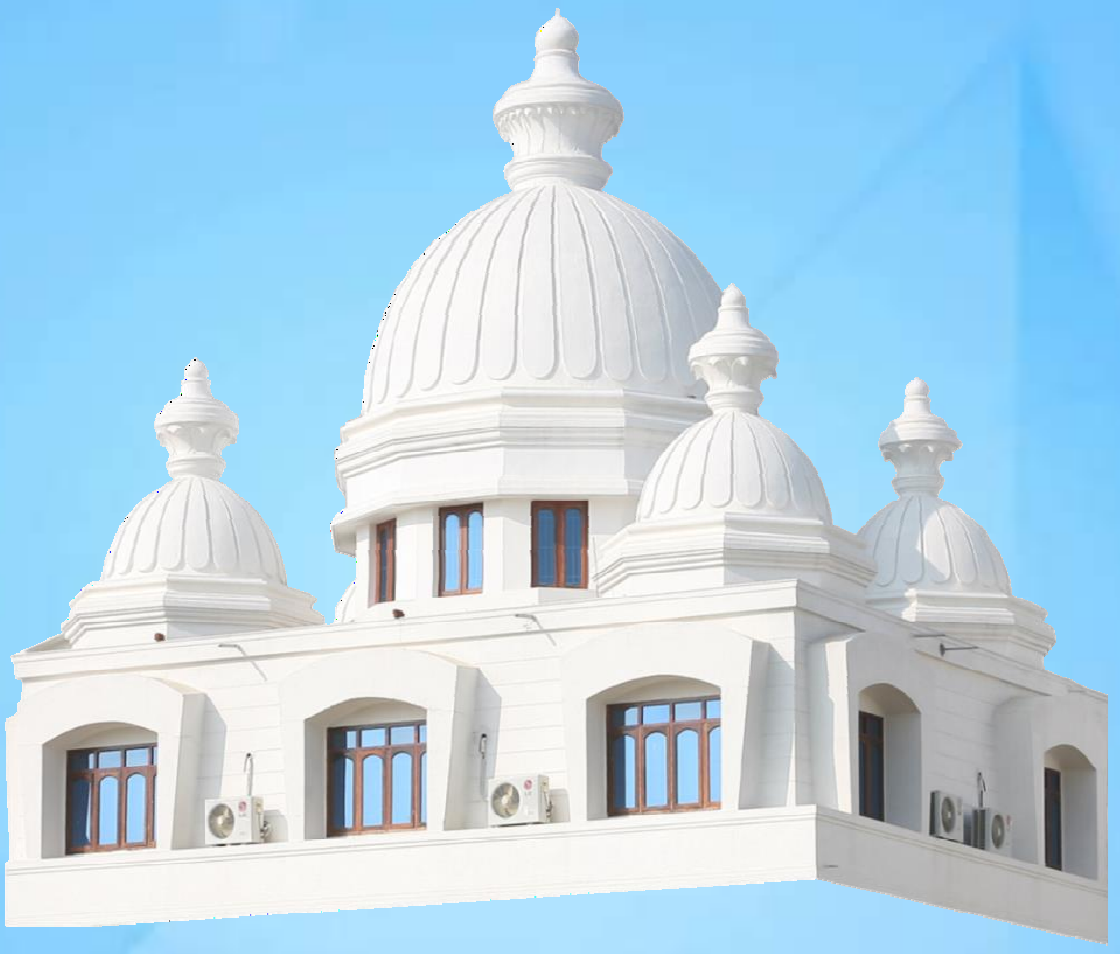
M.E. – Embedded System Technologies

R-2020: Curriculum & Syllabus



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DEPARTMENT OF EEE REGULATION 2020

M.E – EMBEDDED SYSTEM TECHNOLOGIES

Curriculum for Semesters – I to IV

I – SEMESTER										
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20PMA104	Applied Mathematics for Electronics Engineers	FC	3	2	0	4	40	60	100
20PES101	Software for Embedded Systems	PC	3	0	0	3	40	60	100
20PES102	Microcontroller Based System Design	PC	3	2	0	4	40	60	100
20PES103	Design of Embedded Systems	PC	3	0	0	3	40	60	100
20PESEXX	Professional Elective I	PE	3	0	0	3	40	60	100
20PESEXX	Professional Elective II	PE	3	0	0	3	40	60	100
Practical Course									
20PES104	Embedded System Laboratory-I	PC	0	0	4	2	50	50	100
		Total	18	4	4	22	290	410	700

II- SEMESTER									
Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20PES201	Real Time Operating Systems	PC	3	2	0	4	40	60	100
20PES202	Python Programming With Machine Learning	PC	3	0	0	3	40	60	100
20PES203	RISC Processor Architecture and Programming	PC	3	0	0	3	40	60	100
20PES204	Internet of Things	PC	3	0	0	3	40	60	100
20PESEXX	Professional Elective-III	PE	3	0	0	3	40	60	100
20PESEXX	Professional Elective-IV	PE	3	0	0	3	40	60	100

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Practical Course									
20PES205	Embedded System Laboratory-II	PC	0	0	4	2	50	50	100
		Total	18	2	4	21	290	410	700

III – SEMESTER

Code No.	Course	Category	Periods / Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
20PTE301	Research Methodology and IPR	PC	3	0	0	3	40	60	100
20PES302	Wireless And Mobile Communication	PC	3	0	0	3	40	60	100
20PESEXX	Professional Elective V	PE	3	0	0	3	40	60	100
Practical Course									
20PES303	Project Work Phase- I	EEC	0	0	12	6	50	50	100
		Total	9	0	12	15	170	230	400

IV- SEMESTER

Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Practical Course									
20PES401	Project Work Phase -II	EEC	0	0	24	12	50	50	100
		Total	0	0	24	12	50	50	100

LIST OF PROFESSIONAL ELECTIVES

Code No.	Course	Category	Periods /Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
Semester I- Elective I									
20PESE01	ASIC and FPGA Design	PE	3	0	0	3	40	60	100
20PESE02	Advanced Computer Architecture and Parallel Processing	PE	3	0	0	3	40	60	100
20PESE03	Digital Instrumentation	PE	3	0	0	3	40	60	100
Semester I- Elective II									
20PESE11	Device Driver Embedded Linux	PE	3	0	0	3	40	60	100
20PESE12	Advanced Digital Signal Processors	PE	3	0	0	3	40	60	100
20PESE13	Embedded & Real Time Systems	PE	3	0	0	3	40	60	100

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Semester II- Elective III									
20PESE21	Embedded Product Development	PE	3	0	0	3	40	60	100
20PPEE34	Electric Vehicles and Power Management	PE	3	0	0	3	40	60	100
20PESE22	Reconfigurable Processor and SoC Design	PE	3	0	0	3	40	60	100
Semester II- Elective IV									
20PESE31	Digital Image Processing	PE	3	0	0	3	40	60	100
20PESE32	Embedded Networking and Automation of Electrical System	PE	3	0	0	3	40	60	100
20PESE33	Smart System Design	PE	3	0	0	3	40	60	100
Semester III- Elective V									
20PPEE43	Smart Grid	PE	3	0	0	3	40	60	100
20PESE42	Soft Computing and Optimization Techniques	PE	3	0	0	3	40	60	100
20PESE43	Cryptography And Network Security	PE	3	0	0	3	40	60	100
20PESE44	Robotics and Control	PE	3	0	0	3	40	60	100
20PESE45	Digital Signal Processors	PE	3	0	0	3	40	60	100

S. No	Category	CREDITS PER SEMESTER				Total Credit (AICTE)	Credits in %
		I	II	III	IV		
1	FC	4				4	5.71%
2	BS						
3	ES						
4	PC	12	15	6		33	47.14%
5	PE	6	6	3		15	21.42%
6	OE						
7	EEC			6	12	18	25.71%
	Total	22	21	15	12	70	100.00%

FC - Foundation Courses

BS - Basic Sciences

ES - Engineering Sciences

PC - Professional Core

PE - Professional Electives

OE - Open Electives

EEC - Employability Enhancement Courses

CA - Continuous Assessment

FE - Final Examination

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I SEMESTER

20PMA104	APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS	L	T	P	C
		4	0	0	4
Nature of Course	Fundamental Core				
Pre requisites	Basic Engineering Mathematics				

Course Objectives

The course is intended to

1. The main objective of this course is to demonstrate various analytical skills in applied mathematics.
2. Understand the extensive experience with the tactics of problem solving and logical thinking applicable for the students of electrical engineering.
3. To study performance of mathematical tools from a variety of mathematical areas, including matrix theory.
4. To study identify, formulate, abstract, and solve problems in electrical engineering.
5. To study the calculus of variations, probability, linear programming and Fourier series.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Apply various methods in matrix theory to solve system of linear equations	Apply
CO2	Maximizing and minimizing the functional that occur in electrical engineering discipline	Analyze
CO3	Computation of probability and moments, standard distributions of discrete and continuous random variables and functions of a random variable	Understand
CO4	Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems	Understand
CO5	Fourier series analysis and its uses in representing the power signals	Understand

Course Contents:

UNIT I MATRIX THEORY 12

Cholesky decomposition - Generalized Eigenvectors - Canonical basis - QR factorization - Least squares method - Singular value decomposition.

UNIT II CALCULUS OF VARIATIONS 12

Concept of variation and its properties - Euler's equation - Functional dependant on first and higher order derivatives - Functionals dependant on functions of several independent variables - variation problems with moving boundaries - Isoperimetric problems - Direct methods : Ritz and Kantorovich methods.

UNIT III PROBABILITY AND RANDOM VARIABLES 12

Probability - Axioms of probability - Conditional probability - Baye's theorem - Random variables - Probability function - Moments - Moment generating functions and their properties - Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions - Function of a Random variable.

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UNIT IV LINEAR PROGRAMMING 12

Formulation – Graphical solution – Simplex method – Big M method - Two phase method . Transportation and Assignment models.

UNIT V FOURIER SERIES 12

Fourier trigonometric series: Periodic function as power signals – Convergence of series – Even and odd function : Cosine and sine series - Non periodic function : Extension to other intervals - Power signals : Exponential Fourier series - Parseval's theorem and power spectrum - Eigen value problems and orthogonal functions - Regular Sturm - Liouville systems - Generalized Fourier series.

TOTAL: 60 PERIODS

REFERENCES:

1. Andrews L.C. and Phillips R.L., "Mathematical Techniques for Engineers and Scientists", Prentice Hall of India Pvt. Ltd., New Delhi, 2019.
2. Bronson, R. "Matrix Operation", Schaum's outline series, 2nd Edition, McGraw Hill, 2015.
3. Elsgolc, L. D. "Calculus of Variations", Dover Publications, New York, 2007.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
5. O'Neil, P.V., "Advanced Engineering Mathematics", Thomson Asia Pvt. Ltd., Singapore, 2003.
6. Taha, H.A., "Operations Research, An Introduction", 9th Edition, Pearson education, New Delhi, 2016.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										3	2	3
CO2	3	3	2										3	2	3
CO3	3	3	2										3	2	3
CO4	3	3	2										3	2	3
CO5	3	3	2										3	2	3
	3	High				2	Medium					1	Low		

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Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	0	0	0	0
Analyze	30	30	30	60
Evaluate	0	0	0	0
Create	0	0	0	0

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20PES101	SOFTWARE FOR EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Fundamental of Microprocessor and Microcontroller				

OBJECTIVES

1. To expose the students to the fundamentals of embedded Programming.
2. To Introduce the GNU C Programming Tool Chain in Linux.
3. To study basic concepts of embedded C , Embedded OS&Python Programming
4. To introduce time driven architecture, Serial Interface with a case study.
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Ability to use GNU C to develop embedded software.	Understand
CO2	knowledge and understanding of fundamental embedded systems design paradigms, architectures, possibilities and challenges, both with respect to software and hardware	Understand
CO3	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.	Understand
CO4	Analyze and learn to implement the signal processing algorithms in Ebedded.	Analyzing
CO5	Learn the python programming tools and use them for applications	Understand

Course Contents:

UNIT I EMBEDDED PROGRAMMING 9

C and Assembly - Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization – In-line Assembly.

UNIT II 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 - Memory Leak Detection with valgrind - Introduction to GNU C Library

UNIT III 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 IV EMBEDDED OS 9

Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, Using Timer 0 and Timer 1, Portability issue, Alternative system architecture, Important design considerations when using EOS- Memory requirements - embedding serial communication & scheduling data transmission-Case study: Intruder alarm system.

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UNIT V PYTHON PROGRAMMING 9

Basics of PYTHON Programming Syntax and Style - Python Objects- Dictionaries - comparison with C programming on Conditionals and Loops - Files - Input and Output - Errors and Exceptions - Functions - Modules - Classes and OOP - Execution Environment.

TOTAL: 45 PERIODS

REFERENCES:

1. Wesley J.Chun, "Core python application Programming 3rd Edition", Pearson Educat, 2019.
2. Christian Hill, Learning Scientific Programming with Python , CAMBRIDGE UNIVERSITY PRESS ,2016.
3. David Griffiths, Dawn Griffiths, "Head First C", O'reilly,2015.
4. Peter Prinzs, Tony Crawford, "C in a Nutshell",O'Reilly,2016.
5. Dr.Bandu Meshram, "Object Oriented Paradigm C++ BegInnersGuide C&C++",SPD, 2016

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2										3	2	3
CO2	3	2	2										3	2	3
CO3	3	3	3		2								3	2	3
CO4	3	3	3		2								3	2	3
CO5	3	3	2			2						2	3	2	3
	3	High				2	Medium					1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment

Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	0	0	0	0
Analyze	30	30	30	60
Evaluate	0	0	0	0
Create	0	0	0	0

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20PES102	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Basic concepts of microcontroller				

OBJECTIVES:

1. To introduce the fundamentals of microcontroller based system design.
2. To teach I/O and RTOS role on microcontroller.
3. To know Microcontroller based system design, applications.
4. To teach I/O interface in system Design
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	8-bit microcontrollers, learn assembly and C-programming of PIC	Understand
CO2	learn Interfacing of Microcontroller	Understand
CO3	Learners will study about PIC microcontroller and system design	Understand
CO4	The course would enable students to enrich their knowledge with hands on experiments and project based learning	Understand
CO5	Effectively utilize microcontroller software development tools such as a compiler, make files, or compile scripts	Apply

Course Contents:

UNIT I 8051 ARCHITECTURE 9

Architecture - memory organization - addressing modes - instruction set - Timers - Interrupts - I/O ports, Interfacing I/O Devices - Serial Communication.

UNIT II 8051 PROGRAMMING 9

Assembly language programming - Arithmetic Instructions - Logical Instructions -Single bit Instructions - Timer Counter Programming - Serial Communication Programming, Interrupt Programming, LCD digital clock, thermometer - Significance of RTOS for 8051

UNIT III PIC MICROCONTROLLER 9

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

UNIT IV PERIPHERAL OF PIC MICROCONTROLLER 9

Timers - Interrupts, I/O ports- I2C bus-A/D converter-UART- CCP modules -ADC, DAC and Sensor Interfacing -Flash and EEPROM memories.

UNIT V SYSTEM DESIGN – CASE STUDY 9

Interfacing LCD Display – Keypad Interfacing - Generation of Gate signals for converters and Inverters - Motor Control - Controlling DC/ AC appliances - Measurement of frequency - Stand alone Data Acquisition System

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Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions/Practice on Workbench : 8051/PIC/ATMEL/other Microcontroller based Assembly/C language programming - Arithmetic Programming- Timer Counter Programming - Serial Communication- Programming Interrupt -RTOS basis in Task creation and run - LCD digital clock/thermometer- Motor Control.

TOTAL: 45 PERIODS

REFERENCES:

1. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey ' PIC Microcontroller and Embedded Systems using Assembly and C for PIC18', Pearson Education 2018
2. Rajkamal,"Microcontrollers Architecture, Programming Interfacing,& System Design, Pearson,2018.
3. Muhammad Ali Mazidi, Sarmad Naimi ,Sepehr Naimi' AVR Microcontroller and Embedded Systems using Assembly and C", Pearson Education 2014.
4. Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, 'The 8051 Microcontroller and Embedded Systems' Prentice Hall, 2015.
5. John Iovine, 'PIC Microcontroller Project Book ', McGraw Hill 2000.
6. Senthil Kumar,Saravanan,Jeevanathan,"microprocessor & microcontrollers,Oxford,2013.
7. Myke Predko, "Programming and customizing the 8051 microcontroller", TMcGraw Hill 2001.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2										3	2	3
CO2	3	3	3	2		2							3	2	3
CO3	3	2	2										3	2	3
CO4	3	2	2										3	2	3
CO5	3	2	3	2		2						2	3	2	3
	3	High				2	Medium					1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1 (7.5)	2 (7.5)	3 (10)	(60)
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

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20PES103	DESIGN OF EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Fundamental of Embedded Systems				

OBJECTIVES:

1. To provide a clear understanding on the basic concepts, Building Blocks of Embedded System.
2. To teach the fundamentals of Embedded processor Modeling , Bus Communication in processors, Input/output interfacing
3. To introduce on processor scheduling algorithms , Basics of Real time operating system.
4. To discuss on aspects required in developing a new embedded processor, different Phases & Modeling of embedded system
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical.	Analysis
CO2	understand the fundamental concepts of real-time operating systems	Understand
CO3	Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems	Understand
CO4	Design real time embedded systems using the concepts of RTOS	Apply
CO5	Foster ability to understand the role of embedded systems in industry	Understand

Course Contents:

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems -Structural units in Embedded processor, selection of processor & memory devices- DMA, Memory management methods- memory mapping, cache replacement concept, Timer and Counting devices, Watchdog Timer, Real Time Clock

UNIT II EMBEDDED NETWORKING AND INTERRUPTS SERVICE MECHANISM 9

Embedded Networking: Introduction, I/O Device Ports & Buses- Serial Bus communication protocols - RS232 standard – RS485 -USB – Inter Integrated Circuits (I2C) – interrupt sources , Programmed-I/O busy-wait approach without interrupt service mechanism- ISR concept– multiple interrupts - context and periods for context switching, interrupt latency and deadline -Introduction to Basic Concept Device Drivers.

UNIT IV SOFTWARE DEVELOPMENT TOOLS 9

Software Development environment-IDE, assembler, compiler, linker, simulator, debugger, In circuit emulator, Target Hardware Debugging, need for Hardware-Software Partitioning and Co-Design. Overview of UML, Scope of UML modeling, Conceptual model of UML, Architectural, UML basic elements-Diagram, Modeling techniques - structural, Behavioral, Activity Diagrams.

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UNIT III 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- shared memory, message passing-, Interprocess Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance-comparison of commercial RTOS features - RTOS Lite, Full RTOS, VxWorks, µC/OS-II, RT Linux,

UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT 9

Objectives, different Phases & Modeling of the Embedded product Development Life Cycle (EDLC). Case studies on Smart card- Adaptive Cruise control in a Car -Mobile Phone software for key inputs.

Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching /Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded Products like : Smart card -Adaptive Cruise control in a Car - Mobile Phone -Automated Robonoid.

TOTAL: 45 PERIODS

REFERENCES:

1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2019.
2. Peckol, "Embedded system Design",JohnWiley&Sons,2010
3. Shibu.K.V, "Introduction to Embedded Systems", Tata McGraw Hill,2018
4. Lyla B Das," Embedded Systems-An Integrated Approach",Pearson2013
5. Elicia White,"Making Embedded Systems",O'Reilly Series,SPD,2011
6. Bruce Powel Douglass,"Real-Time UML Workshop for Embedded Systems,Elsevier,2011
7. Simon Monk, "Make: Action, Movement, Light and Sound with Arduino and Raspberry Pi", O' Reilly Series , SPD,2016.
8. Tammy Noergaard, "Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier, 2006
9. Jonathan W.Valvano,"Embedded Microcomputer Systems ,Real Time Interfacing", Cengage Learning,3rd edition,2012
10. Michael Margolis, "Arduino Cookbook, O'Reilly Series ,SPD,2013.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										2	3	2	3
CO2	3	3										2	3	2	3
CO3	3	2	3								2	2	3	2	3
CO4	3	2			3							1	3	2	3
CO5	3	1	2								3	2	3	2	3
	3	High				2	Medium					1	Low		

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Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1 (7.5)	2 (7.5)	3 (10)	(60)
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

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20PES104	EMBEDDED SYSTEM LABORATORY-I	L	T	P	C
		0	0	4	2
Nature of Course	Devices and Circuits				
Pre requisites	Fundamentals of Embedded Systems				

Course Objectives

1. To study various controllers and different Languages/ plot form.
2. To Learn Programming for microcontroller with AVR/PIC.
3. To Learn Programming with Arduino Microcontroller Board.
4. To learn Verilog HDL Programming in FPGA processors
5. To understand the concept of built in Simulation Tools as Proteus/ ORCAD/MATLAB.

Course Outcomes

1. The students will learn design with simulators/ programming Environments
2. The students will learn design with simulators/experiments, in programming
3. Processor boards, processor interfacing/ designing digital controllers
4. The students will learn design with simulators/experiments, in programming processor boards, processor interfacing/ designing digital controllers
5. The students will learn design ,modeling & simulation of Combinational, Sequential, Synchronous, Asynchronous circuits with simulators/experiments ,in programming processor boards, processor interfacing/designing reprogrammable system.
6. The students will learn design with experiments ,in programming

CYCLE-1

S.No.	Course Content	CO	Bloom's Level
1	Programming in Higher Level Languages/ Platforms	CO1	Applying
2	Programming with 8 bit Microcontrollers: Assembly programming Study on in circuit Emulators, cross compilers, debuggers	CO1	Analysis
3	I/O Programming with 8 bit Microcontrollers I/O Interfacing : Timers/ Interrupts/ Serial portprogramming/PW M Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing	CO4	Applying
4	Programming with AVR/ PIC Microcontrollers : ✓ Assembly ✓ C programming ✓ programming ✓ Interfacing peripherals Study on in circuit Emulators, cross compilers, debuggers.	CO2	Analysis
5	I/O Programming with AVR/ PIC Microcontrollers I/O Interfacing : Timers/ Interrupts/ Serial port programming/PW M Generation/ Motor Control/ADC/DAC / LCD/ RTC Interfacing/ Sensor Interfacing	CO4	Understand

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CYCLE-2

S.No.	Course Content	CO	Bloom's Level
1	Programming with Arduino Microcontroller Board: Study on in circuit Emulators, cross compilers, debuggers	CO5	Understand
2	VHDL Programming in FPGA processors	CO4	Apply
3	Verilog HDL Programming in FPGA processors	CO3	Apply
4	Programming & Simulation in Simulators /Tools/others-ORCAD	CO4	Analysis
5	Programming & Simulation in Simulators/Tools/others-MATLAB	CO4	Analysis

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										2	3	2	3
CO2	3	2										2	3	2	3
CO3	3	2										2	3	2	3
CO4	3	2										2	3	2	3
CO5	3	2										2	3	2	3
	3	High				2	Medium					1	Low		

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Internal Assessment [50 marks]	End Semester Examination [50 marks]
Remember	10	10
Understand	20	20
Apply	40	40
Analyze	30	30
Evaluate	-	-
Create	-	-

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II SEMESTER

20PES201	REAL TIME OPERATING SYSTEMS	L	T	P	C
		3	2	0	4
Nature of Course	Professional Core				
Pre requisites	Embedded System				

Course Objective

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

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Real-time scheduling and schedulability analysis, including clock-driven and priority-driven scheduling	Analyze
CO2	Theoretical background (specification/verification) and practical knowledge of real-time operating systems.	Apply
CO3	understand the fundamental concepts of real-time operating systems	Understand
CO4	After completing the course students will appreciate the use of multitasking techniques in real- time systems.	Analysis
CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design.	Understand

Course Contents:

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 system - issues in distributed system: states, events, clocks-Distributed scheduling-Fault &recovery.

UNIT II OVERVIEW OF RTOS 9

RTOS Task and Task state -Multithreaded Preemptive scheduler- Process Synchronisation-Message queues- Mail boxes -pipes - Critical section - Semaphores - Classical synchronisation 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 REAL TIME KERNEL 9

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

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UNIT V INTRODUCTION TO EMBEDDED OS

Discussions on Basics of Linux supportive RTOS - uCOS-C Executive for development of RTOS Application -introduction to Android Environment -The Stack – Android User Interface - Preferences, the File System, the Options Menu and Intents, with one Case study

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Practice on Workbench :on understanding the scheduling techniques, timing circuitry, memory allotment scheme , overview of commercial Embedded OS,

TOTAL : 45 PERIODS

REFERENCE BOOKS

1. Silberschatz,Galvin,Gagne" Operating System Concepts,6th ed,John Wiley,2013
2. Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill,2016
3. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill,2009.
4. Karim Yaghmour,Building Embedded Linux System",O'reilly Pub,2003
5. C.M. Krishna, Kang, G.Shin, "Real Time Systems", McGraw Hill, 1997.
6. Marko Gargenta,"Learning Android ",O'reilly 2011.
7. Herma K., "Real Time Systems - Design for distributed Embedded Applications", Kluwer Academic, 1997.
8. Corbet Rubini, Kroah-Hartman, "Linux Device Drivers", O'reilly, 2016.
9. Mukesh Sighal and N G Shi "Advanced Concepts in Operating System", McGraw Hill,2000.
10. D.M.Dhamdhere," Operating Systems,A Concept-Based Approch,TMH,2008.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3										2	3	2	3
CO2	3	3										2	3	2	3
CO3	3	2										2	3	2	3
CO4	3	2										2	3	2	3
CO5	3	2										2	3	2	3
	3	High				2	Medium					1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

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Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

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20PES202	PYTHON PROGRAMMING WITH MACHINE LEARNING	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Basic of Python				

Course Objectives

1. Students will learn the grammar of Python programming language.
2. Students will understand and be able to use the basic programming principles such as data types, variable, conditionals, loops, recursion and function calls.
3. Students will learn how to use basic data structures such as List, Dictionary and be able to manipulate text files and images.
4. Students will understand the process and will acquire skills necessary to effectively attempt a programming problem and implement it with a specific programming language - Python.
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Students will be able to develop skill in system administration	Apply
CO2	Students will be able to network programming by learning Python	Understand
CO3	Students will also learn how to effectively use Python's very powerful processing primitives, modeling etc.	Apply
CO4	Improved Employability and entrepreneurship capacity	Analyze
CO5	To knowledge up gradation on recent trends in embedded systems design	Analyze

Course Contents:

UNIT I INTRODUCTION TO PYTHON 9

Introduction to Python language - Using the interpreter - Python data types and functions - Working with Data - List, Dictionary and Set - Processing Primitives - List comprehensions - File Handling - Object model including Variables, Reference counting, Copying, and Type checking - Error handling.

UNIT II PROGRAM ORGANIZATION AND FUNCTIONS 9

Organize Large programs into functions - Python functions including scoping rules and documentation strings - Modules and Libraries - Organize programs into modules - System administration, Text processing, Subprocesses, Binary data handling, XML parsing and Database Access - Installing third-party libraries..

UNIT III CLASSES AND OBJECTS 9

Introduction to Object-oriented programming - Basic principles of Object-oriented programming in Python - Class definition, Inheritance, Composition, Operator overloading and Object creation - Python special modules - Python Object System - Object representation, Attribute binding, Memory management, and Special properties of classes including properties, slots and private attributes.

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UNIT IV TESTING, DEBUGGING, AND SOFTWARE DEVELOPMENT PRACTICE 9

Python Software development - Use of documentation string - Program testing using doctest and unittest modules - Effective use of assertions - Python debugger and profiler - Iterators and

Passed in Board of Studies Meeting (09.10.2021) Approved in Academic Council Meeting (11.10.2021) Generators to set up data processing pipelines - An effective technique for addressing commonsystem programming problems (e.g. processing large datafiles, handling infinite data streams, etc.)

UNIT V TEXT I/O HANDLING 9

Text generation, Template strings and Unicode-packages - Python Integration Primer - Network programming - Accessing C code - Survey on how Python interacts with other language programs.

TOTAL: 45 PERIODS

Note: Class Room Discussions and Tutorials can include the following Guidelines for Improved Teaching /Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded solutions with improved programming skill learnt through python that can be adopted while programming on other domains.

REFERENCES:

1. Mark Lutz,"Learning Python,Powerful OOPs,O'reilly,2011
2. Robert Sedgewick,Kevin Wayne ,Robert Dondero,Intr Programming in Python, Pearson,2016.
3. Mark J.Guzdial,Barbara Ericson,"Introduction to Computing & Programming in Python,4th Edition Pearson,2015.
4. Budd, Timothy. Exploring Python. McGraw-Hill science,2009.
5. Guttag, John. Introduction to Computation and Programming Using Python. MIT Press, 2013.
6. Zelle, John M. Python Programming: An Introduction to Computer Science. 1st ed. Franklin Beedle& Associates, 2003.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										3	2	3
CO2	3	3	2										3	2	3
CO3	3	3	2										3	2	3
CO4	3	3	2										3	2	3
CO5	3	3	2										3	2	3
	3	High				2	Medium					1	Low		

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Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

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20PES203	RISC PROCESSOR ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Fundamentals of Basic Microcontroller				

Course Objectives

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

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Describe the programmer's model of ARM processor and create and test assembly level programming	Apply
CO2	Analyze various types of coprocessors and design suitable co-processor interface to ARM processor.	Analyze
CO3	Identify the architectural support of ARM for operating system and analyze the function of memory Management unit of ARM	Analyze
CO4	Students will develop more understanding on the concepts ARM Architecture, programming and application development	Understand
CO5	The learning process delivers insight into various embedded processors of RISC architecture / computational processors with improved design strategies.	Understand

Course Contents

Unit-I AVR MICROCONTROLLER ARCHITECTURE **12**

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 **12**

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 **12**

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 **12**

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. linear programming, Interior penalty function method, external penalty function method.

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Unit-V DESIGN WITH ARM MICROCONTROLLERS 12

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

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Exercise/Practice on Workbench : on Programming practices on the KEIL Work Bench for Simple ASM/C / Input & output interfacing programs with ARM 7/ARM 9/Nuvoton Processors.

TOTAL : 45=30=75 PERIODS

REFERENCES

1. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System Developer's Guide Designing and Optimizing System Software', Elsevier 2007.
2. Muhammad Ali Mazidi, Sarmad Naimi ,Sepehr Naimi' AVR Microcontroller and Embedded Systems using Assembly and C", Pearson Education 2014.
3. ARM Architecture Reference Manual, LPC213x User Manual.
4. www.Nuvoton .com/websites on Advanced ARM Cortex Processors.
5. Trevor Martin, 'The Insider's Guide To The Philips ARM7-Based Microcontrollers,
6. An Engineer's Introduction To The LPC2100 Series' Hitex (UK) Ltd.,

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3										1	3	2	2
CO2	3	3										1	3	2	2
CO3	2	3										1	3	2	2
CO4	3	2										1	3	2	2
CO5	3	3										1	3	2	2
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom / Online Quiz/Group discussion	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

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Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1 (7.5)	2 (7.5)	3 (10)	(60)
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

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20PES204	INTERNET OF THINGS	L	T	P
		3	0	0
Nature of Course	Professional Core			
Pre requisites	Fundamentals of Electronics			

Course Objectives

1. To Study about Internet of Things technologies
2. its role in real time applications
3. To familiarize the accessories and communication techniques for IOT.
4. To familiarize the different platforms
5. Attributes for IOT

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Lev
CO1	Students will develop more understanding on the concepts of IOT and its present developments.	Understand
CO2	Students will study about different IOT technologies.	Understand
CO3	Students will acquire knowledge about different platforms and Infrastructure for IOT	Analyze
CO4	Students will learn the art of implementing IOT	Understand
CO5	Students will learn the smart applications and control	Understand

Course Contents

UNIT I INTRODUCTION TO INTERNET OF THINGS

Overview, Technology drivers, Business drivers, Typical IoT applications, Trends and implications

UNIT II IOT ARCHITECTURE:

Node Structure - Sensing, Processing, Communication, Powering, Networking - Topologies, Layer/Stackarchitecture ,IoT standards,Cloud computing for IoT,Bluetooth, Bluetooth Low Energy, beacons

UNIT III PROTOCOLS AND WIRELESS TECHNOLOGY FOR IOT

Protocols : NFC, RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe Wired vs. Wireless communication,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.

UNIT IV DATA ANALYSTICS FOR IOT

Services/Attributes: Big-Data Analytics andVisualization,Dependability,Security,Maintainability Data analytics for IoT: A framework for data-driven decision making , Descriptive, Predictive and Prescriptive Analytics , Business Intelligence and Artificial Intelligence Importance of impact and open innovation in data-driven decision making.

UNIT V CASE STUDIES

Home Automation, smart cities, Smart Grid, Electric vehicle charging, Environment, Agriculture, Productivity Applications

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Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching
/Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded solutions using wireless communication by processor support

TOTAL : 45 PERIODS

REFERENCE BOOKS

1. Arshdeep Bahga and Vijai Madisetti : A Hands-on Approach "Internet of Things",Universities Press2018.
2. Oliver Hersent , David Boswarthick and Omar Elloumi " The Internet of Things", Wiley,2016.
3. Samuel Greengard, " The Internet of Things", The MIT press, 2015
4. Adrian McEwen and Hakim Cassimally "Designing the Internet of Things "Wiley,2014.
5. Jean- Philippe Vasseur, Adam Dunkels, "Interconnecting Smart Objects with IP: The Next Internet"Morgan Kuffmann Publishers, 2014.
6. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", John Wiley and sons,2014
7. Lingyang Song/Dusit Niyato/Zhu Han/ Ekram Hossain," Wireless Device-to-DeviceCommunications and Networks, CAMBRIDGE UNIVERSITY PRESS,2015
8. OvidiuVermesan and Peter Friess (Editors), "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers Series in Communication,2013
9. Vijay Madisetti , ArshdeepBahga, "Internet of Things (A Hands on-Approach)", 2014

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2										3	2	2
CO2	3	3	2										3	2	2
CO3	2	3	2										3	2	2
CO4	3	2	2										3	2	2
CO5	3	3	2										3	2	2
	3	High				2	Medium					1	Low		

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Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom / Online Quiz/Group discussion	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember -	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

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20PES205	EMBEDDED SYSTEM LABORATORY-II	L	T	P	C
		0	0	4	2
Nature of Course	Devices and Circuits				
Pre requisites	Fundamentals of Embedded Systems				

Course Objectives

1. To study various controllers and different ARM processor.
2. To Learn Programming for Programming Compilers & Platforms on freeware.
3. To Learn Programming with Arduino Microcontroller Board.
4. To learn Simulation Tools as Labview /others
5. To understand the concept of Programming in Python Platform.

Course Outcomes

1. The students will learn design with simulators/ex periments,in programming processor boards,processor interfacing/ designing digital controllers.
2. The students will learn design & simulation of Arithmetic ,Logic programs, Filters, Signal analysiswith simulators/ex periments ,in programming processor boards, processor int effacing/Tools.
3. The students will learn programming compiling in various tools & software domains.
4. The students will learn programming compiling in various tools & software domains
5. Learning Communication Protocols & Experimenting with Support Software Tools forcommunication interfaces.

CYCLE-1

S.No.	Course Content	CO	Bloom's Level
1	Programming ARM processor : ARM7 / ARM9/ARM Cortex Study on incircuit Emulators, crosscompilers, debuggers I/O Programming with ARM processor : ARM7 / ARM9/ARM CortexMicrocontrollers I/O Interfacing : Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing	CO1	Apply
2	Programming with Rasberry Pi Microcontroller Board:Study on incircuit Emulators, crosscompilers, debuggers	CO1	Understand
3	I/O Programming with Arduino, Rasberry Pi Microcontroller Boards I/O Interfacing : Timers/ Interrupts/ Serial port programming/PWM Generation/ Motor Control/ADC/DAC/ LCD/ RTC Interfacing/ Sensor Interfacing	CO4	Apply
4	Programming with DSP processors	CO2	Apply
5	Programming in Freeware softwares/ Platforms	CO2	Apply

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CYCLE-2

S.No.	Course Content	CO	Bloom's Level
1	Software & Modelling tools ✓ Study on MEMS Tools ✓ Study on process Controller modeling ✓ PLC/SCADA/PCB one type CAD Tool	CO5	Analysis
2	Programming & Simulation in GUI Simulators /Tools/others ✓ Graphical User interface simulations & modeling of instrumentation & controllers	CO4	Apply
3	Study of one type of Real Time Operating Systems (RTOS)	CO3	Understand
4	Programming & Simulation in Python Simulators/Tools/others	CO4	Apply
5	Programming with wired/wireless communication protocol/Network Simulators	CO4	Apply

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										2	3	2	3
CO2	3	2										2	3	2	3
CO3	3	2										2	3	2	3
CO4	3	2										2	3	2	3
CO5	3	2										2	3	2	3
	3	High				2	Medium					1	Low		

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Internal Assessment [50 marks]	End Semester Examination [50 marks]
Remember	10	10
Understand	20	20
Apply	40	40
Analyze	30	30
Evaluate	-	-
Create	-	-

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LIST OF PROFESSIONAL ELECTIVES
SEMESTER-I

20PESE01	ASIC and FPGA	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Fundamentals of multiprocessor and multicomputer systems & Architecture				

Course Objectives

1. To study the design flow of different types of ASIC.
2. To familiarize the different types of programming technologies and logic devices.
3. To learn the architecture of different types of FPGA.
4. To gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC
5. To analyse the synthesis, Simulation and testing of systems.
6. To understand the design issues of SOC.
7. To know about different high performance algorithms and its applications in ASICs.

CO.No.	Course Outcome	Bloom's Level
CO1	An ability to understand the operations of multiprocessor and multicomputer systems	Understand
CO2	Summarizing the various advanced processor technology, pipelining and scalable architectures	Understand
CO3	Explain the working of superscalar pipeline, cache memory organization	Understand
CO4	Comparing the principles of multithreading, multithread architecture, static and dynamic data flow.	Understand
CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design	Understand

UNIT I OVERVIEW OF ASIC AND PLD 9

Types of ASICs - Design flow - CAD tools used in ASIC Design - Programming Technologies: Antifuse - static RAM - EPROM and EEPROM technology, Programmable Logic Devices: ROMs and EPROMs - PLA - PAL. Gate Arrays – CPLDs and FPGAs

UNIT II ASIC PHYSICAL DESIGN 9

System partition -partitioning - partitioning methods - interconnect delay models and measurement of delay - floor planning - placement - Routing: global routing - detailed routing - special routing - circuit extraction - DRC

UNIT III LOGIC SYNTHESIS, SIMULATION AND TESTING 9

Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language -PLA tools - EDIF- CFI design representation. Verilog and logic synthesis -VHDL and logic synthesis - types of simulation - boundary scan test - fault simulation - automatic test pattern generation.

UNIT IV FPGA 9

Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology -mapping for FPGAs, Xilinx XC4000 - ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance Casestudies: Altera MAX 5000 and 7000 - Altera MAX 9000 – Spartan II and Virtex II FPGAs - Apex and Cyclone FPGAs

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UNIT V SOC DESIGN

Design Methodologies – Processes and Flows - Embedded software development for SOC -Techniques for SOC Testing – Configurable SOC – Hardware / Software co design Case studies: Digital camera, Bluetoothradio / modem, SDRAM and USB

TOTAL: 45 PERIODS

REFERENCES:

1. M.J.S .Smith, "Application Specific Integrated Circuits, Addison -Wesley Longman Inc., 2019
2. S. Trimberger, Field Programmable Gate Array Technology, Edr, Kluwer Academic Publications,2018.
3. John V.Oldfield, Richard C Dore, Field Programmable Gate Arrays, Wiley Publications 2001.
4. P.K.Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall, 199
5. Parag.K.Lala, Digital System Design using Programmable Logic Devices , BSP, 2003.
6. S. Brown, R. Francis, J. Rose, Z. Vransic, Field Programmable Gate Array, Kluwer Pubin,1992.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	2										3	2	2
CO2	3	3	2										3	2	2
CO3	2	3	2										3	2	2
CO4	3	2	2										3	2	2
CO5	3	3	2										3	2	2
	3	High				2	Medium					1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom / Online Quiz/Group discussion	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment

Bloom's Category	Continuous Assessment Tests			Terminal Examination (60
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

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20PESE02	ADVANCED COMPUTER ARCHITECTURE AND PARALLEL PROCESSING	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Fundamentals of multiprocessor and multicomputer systems & Architecture				

Course Objectives

1. To educate the students to the fundamentals of parallel processing
2. To teach the fundamentals of network topologies for multiprocessors
3. To introduce different pipeline designs
4. To introduce features of parallel processors , memory technologies, OS for multi programmedcomputer
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5Units of the subject for improved employability skills

CO.No.	Course Outcome	Bloom's Level
CO1	An ability to understand the operations of multiprocessor and multicomputer systems	Understand
CO2	Summarizing the various advanced processor technology, pipelining and scalable architectures	Understand
CO3	Comparing the working of superscalar pipeline, cache memory organization	Understand
CO4	Classifying the principles of multithreading, multithread architecture, static and dynamic data flow.	Understand
CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design	Understand

UNIT I THEORY OF PARALLELISM 9

Parallel Computer models – the state of computing-introduction to parallel processing- parallelism in uni- processors & Multiprocessors,-parallel architectural classification schemes-speedup performance laws- - Program and Network Properties-H/W-S/W Parallelism training- applications.

UNIT II SYSTEM INTERCONNECT ARCHITECTURES 9

System interconnect Architectures-Network Properties and routing-Static Interconnection Networks-Dynamic Interconnection Networks-Multiprocessor System Interconnects-inter processor communication network- Structure of Parallel Computers; Hierarchical bus systems-Crossbar switch and multiport memory-multistage and combining network.

UNIT III PIPELINING AND SUPERSCALAR TECHNOLOGIES 9

Pipeline principle and implementation-classification of pipeline processor-introduction of arithmetic, instruction,processor pipelining-pipeline mechanisms-hazards

UNIT IV HARDWARE TECHNOLOGIES 9

Introduction to features of advanced embedded processors through Basic Comparative study :of Architectures

-addressing modes -instruction types-performance of- Parallel and scalable architectures, Multiprocessor and SIMD ,MIMD computers, RISC, CISC, Superscalar, VLIW , Vector, Systolic processors of their unique features -Scalable, Multithreaded and data flow Architectures-inter PE communication-interconnection networks- Array & vector processors, vector instruction types- performance modeling-design of vector sing compiler- case Architecture of Itanium processor, Pentium Processor, SPARC Processor.

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UNIT V OS ISSUES FOR MULTI PROCESSOR

Introduction-Need for Pre emptive OS - Synchronizing and Scheduling in Multiprocessor OS-, Usual Os scheduling Techniques, threads - Classification of multi processor OS - Software requirements of multiprocessor OS, Distributed scheduler - PVM - PT Threads in shared memory systems

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: :Discussions/Practice on Workbench : modeling of Computing Algorithms /ALU Functional Blocks.

TOTAL: 45 PERIODS

REFERENCES:

1. Kai Hwang "Advanced Computer Architecture".Tata McGraw Hill 2018.
2. Advanced Computer architecture , By Rajiv Chopra, S Chand , 2010.
3. John L. Hennessy, David A. Petterson, "Computer Architecture: A Quantitative Approach", 4thEdition, Elsevier, 2010
4. Dezso Sima, Terence Fountain, Peter Kacsuk, "Advanced computer Architecture - A design SpaceApproach". Pearson Education,2003.
5. Sajjan G. Shiva "Advanced Computer Architecture", Taylor & Francis, 2008
6. Rajaraman, C.Siva Ram Murthy, "Parallel Computers- Architecture and Programming", Prentice HallIndia, 2008
7. Carl Homacher, Zvonko Vranesic, Sefwat Zaky, "Computer Organisation", 5th Edition,2002.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										3	2	3
CO2	3	3	2										3	2	3
CO3	3	3	2										3	2	3
CO4	3	3	2										3	2	3
CO5	3	3	2										3	2	3
	3	High				2	Medium					1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

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Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

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20PESE03	DIGITAL INSTRUMENTATION	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Fundamentals of Digital Electronics				

Course Objectives

1. To discuss to the students on the fundamentals building blocks of a digital instrument
2. To teach the digital data communication techniques
3. To study on bus communication standards and working principles
4. To teach Graphical programming using GUI for instrument building
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired overthe 5 Units of the subject for improved employability skills

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Use digital integrated circuit logic family chips	Apply
CO2	Perform computational and measurement activities using digital techniques, build sequential and combinational logic circuits	Analyze
CO3	Analyse working of A/D and D/A converters, use display devices for digital circuits, use digital meters for measurements	Analyze
CO4	Graduates will understand the fundamental principles of electrical and electronics circuits and instrumentation, enabling them to understand current technology and to adapt to new devices and technologies.	Understand
CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design	Understand

Course Contents:

UNIT I DATA ACQUISITION SYSTEMS

Overview of A/D converter, types and characteristics - Sampling, Errors. Objective - Building blocks of Automation systems -Calibration, Resolution, Data acquisition interface requirements.-Counters - Modes of operation- Frequency, Period, Time interval measurements, Prescaler, Heterodyne converter for frequency measurement, Single and Multi channel Data Acquisition systems-Digital storage Oscilloscope-digital display interface.

UNIT II INSTRUMENT COMMUNICATION

Introduction, Modem standards, Data transmission systems- Time Division Multiplexing (TDM) - Digital Modulation Basic requirements of Instrument Bus Communications standards, interrupt and data handshaking serial bus- basics, Message transfer, - RS-232, USB, RS-422, Ethernet Bus- CAN standards interfaces. General considerations -advantages and disadvantages-Instrumentation network design ,advantages and limitations ,general considerations, architecture, model, and system configuration of : HART network, Mod Bus, Field bus.

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UNIT III VIRTUAL INSTRUMENTATION BASICS 9

Block diagram ,role, and Architecture for VI– tool bar, Graphical system design &programming using GUI – Virtual Instrumentation for test, control design-modular programming-conceptual and prog approaches for creation of panels, icons-Loops-Arrays-clusters-plotting data-structures-strings and File I/O- Instrument Drivers

UNIT IV CONFIGURING PROGRAMMABLE INSTRUMENTATION 9

Microprocessor based system design -Peripheral Interfaces systems and instrument communication standards -Data acquisition with processor and with VI - Virtual Instrumentation Software and hardware simulation of I/O communication blocks-peripheral interface - ADC/DAC - Digital I/O - Counter , Timer-servomotor control-PID control.

UNIT V CASE STUDIES 9

Processor based DAS, Data loggers, VI based process measurements like temperature, pressure and leveldevelopment system- DSO interface -digital controller for colour video display

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions/Exercise/Practice on Workbench for Digital Control of Relays/Solenoids, Digitall/O - Counter , Timer-servo motor control-PID control./ LCD graphics Interface/storage interface

TOTAL: 45 PERIODS

REFERENCES:

1. Mathivanan, "PC based Instrumentation Concepts and practice", Prentice-Hall India, 2009
2. Jovitha Jerome,"Virtual Instrumentation using Labview"PHI,2010.
3. Gregory J. Pottie / William J. Kaiser, Principles Of Embedded Networked Systems Design,CAMBRIDGE UNIVERSITY PRESS (CUP),2016
4. Jonathan W Valvano, "Embedded Microcomputer systems", Brooks/Cole, Thomson, 2010.
5. Cory L.Clark,"Labview Digital Signal Processing & Digital Communication,TMcH,2005
6. Lisa K. wells & Jeffrey Travis, Lab VIEW for everyone, Prentice Hall, New Jersey,1997.
7. H S Kalsi, "Electronic Instrumentation" Second Edition, Tata McGraw-Hill,2006.
8. K.Padmanabhan, S.Ananthi A Treatise on Instrumentation Engineering ,I K Publish,2011
9. Gary Johnson, LabVIEW Graphical Programming, Second edition, McG Hill,Newyork, 1997.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										3	2	3
CO2	3	3	2										3	2	3
CO3	3	3	2										3	2	3
CO4	3	3	2										3	2	3
CO5	3	3	2										3	2	3
	3	High				2	Medium					1	Low		

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Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

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LIST OF PROFESSIONAL ELECTIVES

SEMESTER-I

20PESE11	DEVICE DRIVER EMBEDDED LINUX	L	P	T	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	fundamentals of Linux Operating system				

Course Objectives

1. To expose the students to the fundamentals of Linux Operating system, its basic commandsand shell programming
2. To teach the history of embedded Linux, various distributions and basics of GNU CrossPlatform Tool Chain.
3. To study on different Host-Target setup, debug and various memory device, file systems andperformance tuning .
4. To introduce the concept of configuring kernel using the cross-platform tool chain.
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired overthe 5 Units of the subject for improved employability skills

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Executing Linux desktop and GNU tool chain with Eclipse IDE	Apply
CO2	Finding cross compile Linux kernel and port it to target board	Analyze
CO3	Add applications and write customized application for the Linux kernel in the target board	Apply
CO4	Students will study about distributions and cross platform tool chain.	Understand
CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design	Understand

Course Contents:

UNIT I FUNDAMENTALS OF LINUX 9

Basic Linux System Concepts: Working with Files and Directories - Introduction to Linux File system - Workingwith Partitions and File systems - Understanding Linux Permissions; Using Command Line Tools: Executing Commands from the Command Line - Getting to a Shell - Popular Command-Line Commands - Working with the Bash Shell

UNIT II VARIOUS DISTRIBUTIONS AND CROSS PLATFORM TOOL CHAIN 9

Introduction - History of Embedded Linux - Embedded Linux versus Desktop Linux - Commercial Embedded Linux Distribution - Choosing a distribution - Embedded Linux Distributions - Architecture of Embedded Linux -Linux Kernel Architecture - Porting Roadmap - GNU Cross Platform Toolchain

UNIT III HOST-TARGET SETUP AND OVERALL ARCHITECTURE 9

Real Life Embedded Linux Systems - Design and Implementation Methodology - Types of Host/Target Development Setups - Types of Host/Target Debug Setups - Generic Architecture of an Embedded Linux System - System Startup - Types of Boot Configurations - System Memory Layout - Processor Architectures - Buses and Interfaces - I/O – Storage

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UNIT IV KERNEL CONFIGURATION

A Practical Project Workspace - GNU Cross-Platform Development Toolchain - C Library Alternatives- Other Programming Languages - Eclipse: An Integrated Development Environment - Terminal Emulators - Selecting a Kernel - Configuring the Kernel - Compiling the Kernel - Installing the Kernel - Basic Root Filesystem Structure - Libraries - Kernel Modules and Kernel Images - Device Files - Main System Applications - System Initialization

9

UNIT V LINUX DRIVERS

Introduction in to basics on Linux drivers, introduction to GNU cross platform Toolchain- Case study on programming one serial driver for developing application using Linux Driver

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process: Discussions/Practice on Workbench : on design of Algorithms for Practicing Shell Programming in Linux / Developing programs in GCC and Eclipse / Learning Debugging and Profiling/Linux Driver interface

TOTAL: 45 PERIODS

REFERENCES:

1. Karim Yaghmour, Jon Masters, Gilad Ben-Yossef, and Philippe Gerum, 'Building Embedded LinuxSystems 2nd Edition', SPD -O'Reilly Publications, 2008
2. P.Raghavan,Amol Lad,Sriram Neelakandan,"EmbeddedLinux System Design &Development,Auerbach Publications, 2012
3. William von Hagen, 'Ubuntu Linux Bible 3rd Edition', Wiley Publishing Inc., 2010
4. Jonathan Corbet, Alessandro Rubini & Greg Kroah-Hartman, 'Linux Device Drivers 3rd Edition',SPD -O'Reilly Publications, 2011
5. Robert Love,"Linux System Programming, SPD -O'Reilly Publications, 2010

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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CO2	3	3	2										3	2	3
CO3	3	3	2										3	2	3
CO4	3	3	2										3	2	3
CO5	3	3	2										3	2	3
	3	High				2	Medium					1	Low		

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Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Passed in Board of Studies Meeting (09.10.21)

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20PESE12	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	fundamentals of digital signal processing				

Course Objectives

1. To expose the students to the fundamentals of digital signal processing in frequency domain& itsapplication
2. To teach the fundamentals of digital signal processing in time-frequency domain& its application
3. To compare Architectures & features of Programmable DS processors & develop logicalfunctions of DS Processors
4. To discuss on Application development with commercial family of DS Processors
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the5 Units of the subject for improved employability skills

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Leve
CO1	Students will learn the essential advanced topics in DSP that are necessary for successful Postgraduate level research	Understand
CO2	Students will have the ability to solve various types of practical problems in DSP	Apply
CO3	Comprehend the DFTs and FFTs, design and Analyze the digital filters, comprehend the Finite word length effects in Fixed point DSP Systems	Analyze
CO4	The conceptual aspects of Signal processing Transforms are introduced	Understand
CO5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design	Understand

Course Contents:

UNIT I FUNDAMENTALS OF DSP

Frequency interpretation, sampling theorem, aliasing, discrete-time systems, constant-coefficient difference equation. Digital filters: FIR filter design – rectangular, Hamming,Hanning windowing technique. IIR filter design – Butterworth filter, bilinear transformation method, frequency transformation. Fundamentals of multirate processing – decimation and interpolation

UNIT II TRANSFORMS AND PROPERTIES

Discrete Fourier transform (DFT): - properties, Fast Fourier transform (FFT), DIT-FFT, and DIF-FFT. Wavelet transforms:Introduction, wavelet coefficients – orthonormal wavelets and their relationship to filter banks, multi-resolution analysis, and Haar and Daubechies wavelet

UNIT III ADAPTIVE FILTERS

Wiener filters - an introduction. Adaptive filters: Fundamentals of adaptive filters, FIR adaptive filter - steepest descent algorithm, LMS algorithm, NLMS, applications - channel equalization. Adaptive recursive filters - exponentially weighted RLS algorithm

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UNIT IV **ARCHITECTURE OF COMMERCIAL DIGITAL SIGNAL PROCESSORS** 9

Introduction to commercial digital signal processors, Categorization of DSP processor – Fixed point and floating point, Architecture and instruction set of the TI TMS 320 C54xx and TMS 320 C6xxx DSP processors, On-chip and On-board peripherals - memory (Cache, Flash, SDRAM), codec, multichannel buffered I/O serial ports (McBSPs), interrupts, direct memory access (DMA), timers and general purpose I/Os.

UNIT V **INTERFACING I/O PERIPHERALS FOR DSP BASED APPLICATIONS** 9

Introduction, External Bus Interfacing Signals, Memory Interface, I/O Interface, Programmed I/O, Interrupts, Design of Filter, FFT Algorithm, ,Application for Serial Interfacing, DSP based Power Meter, Position control , CODEC Interface .

Note: Discussions / Exercise / practice on signal analysis, transforms, filter design concepts with simulation tools such as Mat lab / Lab view / CC studio will help the student understand signal processing concepts and DSP processors. Overview of TMS320C54xx and TMS320C67xx /other DSP Starter Kits, Introduction to code composer studio (CCS), Board support library, Chip support library and Runtime support library, Generating basic signals, Digital filter design, Spectrum analysis, Adaptive filters, Speech and Audio processing applications.

TOTAL: 45 PERIODS

REFERENCES:

1. John. G. Proakis, Dimitris G. Manolakis, "Digital signal processing", Pearson Edu, 2012
2. Sen M.Kuo,Woon-Seng S.Gan, "Digital Signal Processors- Pearson Edu, 2012
3. Ifeachor E. C., Jervis B. W ,"Digital Signal Processing: A practical approach, Pearson-Education,PHI/ 2002
4. Shaila D. Apte, " Digital Signal Processing", Second Edition, Wiley, 2016.
5. Robert J.Schilling,Sandra L.Harris,"Introd. To Digital Signal Processing withMatlab",Cengage,2014.
6. Steven A. Tretter, "Communication System Design Using DSP Algorithms with Laboratory Experiments for the TMS320C6713™ DSK", Springer, 2008.
7. RulphChassaing and Donald Reay, "Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK", John Wiley & Sons, Inc., Hoboken, New Jersey, 2008.
8. K.P. Soman and K.L. Ramchandran,Insight into WAVELETS from theory to practice, Eastern Economy Edition, 2008
9. B Venkataramani and M Bhaskar "Digital Signal Processors", TMH, 2nd, 2010
10. Vinay K.Ingle,John G.Proakis,"DSP-A Matlab Based Approach",Cengage Learning,2010
11. Taan S.Elali,"Discrete Systems and Digital Signal Processing with Matlab",CRC Press2009.
12. Monson H. Hayes, "Statistical Digital signal processing and modelling", John Wiley & Sons, 2008.
13. AvatarSing, S. Srinivasan, "Digital Signal Processing- Implementation using DSPMicroprocessors with Examples from TMS320C54xx", Thomson India,2004.

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Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)																
COs	POs												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	3	2										3	2	3	
CO2	3	3	2										3	2	3	
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CO4	3	3	2										3	2	3	
CO5	3	3	2										3	2	3	
	3	High				2	Medium					1	Low			

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

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LIST OF PROFESSIONAL ELECTIVES

SEMESTER-II

20PESE21	EMBEDDED PRODUCT DEVELOPMENT	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Basis of Embedded System				

Course Objectives

1. The course aims at providing the basic concepts of product design,
2. product features and its architecture
3. student can have a basic knowledge in the common features a product
4. how to incorporate them suitably in product.
5. To learn about Embedded Products design.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	understand the integration of customer requirements in product design	Understand
CO2	Apply structural approach to concept generation, creativity, selection and testing	Apply
CO3	Understand various aspects of design such as industrial design, design of Consumer specific product , its Reverse Engineering manufacture	Understand
CO4	Interpreting various aspects of design such as industrial design, design of,economic analysis and product architecture	Understand
CO5	Implementing Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills	Apply

Course Contents:

UNIT I CONCEPTS OF PRODUCT DEVELOPMENT 12

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 12

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- Product Branding

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UNIT III INDUSTRIAL DESIGN STRATEGIES 6

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 6

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 / DeskJet 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 & Debugging Tools & Application Software, Performance Testing, Costing, Benchmarking ,Documentation

Note: Class room discussions and tutorials can include the following guidelines for improved teaching / learning process: Term Project/Presentation on specific product design can be given for Assessment

TOTAL: 45 PERIODS

REFERENCES

1. Product Design and Development", Anita Goyal, Karl T Ulrich, Steven D Eppinger, McGraw - HillInternational Edns.2019/ Tata McGrawEducation, 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,4th Edition,2019, ISBN 978-007-127189-9
4. Stephen Armstrong, Engineering and Product Development Management ; The Holistic Approach,CAMBRIDGE UNIVERSITY PRESS (CUP),2014
5. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2015.
6. KEVIN OTTO & KRISTIN WOOD, "Product Design and Development", 4th Edition,2013, Product DesignTechniques in Reverse Engineering and New Product Development, , Pearson Education (LPE),2001./ISBN 9788177588217

Passed in Board of Studies Meeting (09.10.21)

Approved in Academic Council Meeting (11.10.21)

CHAIRMAN - BOARD OF STUDIES

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										3	2	3
CO2	3	3	2										3	2	3
CO3	3	3	2										3	2	3
CO4	3	3	2										3	2	3
CO5	3	3	2										3	2	3
	3	High				2	Medium					1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment

Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Passed in Board of Studies Meeting (09.10.21)

Approved in Academic Council Meeting (11.10.21)

CHAIRMAN - BOARD OF STUDIES

20PPE34	ELECTRIC VEHICLES AND POWER MANAGEMENT	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Power Management System				

Course Objectives

1. To understand the concept of electrical vehicles
2. To understand the concept of the operations
3. To understand the need for energy storage in hybrid vehicles
4. To provide knowledge about various possible energy storage technologies
5. Learners will understand the operation of Electric vehicles and various energy storage Technologies for electrical vehicles.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Learners will understand the operation of Electric vehicles.	Understand
CO2	Learners will understand the operation various energy storage technologies for electrical vehicles	Apply
CO3	Learners will understand the used in electrical vehicles	Understand
CO4	Design the electrical vehicles	Analyze
CO5	Discuss the design issues EV.	Understand

Course Contents:

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 EV's AND POWER TRAIN COMPONENTS 9

Architecture of EV's and HEV's - Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes.

UNIT III CONTROL OF DC AND AC DRIVES 9

DC/DC chopper based four quadrant operations of DC drives - Inverter based V/f Operation (Motoring and braking) of induction motor drive system - Induction motor and permanent motor based vector control operation - Switched reluctance motor (SRM) drives.

UNIT IV BATTERY ENERGY STORAGE SYSTEM 9

Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries.

UNIT V ALTERNATIVE ENERGY STORAGE SYSTEMS 9

Fuel cell - Characteristics- Types - hydrogen Storage Systems and Fuel cell EV - Ultra capacitors.

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Approved in Academic Council Meeting (11.10.21)

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Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching /Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded solutions using reconfigurable processor support

TOTAL: 45 PERIODS

REFERENCES

1. Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals, Second Edition" CRC Press, Taylor & Francis Group, Second Edition (2011).
2. Ali Emadi, Mehrdad Ehsani, John M.Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel dekker, Inc 2010..

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										3	2	3
CO2	3	3	2										3	2	3
CO3	3	3	2										3	2	3
CO4	3	3	2										3	2	3
CO5	3	3	2										3	2	3
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Passed in Board of Studies Meeting (09.10.21)

Approved in Academic Council Meeting (11.10.21)

CHAIRMAN - BOARD OF STUDIES

20PESE22	RECONFIGURABLE PROCESSOR AND SOC DESIGN	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Basic of Reconfigurable Processor technologies				

COURSE OBJECTIVES

1. To introduce the Reconfigurable Processor technologies
2. To familiarize the need and role of Reconfigurable Processor
3. embedded system applications.
4. To impart the knowledge of Reconfigurable embedded Processor
5. real time applications.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Adaptability, in its complete strength, is present in reconfigurable processors which makes it an important IP in modern System-on-Chips (SoCs)	Analyze
CO2	Reconfigurable processors have risen to prominence as a dominant computing platform	Analyze
CO3	Understand various aspects across embedded, general-purpose, and high-performance application domains during the last decade	Understand
CO4	Improved Employability and entrepreneurship capacity due to knowledge up gradation	Understand
CO5	The concepts recent trends in embedded systems design	Analyze

Course Contents:

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 PROGRAMMABLE LOGIC DEVICES CPLD 9

Introduction to Programmable logic devices, SPLDs, CPLD building blocks- Architectures and features of Altera:MAX 7000, MAX V- Xilinx XC 9500, Cool Runner-II.

UNIT III PROGRAMMABLE LOGIC DEVICES FPGA 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 Xilinx Virtex II pro, Zynq-7000, Altera Excalibur, Cyclone V -Triscend A7, E5- Atmel 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.

Passed in Board of Studies Meeting (09.10.21)

Approved in Academic Council Meeting (11.10.21)

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Note: Class Room Discussions and Tutorials can include the following Guidelines for improved Teaching /Learning Process: Practice through any of Case studies through Exercise/Discussions on Design , Development of embedded solutions using reconfigurable processor support

TOTAL: 45 PERIODS

REFERENCES

1. Nurmi, Jari (Ed.) "Processor Design System-On-Chip Computing for ASICs and FPGAs" Springer, 2017.
2. Ian Grout , "Digital system design with FPGAs and CPLDs" Elsevier, 2016.
3. Joao Cardoso, Michael Hübner, "Reconfigurable Computing: From FPGAsto Hardware/Software Codesign" Springer, 2011.
4. Ron Sass and Anderew G.Schmidt, " Embedded System design with platform FPGAs: Principles and Practices", Elsevier, 2010.
5. Steve Kilts, "Advanced FPGA Design: Architecture, Implementation, and Optimization" Willey, 2007

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										3	2	3
CO2	3	3	2										3	2	3
CO3	3	3	2										3	2	3
CO4	3	3	2										3	2	3
CO5	3	3	2										3	2	3
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Passed in Board of Studies Meeting (09.10.21)

Approved in Academic Council Meeting (11.10.21)

CHAIRMAN - BOARD OF STUDIES

20PESE32	EMBEDDED NETWORKING AND AUTOMATION OF ELECTRICAL SYSTEM	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Digital Based applications				

COURSE OBJECTIVES:

The objectives of this course to impart knowledge in

1. the fundamentals of image processing
2. the techniques involved in image enhancement
3. the low and high-level features for image analysis
4. the fundamentals and significance of image compression
5. the hardware for image processing applications

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	The learning process delivers insight into categorizing various i/p-o/p configurations of computational processors with improved communication strategies	Understand
CO2	Students will study about different embedded open source and cost effective techniques for developing solution for real time applications.	Apply
CO3	Students will acquire knowledge on different platforms and Infrastructure for Smart system design.	Understand
CO4	Improved Employability and enterprenership capacity due to knowledge upgradation on recent trends in embedded systems design .	Understand
CO5	Students will learn the art of implementing embedded system for smart applications and control.	Apply

Course Contents:

UNIT I EMBEDDED PROCESS COMMUNICATION WITH INSTRUMENT BUS 9

Embedded Networking: Introduction - Cluster of Instruments in System: introduction to bus protocols, connectors, Bus Architecture & Interfacing of external instruments to - RS 232C,RS-422, RS 485 and USB standards - embedded Ethernet - MOD bus and CAN bus.

UNIT II WIRELESS EMBEDDED NETWORKING 9

Wireless sensor networks - Introduction - Sensor node architecture - Commercially available sensor nodes -Network Topology -Localization -Time Synchronization - Energy efficient MAC protocols - SMAC -Energy efficient and robust routing - Data Centric routing Applications of sensor networks; Applications - Home Control - Building Automation - Industrial Automation

UNIT III BUILDING SYSTEM AUTOMATION 9

Concept of Uc Based & PC based data acquisition – Concept of Virtual Instrumentation - Programming Environment to build a Virtual Instrumentation, Building system automation with graphical user interface programming-Programmable Logic Controllers-introduction-Ladder& Functional Block programming-Case study on Temperature control, Valve sequencing control

UNIT IV MEASUREMENT AND EMBEDDED CONTROL OF ELECTRICAL APPARATUS 9

Sensor Types & Characteristics : Sensing Voltage, Current, flux, Torque, Position, Proximity, Force, Data acquisition & Display system- Signal conditioning circuit design- computers/ embedded processor interfacing circuit -design automation and protection of electrical appliances -processor based digital controllers for switching Actuators: Servo motors, Stepper motors, Relays

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 for substation automation, extended control feeder automation, Performance measure and response time, SCADA Data Models, need, sources, interface.

NOTE:Discussions/Exercise/Practice on Workbench /simulators: on the basics interface of sensors, actuators to microcontrollers, role of virtual Instrumentation software packages/ simulators/ special microcontrollers for I/o port communication with electrical loads.

TOTAL: 45 PERIODS

REFERENCES:

1. Control and automation of electrical power distribution systems, James Northcote-Green, Robert Wilson, CRC, Taylor and Francis, 2006
2. Krzysztof Iniewski,"Smart Grid ,Infrastructure & Networking",TMcGH,2012
3. Robert Faludi,"Building Wireless Sensor Networks,O'Reilly,2011
4. W.Bolton,Programmable Logic Controllers,5th Ed,Elsevier,2010.
5. Shih-Lin Wu,Yu-Chee Tseng,{"Wireless Ad Hoc Networking,PAN,LAN,SAN,Aurebach Pub,2012
6. Jan Axelson 'Embedded Ethernet and Internet Complete', Penram publications
7. Bhaskar Krishnamachari, 'Networking wireless sensors', Cambridge press 2005
8. Robert H. Bishop, "Learning with Lab-View" Prenice Hall, 2009
9. Sanjay Gupta, "Virtual Instrumentation, LABVIEW", TMH, New Delhi, 2003
10. Ernest O. Doeblin and Dhanesh N Manik, " Measrement Systems - Application and Design", 5th Edn, TMH, 2007.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										3	2	3
CO2	3	3	2										3	2	3
CO3	3	3	2										3	2	3
CO4	3	3	2										3	2	3
CO5	3	3	2										3	2	3
	3	High				2	Medium					1	Low		

Passed in Board of Studies Meeting (09.10.21)

Approved in Academic Council Meeting (11.10.21)

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Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (50)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Passed in Board of Studies Meeting (09.10.21)

Approved in Academic Council Meeting (11.10

CHAIRMAN - BOARD OF STUDIES

20PESE33	SMART SYSTEM DESIGN	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Digital Electronics Based applications				

COURSE OBJECTIVES:

The objectives of this course to impart knowledge in

1. To under stand about the smart system technologies and its role in real time applications
2. To expose students to different open source platforms and Attributes.
3. To familiarize the design and development of embedded system based system design.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	The learning process delivers insight into categorizing various i/p-o/p configurations of computational processors with improved communication strategies	Understand
CO2	Students will study about different embedded open source and cost effective techniques for developing solution for real time applications.	Apply
CO3	Students will acquire knowledge on different platforms and Infrastructure for Smart system design.	Analyze
CO4	Improved Employability and enterprenership capacity due to knowledge upgradation on recent trends in embedded systems design .	Understand
CO5	Students will learn the art of implementing embedded system for smart applications and control.	Apply

UNIT I INTRODUCTION 9

Overview of smart system design and requirements- Hardware and software selection & co-design-Communications-smart sensors and actuators-Open-source resources for embedded system-android for embedded system - Embedded system for Ecommerce- Embedded system for Smart card design and development -Recent trends.

UNIT II MOBILE EMBEDDED SYSTEM 9

Design requirements-Hardware platform- OS and Software development platform- Mobile Apps development- Applications: heart beat monitoring, blood pressure monitoring, mobile banking and appliances control.

UNIT III HOME AUTOMATION: 9

Home Automation System Architecture-Essential Components- Linux and Raspberry Pi – design and real time implementation.

UNIT IV SMART APPLIANCES AND ENERGY MANAGEMENT 9

Overview- functional requirements-Embedded and Integrated Platforms for Energy Management-Energy Measurement Techniques for Smart Metering-Smart Embedded Appliances Networks – Security Considerations.

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Approved in Academic Council Meeting (11.10.21)

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UNIT V EMBEDDED SYSTEMS AND ROBOTICS 9

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

TOTAL : 45 PERIODS

Note: Class room discussions and tutorials can include the following guidelines for improved teaching /learning process :Discussions on integration of H/W & S/W technology in automation of system/process.

REFERENCES:

1. Thomas Bräunl, Embedded Robotics ,Springer, 2018.
2. Grimm, Christoph, Neumann, Peter, Mahlknech and Stefan, Embedded Systems for Smart Appliances and Energy Management , Springer 2013.
3. Raj Kamal, *Embedded Systems* - Architecture,. Programming and Design" , McGraw-Hill, 2010
4. Nilanjan Dey, Amartya Mukherjee, Embedded Systems and Robotics with Open Source Tools, CRC press, 2016.
5. Karim Yaghmour, Embedded Android , O'Reilly, 2013.
6. Steven Goodwin ,Smart Home Automation with Linux and Raspberry Pi, Apress, 2013
7. C.K.Toh, " AdHoc mobile wireless networks", Prentice Hall, Inc, 2002.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										3	2	3
CO2	3	3	2										3	2	3
CO3	3	3	2										3	2	3
CO4	3	3	2										3	2	3
CO5	3	3	2										3	2	3
	3	High		2	Medium							1	Low		

Formative assessment

Bloom's Level	Assessment Component	Marks	Total marks
Remember	Classroom or Online Quiz	5	15
Understand	Class Presentation/Power point presentation	5	
	Attendance	5	

Passed in Board of Studies Meeting (09.10.21)

Approved in Academic Council Meeting (11.10.21)

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Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	1 (7.5)	2 (7.5)	3 (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Passed in Board of Studies Meeting (09.10.21)

Approved in Academic Council Meeting (11.10.21)

CHAIRMAN - BOARD OF STUDIES

20PTE301	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Fundamental knowledge in data collection and correlations				

Course Objectives

The course is intended to

1. Understand the importance of Research.
2. Developing a hypothesis, a research problem and related question.
3. Acquire knowledge in Data Collection and Analysis of Data.
4. Effectively write reports.
5. Impart scientific, statistical and analytical knowledge for carrying out research work effectively.

Course Outcomes

On successful completion of the course the students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Formulate researchable questions	Understand
CO 2	Define a research strategy and design a research project	Understand
CO 3	Practice the principles of qualitative and quantitative social research	Understand
CO 4	Present complex data or situations clearly	Understand
CO 5	Learn about the different research techniques and research report.	Understand

Course Contents

UNIT I
INTRODUCTION TO RESEARCH 9

Nature, scope, and design of social research; Review of literature: qualitative (literary), quantitative (meta-analysis).

UNIT II HYPOTHESIS 9

Hypothesis: sources, types and characteristics; Sample survey: sample and census survey, probability, non- probability and mixed sampling

UNIT III DATA COLLECTION 9

Methods of data collection: historical method, case study, observation, ethnographic methods, interview, questionnaire, focus group discussion, participatory rural appraisal, experimental method, pre-testing, and pilot survey; Scaling techniques different scales, item analysis, reliability, validity; Method of secondary data collection: sources, sample criteria, characteristics.

UNIT IV DATA ANALYSIS

Data analysis: descriptive statistics, mean difference test, analysis of variance and experiment design; Bivariate and multivariate correlation and regression; Factor analysis, Cluster analysis Discriminant analysis, Structural equation modelling, non-parametric statistics, Content analysis

UNIT V REPORT WRITING

Report writing: review, qualitative, and empirical article writing.

Total : 45 Perio

Reference Books:

1. C.M.Chaudhary, Research Methodology, RBSA Publishers, Jaipur, India 2009
2. R.Paneerselvam, Research Methodology, PHI Learning PvtLtd.,New Delhi 2009.
3. C.R.Kothari, Research Methodology, WishvaPrakashan, New Delhi,2001.
4. Donald H.McBurney, Research Methods, Thomson Asia Pvt. Ltd. Singapore,2002.
5. Donald R. Cooper and Ramela S. Schindler, Business Research Methods, Tata McGraw- Hill Publishing Company Limited, New Delhi,2000
6. G.W.Ticehurst and A.J.Veal, Business Research Methods, Longman,1999.
7. Ranjit Kumar, Research Methodology, Sage Publications, London, New Delhi,1999.
8. Raymond-Alain Thie'tart, et.al., Doing Management Research, Sage Publications, London, 1999.
9. Uma Sekaran, Research Methods for Business, John Wiley and Sons Inc., New York,2000

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										3	1	2
CO2	3	3	2										3	1	2
CO3	3	3	2										3	1	2
CO4	3	3	2										3	1	2
CO5	3	3	2										3	1	2
	3	High				2	Medium					1	Low		

Passed in Board of Studies Meeting (24.02.2022)

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Approved in Academic Council Meeting (09.03.2022)

Assessment	Marks	Weightage	Marks	CIA Marks	FE	Total Marks
CIA - I	50	7.5	25	40	60	100
CIA - II	50	7.5				
CIA - III	50	10				
Quiz/Presentation/Tutorial	10	5	15			
video presentation/Assignment	10	5				
Attendance	10	5				

Passed in Board of Studies Meeting (24.02.2022)

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting (09.03.2022)

20PES302	WIRELESS AND MOBILE COMMUNICATION	L	T	P	C
		3	0	0	3

Nature of Course	Professional Course
Pre requisites	Nil

Course Objectives

The course is intended to

1. Describe fundamentals of wireless communication technologies
2. Understand the Principle of wireless mobile network protocols.
3. Select the features and Architecture of wireless network topologies.
4. Examine the network routing protocols.
5. Analyse the basis for classification of commercial family of wireless communication technologies

Course Outcomes

On successful completion of the course the students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Explain the basics of mobile Telecommunication system	Understand
CO 2	Illustrate the generation of telecommunication systems in wireless network	Understand
CO 3	Express the architecture of Wireless LAN technologies	Understand
CO 4	Determine the functionality of network layer and identify a routing protocol for a given Ad hoc networks.	Apply
CO 5	Compare the functionality of Transport and Application layer	Apply

Course Contents

UNIT I INTRODUCTION 9

Wireless Transmission – signal propagation – Free space and two ray models – spread spectrum- Satellite Networks - Capacity Allocation - FDMA -TDMA- SDMA - CDMA

UNIT II MOBILE NETWORKS 9

Cellular Wireless Networks - GSM - Architecture - Protocols - Connection Establishment - Frequency Allocation - Handover - Security - GPRA.

UNIT III WIRELESS NETWORKS 9

Wireless LANs & PANs – IEEE 802.11 Standard-Architecture – Services – Hiper LAN. Bluetooth – Wi-Fi – WiMAX

UNIT IV MOBILE ROUTING 9

Mobile IP- SIP - DHCP - AdHoc Networks - Proactive and Reactive Routing Protocols - Multicast Routing - WSN routing - LEACH- SPIN- PEGASIS

UNIT V MOBILE TRANSPORT AND APPLICATION LAYERS 9

TCP over Adhoc Networks - WAP - Architecture - WWW Programming Model - WDP - WTLS - WTP - WSP - WAE - WTA Architecture - WML - WML scripts.

Total : 45 Periods

Text Books

1. C. Siva Ram Murthy and B.S. Manoj, AdHoc Wireless Networks: Architectures and protocols, Prentice Hall PTR, 2004
2. Kaveh Pahlavan, Prasanth Krishnamoorthy, " Principles of Wireless Networks' PHI/Pearson Education, 2003
3. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, " Principles of Mobile computing", Springer, New york, 2003.

Reference Books

1. C.K.Toh, " AdHoc mobile wireless networks", Prentice Hall, Inc, 2002.
2. Charles E. Perkins, " Adhoc Networking", Addison-Wesley, 2001.
3. Jochen Schiller, " Mobile communications", PHI/Pearson Education, Second Edition, 2003
4. William Stallings, "Wireless communications and Networks", PHI/Pearson Education, 2002.

Additional References

1. eBook:- www.philadelphia.edu.jo/newlibrary/.../file101fc6e5c77f4675b2958dcl0a8c99c9.pdf
2. NPTEL Video lectures :- https://www.youtube.com/watch?v=Eu mTZxPofl
3. TRAI official website: www.trai.gov.in/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3			2							2		
CO 2	3	3			2							2		
CO 3	3	3			2							2		
CO 4	3	3			2							2		
CO 5	3	3			2							2		
	3-High				2-Medium				1-Low					

Passed in Board of Studies Meeting (24.02.2022)

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Approved in Academic Council Meeting (09.03.2022)

Blooms Taxonomy	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial class / Assignment	5	
Apply		5	
	Attendance		

Summative Assessment

Bloom's Category	Internal Assessment Examinations (IAE)			Final Examinations (FE)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	60
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyse				
Evaluate				
Create				

Passed in Board of Studies Meeting (24.02.2022)

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Approved in Academic Council Meeting (09.03.2022)

20PPEE43	SMART GRID	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Power System				

Course Objectives

The course is intended to

1. Identify about smart grid technologies.
2. Different smart meters and advanced metering infrastructure.
3. Familiarize the power quality management issues in Smart Grid.
4. Analyse the metering and factors influencing cost function.
5. Illustrate the concept of lighting systems and cogeneration.

Course Outcomes

On successful completion of the course the students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Explain the basics of smart grid and its issues.	Understand
CO 2	Complete about different Smart Grid technologies.	Apply
CO 3	Establish about different smart meters and advanced metering infrastructure.	Apply
CO 4	Illustrate on power quality management in smart grids	Analyse
CO 5	Teach about the on LAN, WAN and cloud computing for smart grid applications.	Analyse

Course Contents

UNIT I INTRODUCTIONTO SMART GRID 9

Need for energy management - energy basics- designing and starting an energy management program - energy accounting -energy monitoring, targeting and reporting- energy audit process.

UNIT II ENERGY COST AND LOAD MANAGEMENT 9

Important concepts in an economic analysis - Economic models-Time value of money-Utility rate structures- cost of electricity-Loss evaluation- Load management: Demand control techniques-Utility monitoring and control system-HVAC and energy management-Economic justification.

UNIT III ENERGY MANAGEMENT FOR MOTORS, SYSTEMS, AND ELECTRICAL EQUIPMENT 9

Systems and equipment- Electric motors-Transformers and reactors-Capacitors and synchronous machines.

UNIT IV METERING FOR ENERGY MANAGEMENT 9

Relationships between parameters-Units of measure-Typical cost factors- Utility meters - Timing of meter disc for kilowatt measurement - Demand meters - Paralleling of current transformers - Instrument transformer burdens-Multitasking solid-state meters - Metering location vs. requirements- Metering techniques and practical examples.

UNIT V LIGHTING SYSTEMS & COGENERATION 9

Concept of lighting systems - The task and the working space -Light sources - Ballasts - Luminaries - Lighting controls-Optimizing lighting energy - Power factor and effect of harmonics on power quality - Cost analysis techniques-Lighting and energy standards Cogeneration: Forms of cogeneration - feasibility of cogeneration- Electrical interconnection.

Total : 45 Periods

Text Books

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, "Guide to Energy Management", 7th Edition, The Fairmont Press, Inc.,2016
2. Amit K. Tyagi, "Handbook on Energy Audits and Management", TERI,2013.

Reference Books

1. Reay D.A, "Industrial Energy Conservation", 4st edition, Pergamon Press,2009.
2. Eastop T.D & Croft D.R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical, 2003.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2		1				1						
CO 2	3	3		2				1						
CO 3	3	3		2				1						
CO 4	3	2		2				2						
CO 5	3	3		1				2						
	3-High				2-Medium				1-Low					

Passed in Board of Studies Meeting (24.02.2022)

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Approved in Academic Council Meeting (09.03.2022)

Formative Assessment			
Blooms Taxonomy	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial class / Assignment	5	
Apply			
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations (IAE)			Final Examinations (FE)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	60
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyse				
Evaluate				
Create				

Passed in Board of Studies Meeting (24.02.2022)

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Approved in Academic Council Meeting (09.03.2022)

20PESE42	SOFT COMPUTING AND OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	Embedded & Real Time Systems				

Course Objectives

The course is intended to

1. Apply the Soft computing frameworks and design of various neural networks.
2. Deduce the concept of fuzzy logic.
3. Devise the gain insight onto Neuro Fuzzy modelling and control.
4. Develop the knowledge in conventional optimization techniques.
5. Evaluate the various evolutionary optimization techniques.

Course Outcomes

On successful completion of the course the students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Establish machine learning through Neural networks.	Apply
CO 2	Categorize different Fuzzy expert systems.	Analyse
CO 3	Classify the Model Neuro Fuzzy system for clustering.	Apply
CO 4	Employ the optimization techniques to solve the real world problems.	Apply
CO 5	Solve the problems that arise in engineering using optimization techniques	Analyse

Course Contents

UNIT I NEURAL NETWORKS 8

Machine Learning using Neural Network, Learning algorithms, Supervised Learning Neural Networks – Feed Forward Networks, Radial Basis Function, Unsupervised Learning Neural Networks - Self Organizing map , Adaptive Resonance Architectures, Hopfield network.

UNIT II FUZZY LOGIC 9

Fuzzy Sets - Operations on Fuzzy Sets - Fuzzy Relations - Membership Functions-Fuzzy Rules and Fuzzy Reasoning - Fuzzy Inference Systems - Fuzzy Expert System s - Fuzzy Decision Making.

UNIT III NEURO-FUZZY MODELING 10

Adaptive Neuro-Fuzzy Inference Systems - Coactive Neuro-Fuzzy Modeling Classification and Regression Trees - Data Clustering Algorithms - Rule base Structure Identification - Neuro Fuzzy Control – Case Studies.

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UNIT IV CONVENTIONAL OPTIMIZATION TECHNIQUES 9

Introduction to optimization techniques, Statement of an optimization problem, classification, Unconstrained optimization – gradient search method – Gradient of a function, steepest gradient conjugate gradient, Newton's Method, Marquardt Method, Constrained optimization - sequential linear programming, Interior penalty function method, external penalty function method.

UNIT V EVOLUTIONARY OPTIMIZATION TECHNIQUES 9

Genetic algorithm – Working principle, Basic operators and Terminologies, Building block hypothesis, Travelling Salesman Problem, Particle swarm optimization, Ant colony optimization.

Total : 45 Periods

Text Books

1. Edwin K P Chong and Stanislaw S Zak, "An Introduction to Optimization", Fourth Edition, John Wiley and Sons, 2017.
2. Timothy J.Ross, "Fuzzy Logic Engineering Applications", McGrawHill, NewYork, 2017.
3. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison Wesley, 2017.

Reference Books

4. Venkata Rao, Vimal J. Savsani, Mechanical Design Optimization Using Advanced Optimization Techniques, springer 2019.
5. Singiresu S. Rao, Engineering optimization Theory and practice, John Wiley & sons, inc,Fourth Edition, 2019.
6. Jang J.S.R., Sun C.T and Mizutani E, "Neuro Fuzzy and Soft computing", Pearson education (Singapore) 2017.

Additional References

1. **Gate -** https://www.youtube.com/watch?v=asLoul_m92A
2. **NPTEL -** https://www.digimat.in/nptel/courses/video/106105173/L01.html
3. **MOOC Courses -** http://www.infocobuild.com/education/audio-video-courses/computer-science/IntroToSoftComputing-IIT-Kharagpur/lecture-08.html

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2		2								1		
CO 2	3	2		2								1		
CO 3	3	3		2								1		
CO 4	3	1		1								2		
CO 5	3	1		1								2		
	3-High				2-Medium				1-Low					

Passed in Board of Studies Meeting (24.02.2022)

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Formative Assessment			
Blooms Taxonomy	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial class / Assignment	5	
Apply			
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations (IAE)			Final Examinations (FE)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	60
Remember				
Understand		10	10	20
Apply	20	20	20	40
Analyse	30	20	20	40
Evaluate				
Create				

Passed in Board of Studies Meeting (24.02.2022)

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Approved in Academic Council Meeting (09.03.2022)

20PESE43	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Understand the basic concepts of ciphers.
2. Understand advanced electronics systems and data Interpretation.
3. Test various hardware and software tools.
4. Apply the technical skills in the transferring the data in secure manner.
5. Understand the wireless transformation secure mode.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Describe the encryption standards and ciphers.	Understand
CO 2	Indicate advanced electronics systems (Analog and Digital Systems) and interpret data.	Understand
CO 3	Analyze the systems that include both hardware and software.	Analyze
CO 4	Apply the technical skills in the transferring the data in secure manner.	Apply
CO 5	Understand the wireless transformation in secure mode.	Understand

Course Contents

UNIT I SYMMETRIC CIPHERS 9

Overview - Classical encryption Techniques - Block ciphers and Data encryption standard - Introduction to finite fields - Advanced encryption standard - Contemporary symmetric ciphers - Confidentiality using symmetric encryption.

UNIT II PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS 9

Introduction to number theory - Public-key cryptography and RSA - Key management - Hellman key exchange - Elliptic curve cryptography - Message authentication and Hash functions - Hash algorithms - Digital signatures and Authentication protocols.

UNIT III NETWORK SECURITY PRACTICE 9

Authentication applications - Kerberos - X.509 Authentication service - Electronic mail security - Pretty good privacy -S/MIME - IP Security architecture - Authentication header - Encapsulating security payload-Key management.

UNIT IV SYSTEM SECURITY 9

Intruders – Intrusion detection – Password management – Malicious software – Firewalls – Firewall design principles -Trusted systems.

UNIT V WIRELESS SECURITY 9

Introduction to wireless LAN Security standards - Wireless LAN Security factors and issues

Total : 45 Periods

Reference Books

1. William Stallings, "Cryptography and Network Security – Principles and Practices", Pearson Education, 3rd ed., 2013.
2. Atul Kahate, "Cryptography and Network Security", Tata McGrawHill, 2003.
3. Stewart S.Miller, "Wi-Fi Security", Tata McGrawHill, 2003.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 6	3	2			3							2		
CO 7	3	2			3							2		
CO 8	3	2			3							2		
CO 9	3	2			3							2		
CO 10	3	2			3							2		
	3-High				2-Medium				1-Low					

Formative Assessment			
Blooms Taxonomy	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand	Tutorial class / Assignment	5	
Apply			
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations (IAE)			Final Examinations (FE)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	
Remember	10	10	10	60
Understand	30	30	30	60
Apply	10	10	10	20
Analyse				
Evaluate				
Create				

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20PESE44	ROBOTICS AND CONTROL	L	T	P	C
		3	0	0	3
Nature of Course	Professional Elective				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Describe the robot terminologies and robotic sensors.
2. Analyze direct and inverse kinematic relations.
3. Illustrate the formulation of manipulator Jacobins and introduce path planning techniques.
4. Educate on robot dynamics.
5. Explain robot control techniques.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Understand the components and basic terminology of Robotics.	Understand
CO 2	Explain the motion of Robots and analyze the workspace and trajectory panning of robots.	Analyze
CO 3	Develop application based Robots.	Apply
CO 4	Identify the dynamic models.	Understand
CO 5	Control the mobile robots in various industrial applications.	Apply

Course Contents

UNIT I INTRODUCTION AND TERMINOLOGIES 9

Definition-Classification-History- Robots components-Degrees of freedom-Robot joints-coordinates- Reference frames-workspace-Robot languages-actuators-sensors-Position, velocity and acceleration sensors-Torque sensors-tactile and touch sensors-proximity and range sensors-vision system-social issues.

UNIT II KINEMATICS 9

Mechanism-matrix representation-homogenous transformation-DH representation-Inverse kinematics solution and programming-degeneracy and dexterity.

UNIT III DIFFERENTIAL MOTION AND PATH PLANNING 9

Jacobian-differential motion of frames-Interpretation-calculation of Jacobian-Inverse Jacobian-Robot Path planning

UNIT IV DYNAMIC MODELLING 9

Lagrangian mechanics- Two-DOF manipulator- Lagrange-Euler formulation - Newton- Euler formulation – Inverse dynamics

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UNIT V ROBOT CONTROL SYSTEM

Linear control schemes- joint actuators- decentralized PID control- computed torque control - force control- hybrid position force control- Impedance/ Torque control

Total : 45 Periods

Text Books

1. R.K. Mittal and I J Nagrath, " Robotics and Control", Tata Mac Graw Hill, Fourth edition, 2004.
2. Saeed B. Niku ,"Introduction to Robotics ", Pearson Education, 2002.
3. R.D. Klafter, TA Chmielewski and Michael Negin, "Robotic Engineering,An Integrated approach", Prentice Hall of India,2003.

Reference books

1. John J. Craig, Introduction to Robotics Mechanics and Control, Second Edition, Addison Wesly Longman Inc. International Student edition, 1999.
2. R. N Nazar, Theory of Applied Robotics: Kinematics, Dynamics, and Control, Springer; 2nd Ed. 2010.

Additional References

4. **NPTEL** - https://nptel.ac.in/courses/112/107/112107289
5. **Youtube** - https://youtu.be/N5UYrFpDTMM
6. **Coursera** - https://www.coursera.org/specializations/modernrobotics

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3			3			3			3		3		
CO 2	3			3			3			3		3		
CO 3	3			3			3			3		3		
CO 4	3		3	3			3			3		3		
CO 5	3			3			3			3		3		
	3-High				2-Medium				1-Low					

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Formative Assessment			
Blooms Taxonomy	Assessment Component	Marks	Total marks
Remember	Quiz	5	15
Understand Apply	Tutorial class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Examinations (IAE)			Final Examinations (FE)
	IAE – I (7.5)	IAE – II (7.5)	IAE – III (10)	60
Understand	30	10	30	60
Apply	10	30	10	20
Analyse	10	10	10	20
Evaluate				
Create				

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20PESE45	DIGITAL SIGNAL PROCESSORS	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Signals and Systems				

Course Objectives

The course is intended to

1. Understand the Discrete Fourier Transform for signal analysis.
2. Devise the IIR Filters with its design specifications.
3. Learn and implement of FIR Filters with the design specifications.
4. Understand the internal architecture of different types of digital signal processors.
5. Summarize the DSP processors architecture.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO1	Infer the signals of Discrete Fourier Transform.	Analyze
CO2	Deduce FIR Filters for the given specifications.	Analyze
CO3	Construct IIR Filters for the given specifications.	Analyze
CO4	Describe the Pipeline operation of TMS320C54XX processors.	Understand
CO5	Explain the DSP processors architecture.	Understand

Course Contents

UNIT I DISCRETE FOURIER TRANSFORM 7

Introduction to DFT – Properties of DFT – Relation between DFT and DTFT – FFT & its algorithms - DIT and DIF algorithms- Overlap add method - Overlap save method.

UNIT II FIR FILTER DESIGN 10

Design of analog Butterworth and Chebyshev Filters - Frequency transformation in analog domain - Design of IIR digital filters - Impulse invariance techniques, Bilinear transform - Prewarping - Realization of IIR filters - Direct, cascade and parallel forms, Lattice structure.

UNIT III IIR FILTER DESIGN 9

Linear phase FIR filters - Design using Rectangular, Hamming, Hanning and Blackman Windows - Frequency sampling method - Realization of FIR filters - Direct form and Lattice structure.

UNIT IV DIGITAL SIGNAL PROCESSORS 10

Commercial Digital Signal Processing devices - Architecture of TMS320C54XX Digital signal processors - Bus Structures - CPU - Internal memory and memory mapped registers-Data addressing modes of the TMS320C54XX processors - Memory space of 54XX processors - Program control.

UNIT V DSP ARCHITECTURE 9

Comparison of Von-Neumann and Harvard architecture - Architecture of TMS320C67XX Processors, Addressing modes- Memory organization - Program Control – Pipelining- On-Chip Peripherals- Interrupts.

Total : 45 Periods

Text Books:

1. John G Proakis,Dimitris G.Manolakis,Digital Signal Processing, Pearson Publication, Fifth Edition, 2021.
2. P.Ramesh Babu,Digital Signal Processing, Sciteh Publiation, Sixth Edition,2018.

Reference books :

1. Venkataramani B, and Bhaskar M, "Digital Signal Processors: Architecture, Programming & Applications", Tata McGraw Hill, New Delhi, Fourth Edition 2011.
2. Johny R. Johnson, "Introduction to Digital Signal Processing", PHI, Sixth Edition 2016.
3. S.K. Mitra, "Digital Signal Processing, A Computer Based approach", Tata McGraw-Hill,, Fourth Edition, 2013.

Additional References:

1. https://www.youtube.com/watch?v=6dFnpz_AEyA
2. http://www.digimat.in/nptel/courses/video/117102060/L21.html

Mapping of Course Outcomes (COs) with Program Outcomes (POs) Program Specific Outcomes (PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2		3				2	2					
CO2	3	3	2		3				2	2					
CO3	3	3	2		3				2	2					
CO4	3	3	2		3				2	2					
CO5	3	3	2		3				2	2					
	3	High				2	Medium					1	Low		

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Formative assessment			
Bloom's Level	Assessment Component	Marks	Total marks
Analyze	Classroom or Online Quiz	5	15
Understand	Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Continuous Assessment Tests			Terminal Examination (60)
	IAE I (7.5)	IAE II (7.5)	IAE III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply				
Analyze	30	30	30	60
Evaluate				
Create				

Passed in Board of Studies Meeting (24.02.2022)

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