Hindusthan College of Engineering and Technology

An Autonomous Institution, Approved by AICTE, New Delhi Affiliated to Anna University Accredited by NBA (AERO, AUTO, CIVIL, CSE, ECE, EEE, IT, MECH, MECHATRONICS) Accredited by NAAC with 'A++' Grade | An ISO Certified Institution

Valley Campus, Pollachi Highway, Coimbatore 641032.

POSTGRADUATE PROGRAMMES

M.E EMBEDDED SYSTEMS (PG)

REGULATION-2024

SEMESTER I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	24MA1101	Advanced Mathematics for Electrical Engineering	BS	3	1	0	4	40	60	100
2	24ES1201	Research Methodology	RMC	2	1	0	3	40	60	100
3	24ES1202	Embedded Systems Design	PC	3	0	4	4	40	60	100
4	24ES1203	Microcontroller Based System Design	PC	3	0	2	4	40	60	100
5	24ES1204	Software for Embedded Systems	PC	3	0	0	3	40	60	100
PRACTICAL										
6	24ES1001	Embedded Controllers Laboratory	PC	0	0	4	2	60	40	100
Total Credits:				**14**	**02**	**10**	**20**	**260**	**340**	**600**

SEMESTER II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	24ES2201	Real Time Operating System	PC	3	0	0	3	40	60	100
2	24ES2202	Internet of Things	PC	3	0	0	3	40	60	100
3	24ES2203	Advanced Digital system Design	PC	3	0	2	4	40	60	100
4	24ES23XX	Professional Elective I	PE	3	0	0	3	40	60	100
5	24ES23XX	Professional Elective II	PE	3	0	0	3	40	60	100
PRACTICAL										
6	24ES2001	Real time and Embedded System Laboratory	PC	0	0	4	2	60	40	100
7	24ES2801	MINI PROJECT	PC	0	0	4	2	60	40	100
Total Credits:				**15**	**00**	**10**	**20**	**320**	**380**	**700**

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SEMESTER III

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	24ES33XX	**Professional Elective III**	PE	3	0	0	3	40	60	100
2	24ES33XX	**Professional Elective IV**	PE	3	0	0	3	40	60	100
3	24ES33XX	**Professional Elective V**	PE	3	0	0	3	40	60	100
4	24ES33XX	**Professional Elective VI**	PE	3	0	0	3	40	60	100
PRACTICAL										
5	24ES3901	Project Work - I	PC	0	0	12	6	50	50	100
Total Credits:				**12**	**00**	**12**	**18**	**210**	**290**	**500**

SEMESTER IV

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PRACTICAL										
1	24ES4901	Project Work - II	PC	0	0	24	12	100	100	200
Total Credits:				**0**	**0**	**24**	**12**	100	100	200

Semester I	Semester II	Semester III	Semester IV	
20	20	18	12	70

Total No of Credits: 70

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE I,II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	24ES2301	Advanced Digital Signal Processing	PE	3	0	0	3	40	60	100
2	24ES2302	Digital Image Processing	PE	3	0	0	3	40	60	100
3	24ES2303	Computer Architecture and Parallel Processing	PE	3	0	0	3	40	60	100
4	24ES2304	Embedded Linux	PE	3	0	0	3	40	60	100
5	24ES2305	Nanotechnology-Future trends & challenges	PE	3	0	0	3	40	60	100

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PROFESSIONAL ELECTIVE III, IV,V & VI

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	24ES3301	Electromagnetic Interference andCompatibility	PE	3	0	0	3	40	60	100
2	24ES3302	Python Programming	PE	3	0	0	3	40	60	100
3	24ES3303	Automotive Embedded System	PE	3	0	0	3	40	60	100
4	24ES3304	ASIC and FPGA Design	PE	3	0	0	3	40	60	100
5	24ES3305	Smart Sensors	PE	3	0	0	3	40	60	100
6	24ES3306	Embedded Networking and Automation of Electrical System	PE	3	0	0	3	40	60	100
7	24ES3307	Soft Computing and Optimization Techniques	PE	3	0	0	3	40	60	100
8	24ES3308	Wireless and Mobile Communication	PE	3	0	0	3	40	60	100
9	24ES3309	Electric Vehicles and Power Management	PE	3	0	0	3	40	60	100
10	24ES3310	Distributed Embedded Computing	PE	3	0	0	3	40	60	100
11	24ES3311	Multicore Architecture	PE	3	0	0	3	40	60	100
12	24ES3312	Environmental Impact Assessment	PE	3	0	0	3	40	60	100

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Programme/sem	Course Code	Name of the Course	L	T	P	C
M.E(EMBEDDED)/I	24MA1101	ADVANCED MATHEMATICS FOR ELECTRICAL ENGINEERING	3	1	0	4

Course Objective

The student should be able to

1. To develop proficiency in solving systems of linear equations using various methods such as Gaussian elimination, matrix inversion, and matrix factorization.
2. Introduce fundamental concepts in matrix theory.
3. Introduce optimization techniques for problem solving
4. Discuss the concept of stationary process and correlation function
5. Familiarize the basic characteristic features of a queuing system and acquire skills in analyzing queuing models.

Unit	Description	Instructional Hours
I	**LINEAR ALGEBRA** Linear equations and matrix Algebra : System of linear equations and its solutions sets, elementary row operations and echelon form, matrix operations, invertible matrices	12
II	**MATRIX THEORY** Cholesky decomposition - Generalized Eigen values and Eigenvectors - QR Factorization – Least squares method.	12
III	**OPTIMIZATION TECHNIQUES** Linear Programming problems - Simplex method – Transportation problems - Simple problems in Game Theory.	12
IV	**RANDOM PROCESSES** Classification – Stationary random process – Markov process – Markov chain – Poisson process – Auto correlation – Cross correlation	12
V	**QUEUEING THEORY** Markovian models: Single and Multiple server - Queueing models (Excluding proof) – (M/M/1):(∞/FCFS), (M/M/1):(N/FCFS), (M/M/C):(∞/FCFS) and (M/M/C):(N/FCFS).	12
	Total Instructional Hours	60

Course Outcome

At the end of the course the student will be able to

CO1: Analyze linear equationsby applying linear algebraic concepts.
CO2: Achieve the ability of modeling and analyzing by applying matrix theory
CO3: Apply diverse optimization methods effectively..
CO4: Apply the fundamental knowledge of the Markov and Poisson processes
CO5: Identify the queuing models in the given system, find the performance measures and analyse the result..

TEXT BOOK

T1 - O'Neil, P.V., "Advanced Engineering Mathematics", Thomson Asia Pvt. Ltd., Singapore, 2010.
T2 - Bronson, R. "Matrix Operation", Schaum's outline series, 2nd Edition, McGraw Hill, 2011.
T3 - Ibe. O.C., "Fundamentals of Applied Probability and Random Processes", 2nd Edition, Elsevier, 1st Indian Reprint, 2005.

REFERENCE BOOKS

R1 - Kreyszig.E."Advanced Engineering Mathematics", Tenth Edition, John Wiley and sons (Asia) limited, 2017
R2 - Taha, H.A., "Operations Research, An Introduction", 9th Edition, Pearson education, New Delhi,2016.
R3 - David C Lay, Linear Algebra and its applications, Pearson Education Publishers 3rd Edition 2004.
R4 - KantiSwarup, P.K. Gupta and Man Mohan, Operations Research Sultan Chand and Sons 16th Edition 2018.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	1	-	-	1	2	2	3	2
CO2	3	3	3	3	3	-	1	-	-	1	2	2	3	2
CO3	3	3	3	3	2	-	1	-	-	1	3	2	3	2
CO4	3	3	3	2	2	-	1	-	-	1	3	2	2	2
CO5	3	3	3	2	2	-	1	-	-	1	3	2	2	2
AVG	3	3	3	2.6	2.4	-	1	-	-	1	2.6	2	2.6	2

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E	24ES1201	RESEARCH METHODOLOGY	3	0	0	3

Course Objectives

1. Impart scientific knowledge for carrying out research work effectively.
2. Understand the concepts in various research designs.
3. Acquire knowledge about Experimental design and Data collection
4. Confer about the multivariate analysis techniques
5. Disseminate knowledge on Research Practices and Report writing.

Unit	Description	Instructional hours
I	**INTRODUCTION TO RESEARCH** Research-Definition-Objectives of research, Meaning of research- Characteristics of research - Importance of research activities- Types of research-Research approaches-Significance-Problems in research- Qualities of good researcher- Research process.	9
II	**RESEARCH DESIGN** Formulation of the research design: Process-classification of research designs-Exploratory-Secondary resource analysis-Two-tired research design- -Validity in experimentation-factors affecting external validity-classification of experimental design - Pre-experimental- Quasi-experimental designs.	9
III	**DATA COLLECTION METHODS** Classification of Data-Collection of primary data-Observation-Interview method-Collection of data through Questionnaires-schedules-collection of secondary data-Research applications of secondary data-Benefits and drawbacks-classification of secondary data-Internal –External data sources.	9
IV	**MULTIVARIATE ANALYSIS TECHNIQUES** Growth of Multivariate techniques-Characteristics and applications-Classification-Variables in multivariate analysis-Important multivariate techniques-Factor analysis-Rotation in factor analysis-R-type and Q type factor analysis-Path analysis.	9
V	**RESEARCH PRACTICE AND REPORT WRITING.** Literature review-Conference proceedings-Journals-Journal Impact Factor (JFI)-Citation index-h-index-Significance of report writing-Different steps in writing report-Layout of report writing-Types of reports-Mechanics of writing a research report-precautions for writing research reports-Conclusion and Scope for future work-Oral presentation.	9
	Total instructional hours	**45**

Course Outcomes

Observe the various approaches to do research.
Carryout the research design.
CO3: Evaluate the data collection for research activities.
Acknowledge the function of Multivariate Analysis Techniques
Organize the research activity systematically and prepare research report effectively.

TEXT BOOKS:

T1. C.R. Kothari, Research Methodology Methods &Techniques, NEW Age International (P) Limited, New Delhi, 2007.

T2. Dr. Deepak Chawla, Dr. Neena Sondhi, Research Methodology concepts and cases, Vikas Publishing House Pvt. Ltd., New Delhi, 2011

REFERENCE BOOKS:

R1. K. Prathapan, Research Methodology for Scientific Research, I.K. International Publishing House Pvt. Ltd. New Delhi, 2014L.

R2. R. Panneerselvam, Research Methodology, PHI Learning Private Limited, New Delhi, 2011.

R3. Donald H. McBurney, Research Methods, Thomson Asia Pvt. Ltd. Singapore, 2002.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3		1	-	2	1	2	3	3	3
CO2	3	3	3	3	3		1	-	2	1	2	3	3	3
CO3	3	3	3	3	2		1	-	2	1	3	3	2	3
CO4	3	3	3	2	2	1	1	-	2	1	3	3	2	2
CO5	3	3	3	2	2	1	1	-	2	1	3	3	3	3
AVG	3	3	3	2.6	2.4	1.33	1	-	2	1	2.6	3	2.6	2.8

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E	24ES1202	EMBEDDED SYSTEM DESIGN	3	0	0	3

Course Objective

1. Understand the design challenges and methodologies of embedded system
2. Study general and single purpose processor and its development
3. Understand bus structures
4. Learn the embedded system design procedures for various processes
5. Study the embedded software tools for RTOS

Unit	Description	InstructionalHours
I	**EMBEDDED SYSTEMOVERVIEW** Embedded System Overview, Design Challenges – Optimizing Design Metrics, Design Methodology, RT-Level Combinational and Sequential Components, Optimizing Custom Single-Purpose Processors.	9
II	**GENERAL AND SINGLEPURPOSE PROCESSOR** Basic Architecture, Pipelining, Superscalar and VLIW architectures, Development Environment: Application-Specific Instruction-Set Processors (ASIPs) Microcontrollers, Timers, Counters and watchdog Timer, UART and Analog-to-Digital Converters, Memory Concepts.	9
III	**BUS STRUCTURES** Basic Protocol Concepts, Microprocessor Interfacing – I/O Addressing, Port and Bus-Based I/O, Arbitration, Serial Protocols, I^2C, CAN and USB, Parallel Protocols – PCI and ARM Bus, Wireless Protocols – IRDA, Bluetooth, IEEE 802.11.	9
IV	**STATE MACHINE AND CONCURRENTPROCESSMODELS** Basic State Machine Model, Finite-State Machine with Data path Model, Concurrent Process Model, Communication among Processes, Synchronization among processes, Dataflow Model, Real-time Systems, Automation: Synthesis, Intellectual Property Cores, Design Process Models.	9
V	**EMBEDDED SOFTWARE DEVELOPMENT TOOLSAND RTOS** Compilation Process – Libraries – Porting kernels – C extensions for embedded systems – Emulation and debugging techniques – RTOS – System design using RTOS.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Identify the various embedded system design
CO2: Evaluate the general and single purpose processors
CO3: Compare various bus structures
CO4: Recognize the process models
CO5: Apply the embedded software development tools

TEXT BOOKS:

T1 Bruce Powel Douglas, "Real time UML, second edition: Developing efficient objects for embedded Systems", 3rd Edition 1999, Pearson Education.

T2 Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCE BOOKS:

R1 Daniel W.Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education, 2002.

R2 Steve Heath, "Embedded System Design", Elsevier, Second Edition, 2004.

R3 Jonathan W.Valvano: "Embedded Microcomputer Systems – Real Time Interfacing", Cengage Learning; Third of later edition

R4 Osborn.G, "Embedded microcontroller and processor design", Pearson

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	1	1	1	2	1	2	2	3	2
CO2	3	3	3	2	3	1	1	0	1	1	2	2	3	2
CO3	3	3	3	2	2	0	0	0	1	1	3	2	2	2
CO4	3	3	3	2	2	0	0	1	1	1	3	2	2	3
CO5	3	3	3	2	2	0	1	1	1	1	3	2	2	3
AVG	3	3	2.8	2	2.4	0.4	0.6	0.6	1.2	1	2.6	2	2.4	2.4

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E	24ES1203	MICROCONTROLLER BASED SYSTEM DESIGN	3	0	0	3

Course Objective

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 on revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

Unit	Description	Instructional Hours
I	**8051ARCHITECTURE** Architecture – memory organization – addressing modes – instruction set – Timers - Interrupts - I/O ports ,Interfacing I/O Devices–Serial Communication	9
II	**8051PROGRAMMING** 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	9
III	**PIC MICROCONTROLLER** Architecture – memory organization – Addressing modes – instruction set – PIC programming in Assembly & C –I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, practice in MP-LAB	9
IV	**PERIPHERAL OF PIC MICROCONTROLLER** Timers – Interrupts, I/O ports- I2C bus-A/D converter-UART- CCP modules -ADC, DACand Sensor Interfacing –Flash and EEPROM memories.	9
V	**SYSTEM DESIGN – CASE STUDY** Interfacing LCD Display – Keypad Interfacing - Generation of Gate signals for converters and Inverters - Motor Control – Controlling DC/ AC appliances – Measurement of frequency - Standalone Data Acquisition System	9
	Total Instructional Hours	**45**

Course Outcome

CO1: 8-bit microcontrollers, learn assembly and C programming of PIC.
CO2: Learn Interfacing of Microcontroller.
CO3: Learners will study about PIC microcontroller and system design.
CO4: The course would enable students to enrich their knowledge with hands-on experiments and project-based learning.
CO5: Effectively utilize microcontroller software development tools such as a compiler, make files, or compile scripts.

TEXT BOOKS:

T1: Muhammad Ali Mazidi, Rolin D. McKinlay, Danny Causey, 'PIC Microcontroller and Embedded Systems using Assemblyand C for PIC18', Pearson Education 2008.
T2: Rajkamal, "Microcontrollers Architecture, Programming Interfacing, & System Design, Pearson, 2012.

REFERENCE BOOKS:

R1: Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, 'AVR Microcontroller and Embedded Systems using Assembly andC', Pearson Education 2014.
R2: Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, 'The 8051 Microcontroller and Embedded Systems'Prentice Hall, 2005.
R3: John Iovine, 'PIC Microcontroller Project Book', McGraw Hill 2000.
R4: Senthil Kumar, Saravanan, Jeevanathan, "microprocessor & microcontrollers, Oxford, 2013.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	-	1	-	-	1	2	2	3	2
CO2	3	3	3	2	2	-	1	-	-	1	2	2	3	2
CO3	3	3	3	2	2	-	1	-	-	1	3	2	3	2
CO4	3	3	3	2	2	-	1	-	-	1	3	2	2	2
CO5	3	3	3	2	2	-	1	-	-	1	3	2	2	2
AVG	3	3	3	2	2		1			1	2.6	2	2.6	2

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E	24ES1204	SOFTWARE FOR EMBEDDED SYSTEMS	3	0	0	3

COURSE OBJECTIVE

To impart knowledge on

1. To expose the students to the fundamentals of embedded programming.
2. To introduce the GNU C programming toolchain 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 on revising & familiarizing the concepts acquired over the 5 Units of thesubject for improved employability skills.

Unit	Description	Instruct Hou
	EMBEDDED PROGRAMMING	
I	CandAssembly-ProgrammingStyle-DeclarationsandExpressions-Arrays, Qualifiers and Reading Numbers-DecisionandControlStatements-ProgrammingProcess-MoreControlStatements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers -Debugging and Optimization –In-line Assembly.	9
	C PROGRAMMINGTOOLCHAININ LINUX	
II	C pre processor-Stages of Compilation -Introduction to GCC -Debugging with GDB -The Make utility - GNU Configure andBuild System - GNU Binary utilities - Profiling - using *gprof* - Memory Leak Detection with *valgrind*- Introduction to GNU CLibrary	9
	EMBEDDED C	
III	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.	9
	EMBEDDED OS	
IV	Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, UsingTimer0andTimer1,Portabilityissue,Alternativesystemarchitecture,Importantdesignconsiderationswhenusingsystem-Memoryrequirements-embeddingserialcommunication&schedulingdatatransmission-Casestudy:Intruder alarm system	9
	PYTHON PROGRAMMING	
V	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..	9
	TOTAL INSTRUCTIONAL HOURS	**45**

COURSE OUTCOME

CO1: Ability to use GNUC to develop embedded software.

CO2: knowledge and understanding of fundamental embedded systems design paradigms,architectures,possibilitiesandchallenges,bothwithrespecttosoftwareandhardware

CO3:Improved Employability and entrepreneurship capacity due to knowledge up gradation on recenttrend in embedded systems design

TEXT BOOKS:

T1 SteveOualline, 'PracticalCProgramming3rdEdition',O'Reilly Media,Inc,2006.

T2 MichaelJ Pont,"Embedded C",Pearson Education, 2007

REFERENCES:

R1 Christian Hill, Learning Scientific Programming with Python, CAMBRIDGE UNIVERSITY PRESS, 2016.

R2 WesleyJ.Chun,"Core python application Programming3rdEdition",Pearson Educat,2016.

R3 MarkJ.Guzdial,"introductiontocomputingandprogramminginpython–aMultimediaapproach,4th edition, Pearson Education,2015.

R4 StephenKochan,"ProgramminginC",3rdEdition,SamsPublishing, 2009.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	1	-	2	1	3	2	3	3
CO2	3	3	3	3	3	-	1	-	2	1	3	2	3	3
CO3	3	3	3	3	2	-	1	-	2	1	3	2	3	3
CO4	3	3	3	2	2	-	1	-	2	1	3	2	3	3
CO5	3	3	3	2	2	-	1	-	2	1	3	2	3	3
AVG	3	3	3	2.6	2.4	-	1	-	2	1	3	2	3	3

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E	24ES1001	Embedded Controllers Laboratory	0	0	4	2

Course Objective

1. Impart the knowledge on Interfacing of different Processor.
2. Testing of flash controller programming.
3. Analyze of process control and PCB designing.
4. Intend and analysis of modulator and demodulator.
5. Design system using instrumentation amplifier.

Expt. No.	Description of the experiments
1	Interface matrix keyboard with microcontroller and display the key pressed on seven segment display
2	Program to read analog voltage applied at the input and display
3	Program to generate a PWM waveform
4	Interfacing LCD
5	Analog sensor interfacing
6	Serial communication
7	Motor control applications
8	Traffic control system
9	Wireless networking using ZigBee
10	PWM based motor Control

Total Practical Hours 45

Course Outcome

CO1:Able to interface peripheral devices with embedded processors.
CO2: Can choose appropriate microcontroller for the design specification with reference toa real time problem.
CO3: Ability to troubleshoot embedded based hardware devices.
CO4: Propose interfaces using embedded processors.
CO5: Design and Analysis of real time operating systems.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3		1	1	2	1	2	2	3	2
CO2	3	3	3	3	3		1	1	2	1	2	2	3	2
CO3	3	3	3	3	2		1	1	2	1	3	2	3	2
CO4	3	3	3	2	2	1	1		2	1	3	2	2	2
CO5	3	3	3	2	2	1	1	1	2	1	3	2	2	2
AVG	3	3	3	2.6	2.4	1	1	1	2	1	2.6	2	2.6	2

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