundamentals and Technologies in Electricity Networks, Springer publication, First Edition, 2014.
4. Uslar, Standardization in Smart Grids: Introduction to IT-related Methodologies, Architectures and Standards, Wiley publication, First Edition, 2013.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	2
CO2	3	2	2	3	2
CO3	3	2	2	3	2
CO4	3	2	2	3	2
CO5	3	2	2	3	2

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

PE24E22	VIRTUAL INSTRUMENTATION SYSTEM	Category	L	T	P	SL	C
		PEC	45	0	0	45	3

(Common to PE & ET)

PREREQUISITE:

A basic understanding of programming logic, electrical measurements, and instrumentation systems is necessary for working with LabVIEW and virtual instrumentation.

OBJECTIVE:

- To develop proficiency in graphical programming using LabVIEW for measurement, control, and instrumentation applications.

UNIT - I	INTRODUCTION	(9)

Virtual Instrumentation and LabVIEW – Evolution of LabVIEW – Difference between LabVIEW and Conventional languages – data flow programming – Graphical programming – Diagram of virtual instrument – Architecture, advantages over conventional instruments.

UNIT - II	LabVIEW ENVIRONMENT	(9)

Front panel – Block diagram – Icon and Connector – Control Palette – Function Palette – Tools Palette – Function and Libraries – Creating, editing, wiring, debugging and saving VIS – sub-VIS – creating sub-VIS – Simple examples – Looping: For loop, while loop – Shift registers – Case and sequence; structures, formula nodes – Simple programs using loops, structures and formula nodes.

UNIT - III	PROGRAMMING TECHNIQUES	(9)

Arrays – clusters, charts and graphs, local and global variables – Property node, string and file I/O – Simple programs using arrays, clusters, variables, and string variables.

UNIT - IV	DATA ACQUISITION AND INSTRUMENT CONTROL	(9)

DAQ – Components – Buffers: Buffered and non-buffered I/O – Triggering – Analog I/O – Digital I/O – Counters and timers – Instrument control: VISA, GPIB, VXI and PXI.

UNIT - V	APPLICATIONS OF LabVIEW	(9)

Connectivity in LabVIEW: an introduction IVI – Lab windows/CVI – Applications of LabVIEW: Diode, SCR Conduction, Three-phase rectifiers, Single-phase AC Chopper, Cyclo converters, PWM and Single-phase inverter control methods, and DC motor control.

LECTURE: 45, SELF LEARNING = 45, TOTAL = 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO	Course Outcome	Cognitive Level
CO1	Interpret the function of the virtual instrumentation system and LabVIEW.	Understand
CO2	Discuss the concepts of LabVIEW and its features in various fields.	Understand
CO3	Describe the programming techniques of LabVIEW.	Understand
CO4	Discuss the concepts of Data acquisition and instrument control.	Understand
CO5	Apply LabVIEW programming to simulate and control power electronic circuits and electrical machines for real-time applications.	Apply

TEXT BOOKS:

1. Petru Adrian Cotfas, Daniel Tudor Cotfas, Horia Hedesiu, LabVIEW - Virtual Instrumentation in Education and Industry, Intech Open, First Edition, 2024.
2. Sanjay Gupta, Joseph John, Virtual Instrumentation Using LabVIEW, McGraw-Hill Education, Second Edition, 2017.

REFERENCES:

1. Jovitha Jerome, Virtual Instrumentation Using LabVIEW, PHI Learning Private Limited, First Edition, 2010.
2. Jeffrey Travis, Jim Kring, LabVIEW for Everyone, Prentice Hall, Third Edition, 2007.
3. Nesimi Ertugrul, LabVIEW for Electric Circuits, Machines, Drives, and Laboratories, National Instruments, Pearson Education Limited, First Edition, 2010.
4. Gary Johnson and Richard Jennings, LabVIEW graphical programming, Tata McGraw-Hill, Fourth Edition, 2011.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	3
CO2	3	2	2	2	3
CO3	3	2	2	2	3
CO4	3	2	2	2	3
CO5	3	2	2	2	3

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode, Centre for Academic Courses

AX24A01	DISASTER MANAGEMENT	Category	L	T	P	SL	C
		AC	30	0	0	30	0

(Common to All Branches)

PREREQUISITE:

A basic understanding of geography, environmental science, and public health is a prerequisite for studying disaster management.

OBJECTIVES:

To enable students to understand the nature, causes, and impacts of natural and manmade disasters, identify disaster prone areas with special reference to India, and develop knowledge on disaster preparedness, management strategies, risk assessment techniques, and sustainable approaches for effective disaster mitigation and community resilience.

UNIT - I	INTRODUCTION	(6)

Disaster: Definition, Factors and Significance, Difference between Hazard and Disaster, Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT - II	REPERCUSSIONS OF DISASTERS AND HAZARDS	(6)

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

UNIT - III	DISASTER PRONE AREAS IN INDIA	(6)

Study of Seismic Zones, Areas Prone to Floods and Droughts, Landslides and Avalanches, Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami, Post-Disaster Diseases and Epidemics

UNIT - IV	DISASTER PREPAREDNESS AND MANAGEMENT	(6)

Preparedness-Monitoring of Phenomena Triggering a Disaster or Hazard, Evaluation of Risk-Application of Remote Sensing, Data from Meteorological and other agencies, Media Reports - Governmental and Community Preparedness.

UNIT - V	RISK ASSESSMENT	(6)

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Green economy, Blue economy, Global Co-operation in Risk Assessment and Warning, People's Participation in Risk Assessment, Strategies for Survival.

TOTAL(L:30, SL:30): 60 PERIODS

Chairman (BoS)

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Understand the definitions, differences, and classifications of disasters and hazards	Understand
CO2	Discuss the destruction of ecosystems and the loss of human and animal life resulting from different disaster events.	Understand
CO3	Compare the vulnerability of different regions in India to various natural disasters.	Understand
CO4	Summarize the methods and technologies used in assessing and monitoring disaster risks.	Understand
CO5	Describe the concept, elements, and current global and national scenarios of disaster risk.	Understand

TEXT BOOKS:

1. Gupta, Harsh K., "Disaster Management", Universities Press, Hyderabad, 2nd Edition, 2013.
2. Satendra, "Disaster Management in India: Perspectives, Issues and Strategies", National Institute of Disaster Management, New Delhi, 1st Edition, 2018.

REFERENCES:

1. Goel S. L., "Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies" New Royal book Company, 2007.
3. Sahni, Pardeep et.al., "Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi, 2001.
4. Sharma, R.K. and Sharma, G. "Natural Disaster Management: Causes, Effects and Mitigation", Deep & Deep Publications, New Delhi, 2005.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	1	2	1	1
CO2	2	1	2	2	1
CO3	2	1	2	2	2
CO4	2	1	2	2	2
CO5	2	1	2	1	2
Avg.	**2**	**1**	**2**	**2**	**2**

1-low, 2-medium, 3-high

Chairman (BoS)

AX24A02	VALUE EDUCATION	Category	L	T	P	SL	C
		AC	30	0	0	30	0

(Common to All Branches)

PREREQUISITE:

Basic understanding of moral principles, social responsibilities, and a willingness to engage in self-reflection and personal growth.

OBJECTIVE:

To foster self-development, strengthen human values, and promote overall personality growth and social empowerment through value-based education.

UNIT - I	INTRODUCTION TO VALUE EDUCATION	(6)

Values and self-development – Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral valuation, Standards and principles, Value judgements.

UNIT - II	IMPORTANCE OF VALUES	(6)

Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline.

UNIT - III	INFLUENCE OF VALUE EDUCATION	(6)

Personality and Behaviour development – Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth.

UNIT - IV	REINCARNATION THROUGH VALUE EDUCATION	(6)

Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature Character and Competence – Holy books Vs Blind faith, Self-management and Good health, Science of reincarnation.

UNIT - V	VALUE EDUCATION IN SOCIAL EMPOWERMENT	(6)

Equality, Nonviolence, Humility, Role of Women, all religions and same message, mind your Mind, Self-control, Honesty, Studying effectively.

TOTAL(L:30,SL:30): 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Gain knowledge of self-development	Understand
CO2	Learn the importance of Human values	Understand
CO3	Develop the overall personality through value education	Understand
CO4	Overcome the self-destructive habits with value education	Understand
CO5	Interpret social empowerment with value education	Understand

Chairman (BoS)

TEXT BOOKS:

1. Chakravarthy, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi, 1999.
2. Chitakra, M.G. "Education and Human Values", A.P.H. Publishing Corporation, New Delhi, 2003.

REFERENCES:

1. Satchidananda, M.K, "Ethics, Education, Indian Unity and Culture", Ajantha Publications, Delhi, 1991.
2. Das, M.S., Gupta, V.K. "Social Values among Young adults: A changing Scenario", M.D. Publications, New Delhi, 1995.
3. Bandiste, D.D., "Humanist Values: A Source Book", B.R. Publishing Corporation, Delhi, 1999.
4. Ruhela, S.P., "Human Values and education", Sterling Publications, New Delhi, 1986.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	1	2	-	2
CO2	1	2	1	-	1
CO3	2	2	2	-	2
CO4	2	1	1	-	1
CO5	1	2	2	-	2

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering Tiruchengodu-637215 Centre for Academic Courses

AX24A03	CONSTITUTION OF INDIA	Category	L	T	P	SL	C
		AC	30	0	0	30	0

(Common to All Branches)

PREREQUISITE:

Basic awareness of Indian history, civics, and political system at the school level, along with an Interest in understanding the democratic framework and governance of India.

OBJECTIVE:

- To provide a comprehensive understanding of the India Constitution, including its basic structure, fundamental rights and duties, directive principles, the functioning of the Union and State governments, and the electoral system.

UNIT - I	INTRODUCTION TO INDIAN CONSTITUTION	(6)

Indian Constitution: Necessity of the Constitution, Societies before and after the Constitution adoption. Introduction to the Indian constitution, Making of the Constitution, Role of the Constituent Assembly.

UNIT - II	FUNDAMENTAL RIGHTS AND DUTIES	(6)

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT - III	UNION GOVERNMENT	(6)

Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament – LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism.

UNIT - IV	STATE GOVERNMENT	(6)

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT - V	ELECTION COMMISSION	(6)

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

TOTAL(L:30,SL:30): 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Understand the basic structure of Indian Constitution.	Understand
CO2	Remember their Fundamental Rights, DPSP's and Fundamental Duties (FD's) of our constitution.	Understand
CO3	Know about our Union Government, political structure & codes, procedures.	Understand
CO4	Understand our State Executive of India.	Understand
CO5	Understand our Elections system of India.	Understand

Chairman (BoS)

TEXT BOOKS:

1. Durga Das Basu, "Introduction to the Constitution of India", Lexis Nexis Publisher, New Delhi, Twenty-Three Edition, 2018.
2. P.M. Bakshi, "The Constitution of India", Universal law Publishing, New Delhi, Fifteenth Edition, 2018.

REFERENCES:

1. Brij Kishore sharma, "Introduction to the Constitution India", PHI Learning Pvt. Ltd, New Delhi, Seventh Edition, 2015.
2. M. Laxmikanth, "Indian Polity", Tata McGraw Hill, New Delhi, Sixth Edition, 2017.
3. P. K. Agarwal, "Constitution of India", Prabhat Publishers, New Delhi, Second Edition, 2015. M.P. Jain, "Indian Constitution Law", Lexis Nexis Publisher, New Delhi, Seventh Edition, 2014.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	1	2	1	-	2
CO2	2	2	1	-	2
CO3	2	2	1	-	2
CO4	1	2	1	-	1
CO5	1	2	1	-	2

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering Centre for Academic Courses Tiruchengode-637215

AX24A04	INDIAN KNOWLEDGE SYSTEM	Category	L	T	P	SL	C
		AC	30	0	0	30	0

(Common to All Branches)

PREREQUISITE:

Basic knowledge of Indian history and culture, and an interest in exploring traditional systems of knowledge across disciplines such as science, technology, humanities, and philosophy.

OBJECTIVE:

- To provide an understanding of the historical evolution, key features, and multidisciplinary applications of the Indian Knowledge System, encompassing its contributions to humanities, science, engineering, socio-religious practices, and the need for its protection and preservation.

UNIT - I	INTRODUCTION TO INDIAN KNOWLEDGE SYSTEM	(6)

Importance of Ancient Knowledge System, Definition, concept, and scope of Indian Knowledge System (IKS), IKS based approaches on knowledge paradigms, IKS in modern India, Some unique Aspects of IKS.

UNIT - II	TRADITIONAL KNOWLEDGE IN HUMANITIES AND SCIENCES	(6)

Linguistics, Number and measurements - Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology.

UNIT - III	TRADITIONAL KNOWLEDGE IN PROFESSIONAL DOMAIN	(6)

Town planning and architecture Construction, Health, wellness and Psychology – Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.

UNIT - IV	APPLIED TRADITIONAL KNOWLEDGE	(6)

Myths, Rituals, Spirituals, Taboos and Belief System, Folk Stories, Songs, Proverbs, Dance, Play, Acts and Traditional Narratives, Agriculture, animal husbandry, Forest, Sacred Groves, Water Mills, Sacred Water Bodies, Land, water and Soil Conservation and management Practices, Indigenous Bio-resource Conservation, Utilization Practices and Food Preservation Methods, Handicrafts, Wood Processing and Carving-Fiber Extraction and Costumes

UNIT - V	PROTECTION OF INDIAN KNOWLEDGE SYSTEM	(6)

Documentation and Preservation of IKS, approaches for conservation and Management of nature and bio-resources, Approaches and strategies to protection and conservation of IKS.

LECTURE: 30,SL:30, TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Explain the historicity of Indian Knowledge System.	Understand
CO2	Explain the features of traditional knowledge in humanities and sciences.	Understand
CO3	Develop familiarity with science, engineering and technology of IKS.	Understand
CO4	Understand the importance of functional, aesthetic, and socio-religious concept of IKS.	Understand
CO5	Understand the concepts of protection of IKS.	Understand

Chairman (BoS)

TEXT BOOKS:

1. B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, "Introduction to Indian Knowledge System Concepts and Applications", PHI Learning Private Ltd, 2022, ISBN-978-93-91818-21-0.
2. Amit Jha, "Traditional Knowledge System in India", Atlantic Publishers and Distributors (P) Ltd., 2009, ISBN-13: 978-8126912230

REFERENCES:

1. Kapil Kapoor, Avadesh Kumar Singh, "Knowledge Traditions and Practices of India", Vol. 1, DK Print World (P) Ltd., 2005, ISBN 81-246-0334.
2. D.N. Bose, S.N. Sen, B. V. Subbarayappa, "A Concise History of Science in India", Indian National Science Academy, New Delhi, 2009.
3. S. N. Sen, K. S. Shukla, "History of Astronomy in India", Indian National Science Academy, Second Edition, New Delhi, 2000.
4. Dr. Ravindra Singh Rana, "Indian Knowledge System of Materials in Science and Technology", Walnut Publication, 2023.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	1	0	2
CO2	2	2	1	0	2
CO3	3	2	1	0	3
CO4	2	2	2	0	2
CO5	2	2	1	0	2

1 - Low, 2 - Medium, 3 – High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

PE24O01	SWITCHING CONCEPTS AND POWER SEMICONDUCTOR DEVICES	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:

Basic understanding of semiconductor devices and circuit theory, including diode and transistor operation, is essential to grasp power device switching behavior and protection strategies.

OBJECTIVE:

- To analyze, model, and simulate the operation of current- and voltage-controlled power semiconductor devices along with their firing and protection circuits.

UNIT - I	INTRODUCTION OF SWITCHING CONCEPTS	(9)

Need for switching in power electronic circuits – Switching Characteristics – Ideal switch, practical switch – Types of switches – Comparison of switching devices – Future trends in power devices.

UNIT - II	CURRENT CONTROLLED DEVICES	(9)

Power Diode, Thyristors and BJT's: Construction, static and dynamic characteristics – Negative temperature coefficient and secondary breakdown – Power Darlington – Series and parallel operation – Comparison of BJT and Thyristor – Steady state and dynamic models of BJT and Thyristor – Simulation of Thyristor and BJT.

UNIT - III	VOLTAGE CONTROLLED DEVICES	(9)

Principle of voltage-controlled devices – Power MOSFETs and IGBTs: Construction, Types, Static and switching characteristics – Series and parallel operation – Steady state and dynamic models of MOSFET and IGBTs – Basics of GTO, MCT, FCT, RCT and IGCT – Simulation of MOSFET and IGBT.

UNIT - IV	FIRING PROTECTION CIRCUITS	(9)

Necessity of isolation, Pulse transformer, Opto coupler – Gate Drives Circuit: SCR, MOSFET, IGBTs and base driving for power BJT – Over voltage, over current and gate protections – Design of snubbers.

UNIT - V	THERMAL PROTECTION CIRCUITS	(9)

Heat Transfer: Conduction, convection and radiation – Cooling: liquid cooling, vapor-phase cooling – Guidance for heat sink selection – Thermal resistance and impedance – Electrical analogy of thermal components – Heat sink types and design – Mounting types.

LECTURE: 45, SELF LEARNING = 45, TOTAL = 90 PERIODS

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215

Chairman (BoS)

COURSE OUTCOMES:

At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Summarize the power semiconductor device types and characteristics.	Understand
CO2	Explain the construction, operating principles, and characteristics of various current control devices.	Understand
CO3	Explain the construction, operating principles, and characteristics of voltage-controlled devices.	Understand
CO4	Design the firing and protection circuits for power devices.	Apply
CO5	Explain the various methods of thermal protection and cooling.	Understand

TEXT BOOKS:

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, New Delhi, Third Edition, 2013.
2. Singh M.D., Khanchandani K.B., "Power Electronics", Tata McGraw-Hill, 2014.

REFERENCES:

1. Ned Mohan, Undcland and Robins, "Power Electronics – Concepts, Applications and Design, John Wiley and Sons, Singapore, Third Edition, 2009.
2. Joseph Vithayathil, Power Electronics: Principles and Applications, Delhi, Tata McGraw-Hill, 2010.
3. Simon Ang and Alejandro Oliva, "Power Switching Converters", Taylor & Francis Group, 2010.
4. Christophe P. Basso, Switch-Mode Power Supplies, McGraw-Hill, 2014.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	1	1	-	-
CO2	3	2	2	-	-
CO3	3	2	1	-	-
CO4	3	3	3	-	-
CO5	3	3	3	-	-

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode, Centre for Academic Courses

PE24O02	SMART GRID TECHNOLOGY	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of electrical power systems and communication networks is required to understand the integration and automation aspects of Smart Grid technologies.

OBJECTIVE:

- To understand the concepts, components, and communication technologies essential for implementing and operating Smart Grids effectively.

UNIT - I	INTRODUCTION	(9)

Electrical Grid – Definition of Smart Grid – Opportunities, Challenges and Benefits of Smart Grid – Difference between conventional and Smart Grid – Operating Principles and Models of Smart Grid Components – Implementation of Smart Grid – Early Smart Grid initiatives in India – Overview of the technologies required for the Smart Grid.

UNIT - II	SMART METERING AND DEMAND-SIDE INTEGRATION	(9)

Introduction – Smart metering – Smart meters – An overview of the hardware used – Communications infrastructure and protocols for smart metering, Demand – Side integration – Services provided by DSI – Implementations of DSI – Hardware support to DSI implementations – Flexibility delivered by prosumers from the demand side – System support from DSI.

UNIT - III	DISTRIBUTION AUTOMATION	(9)

Distribution automation – Automated Meter Reading (AMR) – Advanced Metering Infrastructure (AMI) – Intelligent Electronic Devices (IED) – Fault Location Isolation and Service Restoration (FLISR) – Outage Management Systems (OMS) – High Efficiency Distribution Transformers.

UNIT - IV	TRANSMISSION SYSTEM AUTOMATION	(9)

Substation automation, Feeder Automation – Supervisory Control and Data Acquisition (SCADA) – Energy Management System (EMS) – Phasor Measurement Units (PMU) – Wide Area Monitoring Systems (WAMS).

UNIT - V	HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS	(9)

Local Area Network (LAN) – House Area Network (HAN) – Wide Area Network (WAN) – Broadband over Power Line (BPL) – IP-based Protocols – Basics of Web Service and CLOUD Computing to make Smart Grids smarter – Cyber Security for Smart Grid.

LECTURE: 45, SELF LEARNING = 45, TOTAL = 90 PERIODS

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

Chairman (BoS)

COURSE OUTCOMES:
At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Portray the components used in smart grid technologies.	Understand
CO2	Illustrate the concept of smart metering and demand-side integration.	Understand
CO3	Elucidate the concepts of distribution automation in the smart grid.	Understand
CO4	Outline the automated transmission systems in the smart grid.	Understand
CO5	Enlighten the significance of high-performance computing in the smart grid.	Understand

TEXT BOOKS:

1. Stuart Borlase, Smart Grid: Infrastructure, Technology and Solutions, CRC Press, United States, First Edition, 2012.
2. James Momoh, Smart Grid: Fundamentals of Design and Analysis, John Wiley and Sons, United States, First Edition, 2012.

REFERENCES:

1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Smart Grid Technology and Applications, John Wiley and Sons, United States, First Edition, 2012.
2. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang, Smart Grid–The New and Improved Power Grid: A Survey, IEEE Transactions on Smart Grids, 2012.
3. Ryszard Strzelecki, Grzegorz Benysek, Power Electronics in Smart Electrical Energy Networks, Springer, New Zealand, First Edition, 2008.
4. https://nptel.ac.in/courses/108/107/108107113/.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	-	-
CO2	3	2	2	-	-
CO3	3	2	2	-	-
CO4	3	2	2	-	-
CO5	3	2	2	-	-

1- Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses

PE24O03	RENEWABLE ENERGY TECHNOLOGY	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:

Basic understanding of electrical circuits, energy systems, and environmental science is essential to grasp the technologies and integration of renewable energy sources.

OBJECTIVE:

- To study various renewable energy technologies, storage systems, and their integration with the power grid for sustainable energy solutions.

UNIT - I	INTRODUCTION TO RENEWABLE ENERGY	(9)

Energy Scenario – Classification of Energy Sources – Energy needs of India and energy consumption patterns – Worldwide Potentials of these sources – Energy efficiency, energy security – Energy and its environmental impacts – Distributed generation.

UNIT - II	SOLAR PV AND THERMAL SYSTEMS	(9)

Solar Radiation – Radiation Measurement – Solar thermal Systems: Types of collectors, efficiency calculations – Photovoltaic (PV) technology: Present status, solar cells, cell technologies – characteristics of PV systems – equivalent circuit – array design – building integrated PV system, its components, sizing and economics – Peak power operation – series and parallel connections – maximum power point tracking – Applications.

UNIT - III	WIND ENERGY	(9)

Wind speed and power relation – power extracted from wind – wind distribution and wind speed predictions – Wind power systems: system components, Types of turbines, Turbine rating – Choice of generators – turbine rating – electrical load matching – Variable speed operation – maximum power operation – control systems – system design features.

UNIT - IV	ENERGY STORAGE SYSTEM	(9)

Energy storage – Battery – types, equivalent circuit, performance characteristics – battery design – charging and charge regulators – Battery management – Flywheel-energy relations – components – benefits over battery – Fuel Cell energy storage systems – Ultra Capacitors.

UNIT - V	GRID INTEGRATION	(9)

Standalone systems – Concept of Micro Grid and its components – load sharing – system sizing – Hybrid system economics – Interface requirements – Stable operation – Transient – safety, operating limits of voltage, frequency, stability margin, energy storage, and load scheduling – Effect on power quality – Case study on Standalone and grid-interactive solar systems and wind systems.

LECTURE: 45, SELF LEARNING = 45, TOTAL = 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215.

COURSE OUTCOMES:
At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Describe the various energy sources and environmental aspects of energy.	Understand
CO2	Explain the principle of solar photovoltaic systems and their applications.	Understand
CO3	Familiarize with the wind energy conversion process and control of the wind system.	Understand
CO4	Explain the energy storage system and management.	Understand
CO5	Examine real-world case studies to understand the practical applications of solar and wind energy in both standalone and grid-connected systems.	Apply

TEXT BOOKS:

1. Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI Learning, New Delhi, third Edition, 2015.
2. Kothari D.P., Singal, K.C., and Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, PHI Learning, Third Edition, 2021.

REFERENCES:

1. Rai, G.D., Non-conventional energy sources, Khanna Publishers, Second Edition, 2012.
2. Dr.Reeta Pawar, Dr. M.V.K. Srivani, Prof. Thorat S.K., Itum Ruti, "Fundamentals of Renewable Energy Conservation and Technology", AG Publishing House,2023.
3. Khan, B.H. Non-conventional Energy Resources, Tata McGraw-Hill Publishing Company, New Delhi, First Edition, 2017.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	-	-
CO2	2	2	2	-	-
CO3	2	2	2	-	-
CO4	2	2	3	-	-
CO5	2	2	3	-	-

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses

PE24O04	ENERGY MANAGEMENT AND CONSERVATION	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of thermodynamics, electrical systems, and economic principles is essential to understand energy flow, auditing, and management strategies.

OBJECTIVE:

- To impart knowledge on energy management practices, auditing techniques, and economic evaluation for enhancing energy efficiency in various systems.

UNIT - I	INTRODUCTION TO ENERGY MANAGEMENT AND AUDIT	(9)

Classification of energy – Energy scenario – Energy needs of a growing economy – Energy pricing in India – Energy and environment – Energy conservation act. Energy Audit: Types and methodology – Energy audit instruments – Role of energy managers and auditors.

UNIT - II	THERMAL UTILITIES	(9)

Steam: Introduction, Properties of steam, Steam distribution systems – Boilers: Types and classification, Performance evaluation of boilers – Losses in boiler – Energy conservation opportunities in boilers – Waste heat recovery: Classification, Advantages and applications, commercially viable waste heat recovery devices, Saving potential.

UNIT - III	ELECTRICAL AND LIGHTING SYSTEM	(9)

Introduction to electric power supply systems – Electrical load management and maximum demand control – Power factor improvement and its benefit, Basic parameters and terms in lighting systems – Luminous performance Characteristics of commonly used luminaries and Energy saving opportunities in lighting systems.

UNIT - IV	ENERGY CONSERVATION IN BUILDINGS AND ECBC	(9)

About Energy Conservation Building Code (ECBC) – Building envelope, Fenestrations, Insulation, HVAC, Lighting, Water pumping, Inverter – Elevators and Escalators – Star labeling for existing buildings.

UNIT - V	ECONOMICS	(9)

Investment – Need, Appraisal and criteria – Financial analysis techniques – Simple payback period – Return on investment – Net present value – Internal rate of return – Cash flows, Risk and sensitivity analysis – Financing options – Energy performance contracting and role of ESCOs.

LECTURE: 45, SELF LEARNING = 45, TOTAL = 90 PERIODS

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

Chairman (BoS)

COURSE OUTCOMES:
At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Interpret the importance of energy, energy conservation and energy audit.	Understand
CO2	Examine the energy-saving opportunities in thermal systems.	Apply
CO3	Apply the energy-saving opportunities in lighting systems.	Apply
CO4	Assess the energy conservation in buildings and ECBC.	Understand
CO5	Analyze the different financial management techniques for energy management.	Analyze

TEXT BOOKS:

1. Guide Books for National Certification Examination for energy managers and Auditors, third Edition, Bureau of Energy Efficiency, 2010.
2. Wayne C. Turner & Steve Doty, Energy Management Handbook, Seventh Edition, The Fairmont Press, 2009.

REFERENCES:

1. https://beeindia.gov.in/
2. Barny L. Capehart, Wainey C. Turner, William J. Kennedy, Guide to Energy Management, Seventh Edition, The Fairmont Press, 2012.
3. Barney L. Capehart, Wayne C. Turner, William J. Kennedy, "Guide to Energy Management", CRC press, Taylor & Francis group, Eighth Edition, 2016.
4. Witte. L.C., P.S. Schmidt, D.R. Brown, Industrial Energy Management and Utilization, Hemisphere, First Edition, 1988.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	1	-	-	-
CO2	2	1	-	-	-
CO3	2	1	-	-	-
CO4	2	1	-	-	-
CO5	2	1	-	-	-

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

CM24O01	ENERGY EFFICIENT BUILDINGS	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

(M.E.- CONSTRUCTION ENGINEERING AND MANAGEMENT)

PREREQUISITE: A basic understanding of building construction processes, materials, and structural systems. Knowledge of environmental science concepts, including energy flows, sustainability, and environmental impact.

OBJECTIVES:

- To understand energy-efficient building design principles and technologies for sustainable construction and to evaluate energy conservation strategies for different climates.

UNIT - I	INTRODUCTION	(9)

Energy Required for Building Construction - Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Greenhouse Effect – Psychometric Chart – Measuring Latent and Sensible Heat. Thermal Comfort – Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Protection – Types of Shading Devices – Conservation – Heating and Cooling loads.

UNIT - II	PASSIVE SOLAR HEATING AND COOLING	(9)

General Principles of Passive Solar Heating – Key Design Elements - Direct gain Trombe Walls, Water Walls, Convective Air Loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Predicting Ventilation in Buildings – Window Ventilation Calculations - Radiation – Evaporation and Dehumidification – Mass Effect – Load Control – Air Filtration and odour Removal – Heat Recovery in Large Buildings.

UNIT - III	DAYLIGHTING AND ELECTRICAL LIGHTING	(9)

Materials, Components and Details - Insulation – Optical Materials – Radiant Barriers Glazing Materials - Day Lighting – Sources and Concepts – Building Design Strategies – Case Studies – Electric Lighting –Light Distribution – Electric Lighting Control for day lighted buildings – Illumination requirement – Components of Daylight factor – Recommended Daylight Factors – Day Lighting Analysis – Supplementary Artificial Lighting Design.

UNIT - IV	HEAT CONTROL AND VENTILATION	(9)

Requirements – Heat Transmission Through Building Sections – Thermal Performance of Building Sections – Orientation of Buildings – Building Characteristics for Various Climates – Thermal Design of Buildings Influence of Design Parameters – Mechanical Controls – Examples. Ventilation – Requirements – Minimum Standards for Ventilation – Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation.

UNIT - V	DESIGN FOR CLIMATIC ZONES	(9)

Energy Efficiency – an Overview of Design Concepts and Architectural Interventions – Energy Efficient Buildings for Various Zones – Cold and Cloudy – Cold and Sunny – Composite – Hot and Dry – Moderate – Warm and Humid – Case Studies of Residences, Office Buildings and other Buildings in Each Zones – Energy Audit – Certification.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS,

COURSE OUTCOMES:
At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Explain the energy requirement of the building construction.	Understand
CO2	Obtain the key design principles for energy efficient buildings.	Create
CO3	Articulate the concepts of day lighting and components of daylight factor.	Remember
CO4	Explain the heat transmission, heat control and ventilation.	Evaluate
CO5	Explain about the energy efficient buildings for various zones.	Understand

REFERENCES:

1. Hossam, A. and Gabbar., Energy Conservation in Residential, Commercial, and Industrial Facilities, Wiley-Blackwell, New Delhi, First Edition, 2018.
2. National Renewable Energy Laboratory, Passive Solar Design Strategies: Guidelines for Home Building, Central Tennessee and Northern Alabama, Scholar's Choice, First Edition, 2015.
3. Mark DeKay. and Brown, G. Z., Sun, Wind and Light Architectural Design Strategies, John Wiley & Sons, New Delhi, Third Edition, 2014.
4. Moore, F., Environmental Control Systems Heating, Cooling, Lighting, McGraw Hill, New York, First Edition, 2002.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	2	2	3
CO2	3	-	2	2	3
CO3	2	-	3	2	3
CO4	2	-	3	2	3
CO5	3	-	3	2	3
Avg.	3	-	3	2	3

1-low, 2-medium, 3-high

Chairman (BoS)

CM24O02	ECONOMICS AND FINANCE MANAGEMENT IN CONSTRUCTION	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

(M.E.- CONSTRUCTION ENGINEERING AND MANAGEMENT)

PREREQUISITE: A foundational understanding of construction project management, including planning and execution processes. Basic knowledge of financial principles such as cost estimation, budgeting, and economic analysis.

OBJECTIVES:

- To equip students with the skills to analyze and manage financial aspects of construction projects, including cash flow, investment evaluation, and financial management techniques.

UNIT - I	BASIC PRINCIPLES	(9)

Time Value of Money – Cash Flow diagram – Nominal and effective interest- continuous interest. Single Payment Compound Amount Factor (P/F, F/P) – Uniform series of Payments (F/A, A/F, F/P, A/P) – Problem time zero (PTZ) - equation time zero (ETZ). Constant increment to periodic payments – Arithmetic Gradient (G), Geometric Gradient (C).

UNIT - II	COMPARING ALTERNATIVES PROPOSALS	(9)

Comparing alternatives- Present Worth Analysis, Annual Worth Analysis, Future Worth Analysis, Rate of Return Analysis (ROR) and Incremental Rate of Return (IROR) Analysis, Benefit/Cost Analysis, Break Even Analysis.

UNIT - III	EVALUATING ALTERNATIVE INVESTMENTS	(9)

Real Estate - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – Value Added Tax (VAT) – Inflation.

UNIT - IV	FUNDS MANAGEMENT	(9)

Project Finance – Sources of finance - Long-term and short -term finance, Working Capital Management, Inventory valuation, Mortgage Financing - International financial management-foreign currency management.

UNIT - V	FUNDAMENTALS OF MANAGEMENT ACCOUNTING	(9)

Management accounting, Financial accounting principles- basic concepts, Financial statements – accounting ratios - funds flow statement – cash flow statement.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Apply knowledge on concept of cash flow and payment factors.	Apply
CO2	Evaluate worth analysis and comparing alternatives.	Analyse
CO3	Analyse value added tax and alternative investments.	Analyse
CO4	Recognize the importance of working capital management, budgeting and control.	Remember
CO5	Prepare income, profit and loss statements and implement management accounting.	Understand

REFERENCES:

1. Collier, C. and Gla Gola, C., Engineering Economics & Cost Analysis, Addison Wesley Education Publishers, New Delhi, Third Edition, 2017.
2. Shrivastava, U.K., Construction Planning and Management, Galgotia Publications, New Delhi, Third Edition, 2016.
3. Patel, B.M., Project Management - Strategic Financial Planning, Evaluation and Control, Vikas Publishing House, Chennai, Second Edition, 2011
4. https://nptel.ac.in/courses/105/103/105103023/

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	2	2	3
CO2	3	-	2	2	3
CO3	2	-	3	2	3
CO4	2	-	3	2	3
CO5	3	-	3	2	3
Avg.	3	-	3	2	3

1-low, 2-medium, 3-high

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

CM24O03	STRESS MANAGEMENT	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

(M.E.- CONSTRUCTION ENGINEERING AND MANAGEMENT)

PREREQUISITE: Basic understanding of human behavior, communication, and workplace dynamics. Familiarity with personal time management and self-regulation techniques. An interest in self-development, mental well-being, and emotional intelligence is beneficial.

OBJECTIVES:

- To help students identify stress triggers and effectively manage them through practical strategies and to develop skills in time management, crisis handling, workplace communication, and self-improvement.

UNIT - I	UNDERSTANDING STRESS	(9)

Meaning – Symptoms – Works Related Stress – Individual Stress – Reducing Stress – Burnout.

UNIT - II	COMMON STRESS FACTORS TIME & CAREER PLATEAUING	(9)

Time Management – Techniques – Importance of planning the day – Time management schedule – Developing concentration – Organizing the Work Area – Prioritizing – Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say 'No'.

UNIT - III	CRISIS MANAGEMENT	(9)

Implications – People issues – Environmental issues –Psychological fall outs – Learning to keep calm – Preventing interruptions – Controlling crisis – Importance of good communication – Taking advantage of crisis – Pushing new ideas – Empowerment.

UNIT - IV	WORK PLACE HUMOUR	(9)

Developing a sense of Humour – Learning to laugh – Role of group cohesion and team spirit – Using humour at work – Reducing conflicts with humour.

UNIT - V	SELF DEVELOPMENT	(9)

Improving Personality – Leading with Integrity – Enhancing Creativity – Effective decision Making – Sensible Communication – The Listening Game – Managing Self – Meditation for peace – Yoga for Life.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering for Academic Courses, Tiruchengode-637 215

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Recognize your stress triggers and how to manage them.	Apply
CO2	Apply the time management skills in effective manner.	Apply
CO3	Handle the various crisis with full of confidence.	Evaluate
CO4	Solve the various conflicts with humour sense.	Apply
CO5	Improve the personality, creativity and decision making skills.	Create

REFERENCES:

1. Argyle., The Psychology of Happiness, Tata McGraw Hill, New Delhi, Second Edition, 2012.
2. Bartlet., Stress Perspectives & Process, Tata McGraw Hill, New Delhi, Sixth Edition, 2012.
3. Juan, R. Alascal Brucata. Laurel Brucata. and Daisy Chauhan., Stress Mastery, Pearson Education, New Delhi, Fourth Edition.
4. Jeff Davidson., Managing Stress, Prentice Hall of India, New Delhi, Fourth Edition, 2012.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	2	2	3
CO2	3	-	2	2	3
CO3	2	-	3	2	3
CO4	2	-	3	2	3
CO5	3	-	3	2	3
Avg.	3	-	3	2	3

1-low, 2-medium, 3-high

Chairman (BoS,

K.S.R. College of Engineering, Tiruchengode-637 215. Centre for Academic Courses

ST24O01	PRINCIPLES OF SUSTAIBALE DEVELOPEMENT	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of environmental science and understanding of economic and social systems are prerequisites for studying the principles of sustainable management.

OBJECTIVES:

- To understand the environmental, social, and economic dimensions of sustainability; explore global principles and agreements; and develop an action-oriented mindset to apply sustainable practices in personal, professional, and policy decisions.

UNIT - I	SUSTAINABILITY AND DEVELOPMENT CHALLENGES	(9)

Definition of sustainability - Environmental, Economic and Social dimensions of sustainability - Sustainable Development Models - Strong and Weak Sustainability - Defining Development- Millennium Development Goals - Mindsets for Sustainability : Earthly, Analytical, Precautionary, Action and Collaborative - Syndromes of Global Change: Utilization Syndromes, Development Syndromes, and Sink Syndromes - Core problems and Cross Cutting Issues of the 21 Century - Global, Regional and Local environmental issues - Social insecurity - Resource Degradation - Climate Change - Desertification

UNIT - II	PRINCIPLES AND FRAME WORK	(9)

History and emergence of the concept of sustainable development - Our Common Future - Stockholm to Rio plus 20 - Rio Principles of Sustainable Development - Precautionary Principle - Polluter Pays Principle - Role of Civil Society, Business and Government - Natural Step - Peoples Earth Charter - Business Charter for Sustainable Development - UN Global Compact - Agenda 21

UNIT - III	SUSTAINABLE LIVELI HOOD	(9)

The Unjust World and inequities - Quality of Life - Poverty, Population and Pollution - Combating Poverty - Millennium Development Goals, Indicators, Targets, Status and intervention areas - Demographic dynamics of sustainability - Strategies to end Rural and Urban Poverty and Hunger - Sustainable Livelihood Framework - Health, Education and Empowerment of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities and Industry for Prevention, Precaution , Preservation and Public participation.

UNIT - IV	SUSTAINABLE SOCIO-ECONOMIC SYSTEM	(9)

Protecting and Promoting Human Health - Investing in Natural Capital - Agriculture, Forests, Fisheries - Food security and nutrition and sustainable agriculture - Water and sanitation - Biodiversity conservation and Ecosystem integrity - Ecotourism - Urbanization and Sustainable Cities - Sustainable Habitats - Green Buildings - Sustainable Transportation - Sustainable Consumption and Production - Sustainable Mining - Sustainable Energy - Climate Change - Mitigation and Adaptation - Safeguarding Marine Resources - Financial Resources and Mechanisms

UNIT - V	ASSEESING PROGRESS AND WAY FORWARD	(9)

Nature of sustainable development strategies and current practice - Sustainability in global, regional and national context - Rio Plus 20 - Approaches to measuring and analysing sustainability - limitations of GDP- Ecological Footprint- Human Development Index- Human Development Report - National initiatives for Sustainable Development - Hurdles to Sustainability - Operational

Chairman (BoS)

guidelines - Science and Technology for sustainable development - Performance indicators of sustainability and Assessment mechanism - Inclusive Green Growth and Green Economy - National Sustainable Development Strategy Planning - Governance - Science and Technology- Sustainability Education

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Understand the key concepts and dimensions of sustainability and global environmental challenges.	Understand
CO2	Interpret major principles, frameworks, and global agreements on sustainable development.	Analyze
CO3	Assess livelihood strategies and the role of marginalized groups in sustainable development.	Analyze
CO4	Analyze sustainable socio-economic systems including agriculture, energy, and urban development.	Analyze
CO5	Apply sustainability indicators and tools to evaluate progress and recommend future strategies.	Apply

REFERENCES

1. Barry Dalal Clayton and Stephen Bass, Sustainable Development Strategies- a resource book", Earthscan Publications Ltd, London, 2002.
2. Karel Mulder, Sustainable Development for Engineers - A Handbook and Resource Guide, Green Leaf Publishing, 2006.
3. MoEF "Sustainable Development in India –stocktaking in the Run up to Rio plus 20", Ministry of Environment and Forests, Government of India, New Delhi. 2012,
4. UNEP, Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication, www.unep.org/greeneconomy, ISBN: 978-92-807-3143-9, 2011

Mapping of COs with POs and PSOs

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	2	3	2
CO2	3	-	2	3	3
CO3	3	-	3	3	3
CO4	3	-	3	3	3
CO5	3	-	2	3	2
Avg.	3	-	2	3	3

1-low, 2-medium, 3-high

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses, Tiruchengode-637215.

K.S.R. College of Engineering Applicable for the students admitted from 2024-2025 onwards

ST24O02	FAILURE ANALYSIS OF STRUCTURES	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:

A basic understanding of structural engineering principles, material science, and mechanics of materials is essential. Familiarity with construction practices and failure modes in civil structures will aid comprehension. Knowledge of engineering mathematics and analytical modeling is also recommended.

OBJECTIVES:

- To understand the causes and types of structural failures, explore material defects, loading and environmental factors, apply failure theories, study structural system behavior, and examine smart structures with sensors and adaptive systems.

UNIT - I	Introduction to Failure Mechanisms	(9)

Causes of failure - Types of failure - Why, what, how - Durability of materials - Landmark - Case - Performance and shape inadequacy - Statistics and reliability - Life cycle assessment

UNIT - II	Structural Failures and Material Deterioration	(9)

Structural failure - Material and load effects - Environment effect - Non-structural and structural repairs - Biocidal treatment and use of preservatives - Deterioration of wood

UNIT - III	Failure Analysis and Safety Evaluation	(9)

Macro micro level failures - Component and sub-system failures - Failure theories - Analytical models - Cases and type of problem in components - Safety evaluation.

UNIT - IV	Structural System Failures and Rehabilitation Techniques	(9)

Structural systems - case studies - Pin-jointed steel systems - Rigid jointed frames - Concrete walls arches - Reinforced concrete beams and frames - Shells - Repair of concrete bridge and water retaining structures.

UNIT - V	Maintenance, Refurbishment, and Smart Systems	(9)

Bridge maintenance techniques - The refurbishment of buildings, legal responsibilities - Case studies - Definition of smartness - Sensors - Automatic and adaptive systems - Smart components.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R College of Engineering, Centre for Academic Courses, Tiruchengode-637215

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Identify and classify different types of structural failures and explain the underlying causes.	Understand
CO2	Explain the mechanisms of structural failure due to material inadequacies and load effects.	Understand
CO3	Classify failure types in structural components through real-world case studies and diagnostics.	Analyze
CO4	Explain the behaviour of different structural systems, including steel trusses, rigid frames, shells, and arches.	Understand
CO5	Describe various bridge maintenance techniques and evaluate their applicability in different scenarios.	Understand

REFERENCES:

1. D Schiff, "Dynamic Analysis & Failure Modes of Simple Structures", John Wiley & Sons Inc, ISA, First Edition, 1990.
2. Wanhill R, Barter S, Molent L, "Fatigue Crack Growth Failure and Lifing Analyses for Metallic Aircraft Structures and Components", Springer, Germany, Nineteenth Edition, 2019.
3. Ravindran G, Mahesh V, Kassem M M, "Failure Analysis: Structural Health Monitoring of Structure and Infrastructure Components", Intech Open, United Kingdom, First Edition, 2023.
4. https://archive.nptel.ac.in/courses/112/107/112107241/

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	3	3	3
CO2	3	-	3	2	3
CO3	3	-	3	2	2
CO4	3	-	3	2	3
CO5	3	-	3	2	3
Avg.	3	-	3	2	3

1-Low, 2-Medium, 3-High

Chairman (BoS)

ST24O03	SMART MATERIALS AND SMART STRUCTURES	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

(M.E.- STRUCTURAL ENGINEERING)

PREREQUISITE: Basic knowledge of structural engineering, mechanics of materials, and civil engineering materials.

OBJECTIVES:

- To study the functions of smart materials and structures with integrated sensing and actuation, understand strain measurement techniques, explore sensing technologies, examine actuator systems like piezoelectric and shape memory materials, and understand data acquisition, signal processing, and control in smart structures.

UNIT - I	INTRODUCTION	(9)

Introduction to smart materials and structures - Instrumented structure functions and response - sensing systems - Self-diagnosis - Signal processing consideration - Actuation systems and effectors.

UNIT - II	MEASURING TECHNIQUES	(9)

Strain measuring techniques using electrical strain gauges, types - Resistance - Capacitance - inductance - Wheatstone bridges - Pressure transducers - Load cells - Temperature compensation - Strain rosettes.

UNIT - III	SENSORS	(9)

Sensing technology - Types of sensors - Physical measurement using piezo electric strain measurement - Inductively read transducers - LVDT - Fibre optic techniques - Chemical and bio-chemical sensing in structural assessment - Absorptive chemical sensors - Spectroscopes - Fibre optic chemical sensing systems and Distributed measurement.

UNIT - IV	ACTUATORS	(9)

Actuator techniques - Actuator and actuator materials - Piezoelectric and electro structure material - Mange to stricture material - Shape memory alloys - Electro rheological fluids - Electromagnetic actuation - Role of actuators and actuator materials.

UNIT - V	SIGNAL PROCESSING AND CONTROL SYSTEMS	(9)

Data acquisition and processing - Signal processing and control for smart structures - Sensors as geometrical Processors - Signal processing - Control system - Linear and nonlinear.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215. Centre for Academic Courses

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Explain about the instrumented structure functions and response in modern engineering.	Understand
CO2	Examine the strain measuring techniques using strain gauges.	Analyze
CO3	Choose sensors according to their applications in structures	Apply
CO4	Classify the actuator materials based on their applications	Analyze
CO5	Explain about data acquisition system and control system.	Understand

REFERENCES:

1. Srinivasan, A. V., Michael Mc Farland D., Smart Structures Analysis and Design, Cambridge University Press, England, South Asian Edition, 2010.
2. Peter L. Reece., Smart Materials and Structures: New Research, Nova Science Publishers Inc., New York, First Edition, 2007.
3. Gustav Gautschi., Piezoelectric Sensorics, Springer, New York, Second Edition, 2006.
4. Gandhi, M.V., and Thompson, B.D., Smart materials and structures, Springer, New York, First Edition, 2014

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	3	3	3
CO2	2	-	3	2	3
CO3	2	-	3	3	3
CO4	3	-	3	2	3
CO5	3	-	3	3	3
Avg.	3	-	3	3	3

1-low, 2-medium, 3-high

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215. Centre for Academic Courses

CU24O01	PRINCIPLES OF MULTIMEDIA	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:

Students should be familiar with networking and compression techniques.

OBJECTIVES:

This course introduces the fundamentals and importance of multimedia. It covers key multimedia elements and the use of tools and authoring techniques to create interactive content. Students will learn to develop, test and deploy multimedia applications for both web and mobile platforms using relevant technologies.

UNIT - I	INTRODUCTION	(9)

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

UNIT - II	ELEMENTS OF MULTIMEDIA	(9)

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

UNIT - III	MULTIMEDIA TOOLS	(9)

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

UNIT - IV	MULTIMEDIA SYSTEMS	(9)

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

UNIT - V	MULTIMEDIA APPLICATIONS FOR THE WEB AND MOBILE PLATFORMS	(9)

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

TOTAL(T:45, SL:45) : 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Explore multimedia components, architecture, and data streams by constructing basic multimedia documents.	Understand
CO2	Describe the multimedia elements to select appropriate models, formats, and standards for integrating content into multimedia applications.	Understand

Chairman (BoS)

CO3	Use multimedia authoring and editing tools to develop interactive multimedia content across different platforms.	Apply
CO4	Implement multimedia compression techniques and synchronization protocols to manage multimedia storage, retrieval and playback systems efficiently.	Apply
CO5	Develop ADDIE model and relevant frameworks to conceptualize and deploy multimedia content for web and mobile platforms.	Apply

REFERENCES:

1. Li, Ze-Nian, Drew, Mark, Liu, Jiangchuan, "Fundamentals of Multimedia", Springer, Germany, Third Edition, 2021.
2. Prabhat K. Andleigh, Kiran Thakrar, "Multimedia Systems Design", Pearson Education, London, First Edition 2015.
3. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, United Kingdom, First Edition 2018.
4. Ranjan Parekh, "Principles of Multimedia", McGraw-Hill Education, New York, Second Edition, 2017.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	3	3	-
CO2	3	-	3	3	-
CO3	3	-	3	3	-
CO4	3	-	3	3	-
CO5	3	-	3	3	-

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

CU24O02	IoT FOR SMART SYSTEMS	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:

A solid understanding of basic of Micro Controllers and Sensors and Real Time IoT development Tools.

OBJECTIVES:

This course provides a foundational understanding of the Internet of Things (IoT), including its core concepts and architectures. It familiarizes students with various communication protocols, networking models, and IoT implementation tools. The course also explores diverse real-world applications of IoT across multiple domains.

UNIT - I	INTRODUCTION TO INTERNET OF THINGS	(9)

Overview, Hardware and software requirements for IOT– Sensor and actuators – Technology drivers, Business drivers, Typical IoT applications – Trends and implications.

UNIT - II	IOT ARCHITECTURE	(9)

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

UNIT - III	PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT	(9)

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

UNIT - IV	IoT PROCESSORS	(9)

Services/Attributes: Big-Data Analytics for IoT – Dependability – Interoperability – Security, Maintainability. Embedded processors for IoT: Introduction to Python programming – Building IoT with RASPERRY PI and Arduino.

UNIT - V	CASE STUDIES	(9)

Industrial IoT – Home Automation – Smart cities, Smart Grid connected vehicles – Electric vehicle charging, Environment, Agriculture – Productivity Applications – IoT Defense

TOTAL (L:45, SL:45) : 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Articulate the main concepts, key technologies, strength and limitations of IoT.	Understand
CO2	Identify the architecture, infrastructure models of IoT	Understand
CO3	Analyze the networking and Protocols are used for communication in IoT	Analyze
CO4	Analyze and design different models for IoT implementation through various IoT Processors.	Analyze
CO5	Identify and design the new models for market strategic interaction	Apply

REFERENCES:

1. Arshdeep Bahga, Vijai Madisetti: A Hands-on Approach: Internet of Things, Universities Press, 2015.

Chairman (BoS)

2. Oliver Hersent, David Boswarthick, Omar Elloumi, the Internet of Things, Wiley, 2016.
3. Samuel Greengard, The Internet of Things, The MIT press, 2015
4. Adrian McEwen, 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.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	3	3	-
CO2	3	-	3	3	-
CO3	3	-	3	3	-
CO4	3	-	3	3	-
CO5	3	-	3	3	-

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

CU24O03	MEMS AND NEMS	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:
Engineering Physics- I & II , Engineering Chemistry - I & II

OBJECTIVES:
This course introduces learners to micro and nanoscale systems, materials, and the fundamental principles of MEMS and NEMS. It covers microsystem fabrication processes, the design and operation of MEMS sensors and actuators using various actuation techniques.

UNIT - I	OVERVIEW AND INTRODUCTION	(9)

New trends in Engineering and Science: Micro and Nanoscale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nano electro-mechanical systems, Microelectromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals.

UNIT - II	MEMS FABRICATION TECHNOLOGIES	(9)

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials.

UNIT - III	MICROSENSORS	(9)

MEMS Sensors: Design of Acoustic wave sensors, resonant sensors, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor

UNIT - IV	MICRO ACTUATORS	(9)

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators

UNIT - V	NANOSYSTEMS AND QUANTUM MECHANICS	(9)

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Schrodinger Equation and Wave function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their Quantization, Molecular Wires and Molecular Circuits.

TOTAL (L:45, SL:45) : 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Explain the fundamentals of micro and nanoscale systems, including MEMS/NEMS design concepts.	Understand
CO2	Describe various microsystem fabrication techniques such as photolithography, thin-film deposition and micromachining processes.	Understand
CO3	Illustrate the structure, function, and engineering principles of MEMS sensors like acoustic wave, resonant, gyroscopic, capacitive and piezo resistive sensors.	Understand

Chairman (BOS)

CO4	Summarize different actuation mechanisms in micro actuators, including thermal, piezoelectric, electrostatic and shape memory alloy-based designs.	Understand
CO5	Discuss key concepts of quantum mechanics and Nano system behavior, including molecular dynamics and wave function theory.	Understand

TEXTBOOKS:

1. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", First edition, Tata McGraw-Hill, India, 2002.
2. Stephen D. Senturia," Microsystem Design", Second edition, Springer, India, 2004.
3. M.J. Madou, "Fundamentals of Micro Fabrication", CRC Press, New Delhi, Second edition, 2002
4. Chang Liu, "Foundations of MEMS", Second edition, Pearson Education Limited, India, 2006

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	-	2	2	-	3
CO2	-	2	2	-	3
CO3	-	2	2	-	3
CO4	-	3	3	-	3
CO5	-	3	3	-	3

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

CU24O04	INTRODUCTION TO COGNITIVE RADIO NETWORK	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:
Digital Communication.

OBJECTIVES:

This course introduces students to cognitive radio networks, focusing on their architecture and importance in efficient spectrum utilization. It covers spectrum sensing techniques, dynamic spectrum allocation using optimization methods, and various access models.

UNIT - I	INTRODUCTION TO COGNITIVE RADIO	(9)

Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

UNIT - II	SPECTRUM SENSING	(9)

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models.

UNIT - III	OPTIMIZATION TECHNIQUES	(9)

Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

UNIT - IV	DYNAMIC SPECTRUM	(9)

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

UNIT - V	SPECTRUM TRADING AND RESEARCH CHALLENGES	(9)

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential). Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross layer design for cognitive radio networks.

TOTAL (L:45, SL:45): 90 PERIODS

COURSE OUTCOMES:
At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Demonstrate knowledge of cognitive radio architecture, functions, and applications.	Understand
CO2	Analyze and apply spectrum sensing techniques for detecting spectrum holes and managing shared resources.	Analyse
CO3	Solve dynamic spectrum allocation problems using mathematical optimization techniques.	Apply
CO4	Compare and contrast centralized and distributed spectrum access strategies and their real-world applications.	Apply
CO5	Identify and propose solutions for key research challenges in cognitive radio networks.	Understand

Chairman (BoS)

REFERENCES:

1. Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems", Hüseyin Arslan, Springer, ISBN 978-1-4020-5541-6 (HB), 2007.
2. Kwang-Cheng Chen, Ramjee Prasad, Cognitive radio networks, John Wiley & Sons Ltd., New York, 2009
3. Bruce Fette, Cognitive radio technology, Elsevier, Second edition, 2009.
4. Huseyin Arslan, Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007.
5. Francisco Rodrigo Porto Cavalcanti, Soren Anderson, Optimizing Wireless Communication Systems, Springer, 2009.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	-	3	3	-
CO2	3	-	3	3	-
CO3	3	-	3	3	-
CO4	3	-	3	3	-
CO5	3	-	3	3	-

1 - Low, 2 - Medium, 3 - High

C. Gunt
Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215 Centre for Academic Courses

ET24O01	EMBEDDED SYSTEMS	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:

Fundamentals of digital electronics and microprocessors, along with basic programming knowledge in C or assembly language.

OBJECTIVE:

- To design, model, and develop reliable embedded systems using both hardware and software components across diverse application domains.

UNIT - I	OVERVIEW OF EMBEDDED SYSTEMS	(9)

Embedded Systems Vs General computing systems – Selection of Embedded processor – DMA – Memory devices – Memory management methods – Memory mapping, cache replacement policies – Timer and Counting devices, Watchdog Timer, Real Time Clock – Software Development tools – IDE, assembler, compiler, linker, simulator, debugger, In-circuit emulator, Target Hardware Debugging – Overview of functional safety standards for embedded systems.

UNIT - II	EMBEDDED NETWORKING	(9)

I/O Device Ports & Buses – Multiple interrupts and interrupt service mechanism – Serial communication protocols: RS232 standard – RS485 – USB – Inter Integrated Circuits (I2C) – CAN Bus – Parallel communication using PCI, PCI-X buses, ARM bus – Wireless protocol: Wi-Fi – Bluetooth – Zigbee – Introduction to Device Drivers.

UNIT - III	HARDWARE/SOFTWARE MODELLING	(9)

Modeling embedded systems – Embedded software development approach – Overview of UML modeling – UML diagrams – Hardware/Software Partitioning, Co-Design Approaches for System Specification and modeling – Features Comparing Single-processor Architectures and Multi-Processor Architectures – Design approach on parallelism in Uniprocessors and Multiprocessors.

UNIT - IV	RTOS BASED EMBEDDED SYSTEM DESIGN	(9)

Introduction to basic concepts of RTOS – Task, Process & threads – Interrupt routines in RTOS – Multiprocessing and Multitasking – Preemptive and non-preemptive scheduling – Task communication – Context switching – Shared memory – Message passing – Interprocess communication – synchronization between processes – Semaphores – Mailbox – Pipes – Priority inversion – Priority inheritance – Comparison of Real-time Operating systems: VxWorks, uC/OS-II, RT Linux.

UNIT - V	EMBEDDED SYSTEM APPLICATION DEVELOPMENT	(9)

Objective, need, different phases and Modelling of the EDLC – Choice of Target Architectures for Embedded Application Development – Data Dominated Systems – Case studies: Digital Camera – Adaptive Cruise control in a Car – Mobile Phone software for key inputs.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Demonstrate the functionalities of processor internal blocks, with their requirement.	Apply
CO2	Recognize the Bus standards chosen based on interface overheads without sacrificing processor performance.	Apply
CO3	Illustrate that using multiple CPUs based on either hardcore or softcore helps data overhead management with processing speed reduction.	Apply
CO4	Describe the role and features of the RT operating system, that makes multitask execution possible by processors	Apply
CO5	Recommend Embedded consumer product design based on phases of product development.	Apply

TEXT BOOKS

1. Rajkamal, "Embedded System: Architecture, Programming, Design", TMH, 2011.
2. Peckol, "Embedded system Design", John Wiley & Sons, 2010.

REFERENCES:

1. Rajiv Chopra, "Advanced Computer Architecture", S. Chand, 2010.
2. Elicia White, "Making Embedded Systems", O'Reilly Series, SPD, 2011.
3. Bruce Powel Douglass, Real-Time UML Workshop for Embedded Systems, Elsevier, 2011.
4. Lyla B.Das, "Embedded Systems: An Integrated Approach", Pearson, 2013.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	2	-	3	-	-
CO2	2	-	1	-	-
CO3	2	-	2	-	-
CO4	2	-	3	-	-
CO5	2	-	1	-	-

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Tiruchengode-637215, Centre for Academic Courses

ET24O02	EMBEDDED CONTROL	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:

Basic understanding of electrical machines, power electronics, and microcontrollers. Familiarity with control systems and programming in C/C++ is advantageous.

OBJECTIVE:

- To develop intelligent, embedded-controlled electric drive systems for industrial automation and robotic applications.

UNIT - I	INTRODUCTION TO ELECTRICAL DRIVES	(9)

Electric drive and its classification, Four-quadrant drive, dependence of load torque on various factors, Dynamic of motor – load Combination – Sold controlled Drives – Machine learning and optimization techniques for electrical drives – IoT for Electrical drives applications.

UNIT - II	OVERVIEW OF EMBEDDED PROCESSOR	(9)

Embedded Processor architecture – RTOS – Hardware/software co-design-Programming with Soc processors.

UNIT - III	INDUCTION MOTOR CONTROL	(9)

Types-speed control methods – PWM techniques – VSI fed three-phase induction motor – Fuzzy logic based speed control for three-phase induction motor – FPGA based three-phase induction motor control.

UNIT - IV	BLDC MOTOR CONTROL	(9)

Overview of BLDC motor – speed control methods – PWM techniques – ARM processor-based BLDC motor control – ANN for BLDC motor control application.

UNIT - V	INDUSTRIAL AUTOMATION & ROBOTICS CONTROL	(9)

Industrial Automation: Role of embedded systems in automation, including PLCs, HMIs, and communication protocols.

Robotics: Integration of embedded control in robotic systems, covering sensors, actuators, kinematics, and path planning.

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the learners will be able to:

COs	Course Outcome	Cognitive Level
CO1	Interpret the significance of embedded control for electrical drives.	Understand
CO2	Describe various control strategy for electric drives.	Understand
CO3	Apply control techniques like PWM, fuzzy logic, and FPGA to implement speed control for induction motors.	Apply
CO4	Apply ARM-based and ANN-based methods to control the speed of BLDC motors in embedded systems.	Apply
CO5	Apply embedded control strategies for industrial automation and robotic systems using sensors, actuators, and communication interfaces.	Apply

Chairman (BoS)

TEXT BOOKS:

1. R.Krishnan, "Electric Motor Drives-Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltde., New Delhi, 2010.
2. Vedamsubramanium, "Electric Drives – Concepts and Applications", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2002

REFERENCES:

1. K. Venkataratnam, Special Electrical Machines, Universities Press, 2014.
2. Steve Furber, 'ARM system on chip architecture', Addisson Wesley, 2010.
3. Ron Sass and Andrew G. Sehmid, Embedded System Design with Platform FPGAs: Principles and Practices, Elsevier, 2010.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	1	-	2	-	-
CO2	1	1	3	-	-
CO3	2	-	-	-	-
CO4	1	2	3	-	-
CO5	2	-	-	-	-

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering. Tiruchengode. Centre for Academic Courses

ET24O03	EMBEDDED AUTOMATION	Category	L	T	P	SL	C
		OEC	45	0	0	45	3

PREREQUISITE:

Basic knowledge of digital electronics, microcontrollers, and programming in C or any procedural language. Familiarity with electronics lab tools is an added advantage.

OBJECTIVE:

- To develop embedded C programming skills for real-time applications involving microcontroller interfacing, vision systems, and home automation.

UNIT - I	INTRODUCTION TO EMBEDDED C PROGRAMMING 9	(9)

C Overview and Program Structure – C Types, Operators and Expressions – C Control Flow – C Functions and Program Structures – C Pointers and Arrays – FIFO and LIFO – C Structures – Development Tools.

UNIT - II	AVR MICROCONTROLLER	(9)

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

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

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

UNIT - IV	VISION SYSTEM	(9)

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

UNIT - V	HOME AUTOMATION	(9)

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

LECTURE: 45, SELF LEARNING: 45, TOTAL: 90 PERIODS

Chairman (BoS)

COURSE OUTCOMES:

At the end of the course, the students will be able to:

COs	Course Outcome	Cognitive Level
CO1	Understand the 8-bit series microcontroller architecture, features and pin details.	Understand
CO2	Write embedded C programs for embedded system applications.	Apply
CO3	Develop real-time systems using AVR microcontrollers.	Understand
CO4	Develop the systems based on the vision mechanism.	Apply
CO5	Develop a real-time home automation system for home needs.	Apply

TEXT BOOKS:

1. Dhananjay V. Gadre, Programming and Customizing the AVR Microcontroller, McGraw-Hill, 2001.
2. Joe Pardue, C Programming for Microcontrollers, Smiley Micros, 2005.

REFERENCES:

1. Steven F. Barrett, Daniel J. Pack, ATMEL AVR Microcontroller Primer: Programming and Interfacing, Morgan & Claypool Publishers, 2012.
2. Mike Riley, "Programming Your Home - Automate with Arduino, Android and Your Computer", Pragmatic Programmers, Llc, 2012.
3. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2011.
4. Kevin P. Murphy, "Machine Learning - a Probabilistic Perspective", The MIT Press, Cambridge, Massachusetts, London, 2012.

Mapping of COs with POs and PSOs

COs/ POs	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	-	-
CO2	3	2	3	-	-
CO3	3	2	3	-	-
CO4	3	2	3	-	-
CO5	3	2	3	-	-

1 - Low, 2 - Medium, 3 - High

Chairman (BoS)

K.S.R. College of Engineering, Centre for Academic Courses