HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai) (Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade),COIMBATORE 641 032

M.E EMBEDDED SYSTEMS –R2020

Curriculum & Syllabus

2022-2023

VISION AND MISSION OF THE DEPARTMENT

VISION

To become a Centre of Excellence in Electrical and Electronics Engineering, in every facet of Engineering Education.

MISSION

M1. Provide a solid foundation in basic science, mathematics and engineering fundamentals enhancing the student's capability to identify, formulate, analyze and develop solutions for Engineering problems.

M2. Create an ambiance for the students to develop and flourish their technical skills, design knowledge and innovative ideas to address the environmental issues and sustainable development of the society.

M3. Inculcate moral values and leadership qualities to meet the challenges of life with courage and confidence.

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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO 1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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PO 6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports anddesign documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1. To analyze, design and implement solutions for simple and complex engineering problems that are economically feasible, eco-friendly and socially acceptable solutions in the field of Applied Electronics.

PSO 2. To apply research and project management skills in Applied Electronics domain concerned with communication system by employing recent technologies.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1. To enable graduates to develop solutions to real world problems in the frontier areas of Applied Electronics.

PEO 2. To enable the graduates to adapt to the latest trends in technology through self-learning and to pursue research to meet out the demands in industries and Academia.

PEO 3. To enable the graduates to exhibit leadership skills and enhance their abilities through lifelong learning.

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CURRICULUM

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

POSTGRADUATE PROGRAMMES

M.E EMBEDDED SYSTEMS –R2020

REGULATION-2020

For the students admitted during the academic year 2021-2022 and onwards

SEMESTER I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20MA1105	Advanced Mathematics for Electrical Engineering	BS	3	1	0	4	40	60	100
2	20ES1201	Advanced Digital system Design	PC	3	0	0	3	40	60	100
3	20ES1202	Embedded Systems Design	PC	3	0	0	3	40	60	100
4	20ES1203	Microcontroller Based System Design	PC	3	0	0	3	40	60	100
5	20ES1204	Software for Embedded Systems	PC	3	0	0	3	40	60	100
PRACTICAL										
6	20ES1001	Embedded Controllers Laboratory	PC	0	0	4	2	50	50	100
7	20ES1701	Technical Seminar	ES	0	0	2	1	0	100	100
MANDATORY COURSES										
8	20AC10XX	AUDIT COURSE I	AC	2	0	0	0	100	0	100
Total Credits:				**17**	**1**	**6**	**19**	**350**	**450**	**800**

SEMESTER II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20ES2201	Real Time Operating System	PC	3	0	0	3	40	60	100
2	20ES2202	Internet of Things	PC	3	0	0	3	40	60	100
3	20ES23XX	**Professional Elective I**	PE	3	0	0	3	40	60	100
4	20ES23XX	**Professional Elective II**	PE	3	0	0	3	40	60	100
5	20ES23XX	**Professional Elective III**	PE	3	0	0	3	40	60	100
PRACTICAL										
6	20ES2001	Real time and Embedded System Laboratory	PC	0	0	4	2	50	50	100
7	20ES2901	MINI PROJECT	PC	2	0	0	2	50	50	100
MANDATORY COURSES										
8	20AC20XX	AUDIT COURSE II	AC	2	0	0	0	100	0	100
Total Credits:				**19**	**0**	**4**	**19**	**400**	**400**	**800**

For the students admitted during the academic year 2020-2021 and onwards

SEMESTER III

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20ES33XX	**Professional Elective IV**	PE	3	0	0	3	40	60	100
2	20ES33XX	**Professional Elective V**	PE	3	0	0	3	40	60	100
3	20ES34XX	**OPEN ELECTIVE**	OE	3	0	0	3	40	60	100
PRACTICAL										
4	20ES3901	DISSERTATION I	PC	0	0	20	10	50	50	100
Total Credits:				**9**	**0**	**20**	**19**	**170**	**230**	**400**

SEMESTER IV

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PRACTICAL										
1	20ES4901	DISSERTATION – II	PC	0	0	30	15	50	50	100
Total Credits:				**0**	**0**	**30**	**15**	**50**	**50**	**100**

Total No of Credits: 72

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE I, II & III

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20ES2301	Advanced Digital Signal Processing	PE	3	0	0	3	40	60	100
2	20ES2302	Research Methodology	PE	3	0	0	3	40	60	100
3	20ES2303	Digital Image Processing	PE	3	0	0	3	40	60	100
4	20ES2304	Computer Architecture and Parallel Processing	PE	3	0	0	3	40	60	100
5	20ES2305	Embedded Linux	PE	3	0	0	3	40	60	100
6	20ES2306	Robotics and Control	PE	3	0	0	3	40	60	100
7	20ES2307	Electromagnetic Interference and Compatibility	PE	3	0	0	3	40	60	100
8	20ES2308	Python Programming	PE	3	0	0	3	40	60	100
9	20ES2309	Automotive Embedded System	PE	3	0	0	3	40	60	100
10	20ES2310	ASIC and FPGA Design	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE IV & V

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20ES3301	Smart Sensors	PE	3	0	0	3	40	60	100
2	20ES3302	Embedded Networking and Automation of Electrical System	PE	3	0	0	3	40	60	100
3	20ES3303	Soft Computing and Optimization Techniques	PE	3	0	0	3	40	60	100
4	20ES3304	Wireless and Mobile Communication	PE	3	0	0	3	40	60	100
5	20ES3305	Electric Vehicles and Power Management	PE	3	0	0	3	40	60	100
6	20ES3306	Distributed Embedded Computing	PE	3	0	0	3	40	60	100
7	20ES3307	Multicore Architecture	PE	3	0	0	3	40	60	100

OPEN ELECTIVE

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20ES3401	Smart Grid	OE	3	0	0	3	40	60	100
2	20ES3402	Nano Electronics	OE	3	0	0	3	40	60	100

AUDIT COURSES – I

S.No.	Course Code	Course Title	L	T	P	C
THEORY						
1	20AC1091	English for Research Paper writing	2	0	0	0
2	20AC1092	Disaster Management	2	0	0	0
3	20AC1093	Sanskrit for Technical knowledge	2	0	0	0
4	20AC1094	Value Education	2	0	0	0
5	20AC1095	Constitution of India	2	0	0	0

AUDIT COURSES - II

S.No.	Course Code	Course Title	L	T	P	C
THEORY						
1	20AC2091	Pedagogy Studies	2	0	0	0
2	20AC2092	Stress Management by Yoga	2	0	0	0
3	20AC2093	Personality Development Through Life Enlightenment Skills	2	0	0	0
4	20AC2094	Unnat Bharat Abhiyan	2	0	0	0

CREDIT DISTRIBUTION

Semester	I	II	III	IV	TOTAL
Credits	19	19	19	15	72

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SYLLABUS

SEMESTER-I

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20MA1105	ADVANCED MATHEMATICS FOR ELECTRICAL ENGINEERING	3	1	0	4

Course Objective

1. Apply various analytical skills in applied mathematics with the tactics of problem solving and logical thinking of electrical engineering.
2. Analyze problems in electrical engineering using matrix theory.
3. To understand the knowledge of the linear programming problems.
4. To cultivate a mathematical attitude and nurture the interests in Stochastic and Special Random Processes.

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 Eigenvectors - Canonical basis - QR Factorization – Least squares method – Singular value decomposition.	12
III	**LINEAR PROGRAMMING PROBLEMS** Linear Programming problems - Simplex method - Big M technique - Duality - Simple problems in Game Theory.	12
IV	**STOCHASTIC PROCESSES** Classification of random processes - Strictly and wide sense stationary processes - Ergodic process -Auto correlation - Cross correlation - Properties and problems - Power spectral density functions	12
V	**SPECIAL RANDOM PROCESSES** Markov process - Poisson process - Gaussian process - Linear time invariant systems - Linear System with random inputs - Autocorrelation and cross correlation functions of input and output.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Apply various methods to solve system of linear equations.
CO2: Apply matrix theory in Electrical Engineering problems.
CO3: Apply the knowledge of linear programming problem.
CO4: Apply the concept of power spectral density functions.
CO5: Apply the fundamental knowledge of the Markov and Poisson processes.

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", Elsevier, 1st Indian Reprint, 2010.

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 (Jain Book Agency Publishers Paper Back) 17th Edition 2014 Reprint New Delhi ISBN: 9789351610236

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES1201	ADVANCED DIGITAL SYSTEM DESIGN	3	0	0	3

Course Objective

1. Basic concepts of Sequential Circuit Design.
2. Basic concepts of Asynchronous Sequential Circuit Design.
3. Learn the concepts of fault modeling and fault - tolerant systems
4. Study the concepts of programmable logic devices.
5. Apply the concepts of System Design Using Verilog and Programmable Devices

Unit	Description	Instructional Hours
I	**SEQUENTIAL CIRCUIT DESIGN** Analysis of clocked synchronous sequential circuits and modeling- State diagram, state table, state table assignment and reduction-Design of synchronous sequential circuits - ASM chart and realization using ASM.	9
II	**ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN** Analysis of asynchronous sequential circuit – flow table reduction-races-state assignment-transition table and problems in transition table- design of asynchronous sequential circuit-Static, dynamic and essential hazards – data synchronizers – mixed operating mode asynchronous circuits – designing vending machine controller	9
III	**FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS** Fault table method-path sensitization method – Boolean difference method-D algorithm - Tolerance techniques – The compact algorithm – Fault in PLA – Test generation-DFT schemes – Built in self test.	9
IV	**SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES** Programming logic device families – Designing a synchronous sequential circuit using PLA/PAL – Realization of finite state machine using PLD – FPGA – Xilinx FPGA-Xilinx 4000	9
V	**SYSTEM DESIGN USING VERILOG** Hardware Modelling with Verilog HDL – Logic System, Data Types and Operators For Modelling in Verilog HDL - Behavioral Descriptions in Verilog HDL – HDL Based Synthesis – Synthesis of Finite State Machines– structural modeling – compilation and simulation of Verilog code –Test bench - Realization of combinational and sequential circuits using Verilog – Registers – counters – sequential machine – serial adder – Multiplier- Divider – Design of simple microprocessor.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Design and analysis of sequential circuit.
CO2: Design and analysis of asynchronous sequential circuit.
CO3: Explore fault diagnosis and testability algorithm
CO4: Learn of programmable logic devices.
CO5: Design and analysis of hardware description languages.

TEXT BOOKS:

T1 Charles H.Roth Jr "Fundamentals of Logic Design" Thomson Learning 2004

T2 M.D.Ciletti , Modeling, Synthesis and Rapid Prototyping with the Verilog HDL, Prentice Hall, 1999.

REFERENCE BOOKS:

R1 M.G.Arnold, Verilog Digital – Computer Design, Prentice Hall (PTR), 1999.

R2 Parag K.Lala "Digital system Design using PLD" B S Publications,2003

R3 Nripendra N Biswas "Logic Design Theory" Prentice Hall of India,2001

R4 Parag K.Lala "Fault Tolerant and Fault Testable Hardware Design" B S Publications,2002

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES1202	EMBEDDED SYSTEMS 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 developement
3. Understand bus structures
4. Learn the embedded system design procedurs for various processes
5. Study the embedded software tools for RTOS

Unit	Description	Instructional Hours
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

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES1203	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. ToinvolveDiscussions/Practice/Exerciseontorevising&familiarizingtheconceptsacquiredover the5UnitsofthesubjectforimprovedemployabilityskillS.

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, DAC and 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, RolinD.Mckinlay,DannyCausey'PICMicrocontrollerandEmbeddedSystems usingAssemblyandCforPIC18',PearsonEducation2008

T2 Rajkamal,"Microcontrollers Architecture, Programming Interfacing,& System Design,Pearson,2012

REFERENCE BOOKS:

R1 Muhammad Ali Mazidi, Sarmad Naimi,Sepehr Naimi'AVR Micro controller and Embedded Systems using Assembly and C", Pearson Education 2014.

R2 Muhammad Ali Mazidi, Janice G.Mazidi and Rolin D.McKinlay,'The 8051MicrocontrollerandEmbedded Systems' PrenticeHall,2005.

R3 JohnIovine, 'Pic Microcontroller Project Book', McGrawHill 2000

R4 SenthilKumar, Saravanan, Jeevanathan," microprocessor&microcontrollers,Oxford,2013.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES1204	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 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. ToinvolveDiscussions/Practice/Exercisecontorevising&familiarizingtheconceptsacquire dover the5Unitsofthesubjectforimprovedemployabilityskills.

Unit	Description	Instructional Hours
I	**EMBEDDED PROGRAMMING** 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.	9
II	**C PROGRAMMING TOOL CHAIN IN LINUX** 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	9
III	**EMBEDDED C** 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
IV	**EMBEDDED OS** Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, Using Timer0 and Timer1, Portability issue, Alternative system architecture, Important design considerations when using sEOS – Memory requirements –embedding serial communication & scheduling data transmission – Case study: Intruder alarm system	9
V	**PYTHON PROGRAMMING** 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, possibilities and challenges, both with respect to software and hardware
CO3: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design

TEXT BOOKS:

T1 Steve Oualline, 'PracticalCProgramming3rdEdition',O'ReillyMedia,Inc,2006.

T2 Michael J 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," introduction to computing and programming in python–a Multimedia approach,4th edition, Pearson Education,2015.

R4 Stephen Kochan,"ProgramminginC",3rdEdition,SamsPublishing, 2009.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES1001	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 to a 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.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES1701	TECHNICAL SEMINAR	0	0	2	1

Course Objective

1. Prepare Engineering developments, prepare, and present on technical topics.
2. Usage of various teaching aids such as overhead projectors, power point presentation and demonstrative models.

Description

During the seminar session, each student is expected to prepare and present a topic on engineering/technology, for duration of about 8 to 10 minutes. In a session of two periods per week, 15 students are expected to present the seminar.

Each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report.

Three member departmental committee headed by Head of the Department will evaluate the student attendance, presentation, report and conduct viva-voce examination to award marks appropriately. Evaluation is 100% internal mode.

Total Instructional Hours **30**

Course Outcome

CO1: Prepare and present a topic on engineering subjects

CO2: Prepare and present general topics effectively with good communication skills

CO3: Categorize the available teaching aids and use them in their presentations.

CO4: Discuss their ideas with confidence.

CO5: Transfer their technical or general knowledge to others with confidence.

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SEMESTER-II

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES2201	REAL TIME OPERATING SYSTEM	3	0	0	3

Course Objectives

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

Unit	Description	Instructional hours
I	**REVIEW OF OPERATING SYSTEMS** Basic Principles - Operating System structures – System Calls – Files – Processes – Design and Implementation of processes – Communication between processes – Introduction to Distributed operating system – Embedded operating systems	9
II	**OVERVIEW OF RTOS** RTOS Task and Task state –Multithreaded Preemptive scheduler- Process Synchronization- Message queues– Mail boxes -pipes – Critical section – Semaphores – Classical synchronization problem – Deadlocks	9
III	**REAL TIME MODELS AND LANGUAGES** Event Based – Process Based and Graph based Models – Real Time Languages – RTOS Tasks – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements.	9
IV	**REAL-TIME KERNEL** Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and Basic study of various RTOS like – VX works – Linux supportive RTOS – C Executive.	9
V	**APPLICATION DEVELOPMENT** Discussions on Basics of Linux supportive RTOS – uCOS-C Executive for development of RTOS Application – Case study	9
	Total instructional hours	**45**

Course Outcomes

CO1: Explain the operating system structures and types.
CO2: Insight into scheduling, disciplining of various processes execution.
CO3: Describe the various RTOS support modelling
CO4: Explain the commercial RTOS Suite features to work on real time Processes design.
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in RTOS and embedded automation design.

TEXT BOOKS:

T1. Silberschatz,Galvin,Gagne" Operating System Concepts,6th ed,John Wiley,2003
T2. Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill,1997

REFERENCE BOOKS:

R1. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill,2006.
R2. Karim Yaghmour, Building Embedded Linux System",O'reilly Pub,2003
R3. Mukesh Sighal and N G Shi "Advanced Concepts in Operating System", McGraw Hill,2000

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES2202	INTERNET OF THINGS	3	0	0	3

COURSE OBJECTIVE

To impart knowledge on

1. Impart the outline knowledge on fundamentals of IoT
2. Study the Internal structures and layers of IoT
3. Identification of IoT protocols and wireless technology
4. Gain the different platforms of IoT attributes and Data analytics
5. Familiarize thed ifferent applications of IoT as a case study.

Unit	Description	Instructional Hours
I	**INTRODUCTION TOINTERNETOF THINGS** Overview, Technology drivers, Business drivers, Typical IoT applications, Trends and implications	6
II	**IOT ARCHITECTURE** Node Structure-Sensing, Processing, Communication, Powering, Networking-Topologies Layer/Stack architecture, IoT standards, Cloud computing for IoT, Bluetooth, Bluetooth Low Energy, beacons.	12
III	**PROTOCOLS AND WIRELESS TECHNOLOGY FOR IOT** **Protocols:** NFC, RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIeWired vs. Wireless communication, GSM, CDMA, LTE, GPRS, small cell. **Wireless technologies for IoT:** WiFi (IEEE802.11), Bluetooth / Bluetooth Smart, ZigBee / Zig Bee Smart, UWB (IEEE 802.15.4),6LoWPAN, Proprietary systems	9
IV	**DATA ANALYSTICS FOR IOT** **Services/Attributes:** Big-Data Analytics and Visualization, 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	9
V	**CASE STUDIES** Home Automation, smart cities, Smart Grid, Electric vehicle charging, Environment, Agriculture, Productivity Applications	9
	TOTAL INSTRUCTIONAL HOURS	**45**

COURSE OUTCOME

CO1: Understand and Develop on the basic's concepts ofIoT and its present developments.
CO2: Identify the IoT structures and components related to IoT.
CO3: Infer the protocols that associated with IoT.
CO4: Develop and apply the platform for IoT in data analytics and its services or attributes.
CO5: Discover the smart applications and control used by IoT

TEXT BOOKS:

T1 Arshdeep Bahga and Vijai Madisetti: A Hands-on Approach "Internet of Things", Universities Press 2015.
T2 Oliver Hersent, David Boswarthick and Omar Elloumi"The Internet ofThings",Wiley,2016

REFERENCES:

R1 Samuel Greengard,"The InternetofThings",TheMITpress,2015
R2 Adrian McEwen and Hakim Cassimally "DesigningtheInternetofThings"Wiley,2014.
R3 Jean-Philippe Vasseur, Adam Dunkels,"Interconnecting Smart Objects with IP: TheNext Internet" MorganKuffmannPublishers,2010.
R4 Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", JohnWileyandsons,2014

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES2001	REAL TIME AND EMBEDDED SYSTEM LABORATORY	0	0	4	2

Course Objective

1. Understand the design challenges of ARM processorin embedded system
2. Study general of I/O Interfacing
3. Understand and study of different types of microcontrollers.
4. Learn the embedded system design real time system
5. Study the embedded software tools for RTOS

EXPT. No	Description of the Experiments
1.	Programming ARM processor:ARM7 /ARM9/ARM Cortex
2.	Study on in circuit Emulators, cross compilers, debuggers
3.	I/O Programming with ARM processor: ARM7 /ARM9/ARM Cortex Microcontrollers I/O Interfacing: Timers/Interrupts/Serial port programming/PWM Generation/Motor Control/ADC/DAC/ LCD/RTC Interfacing/ Sensor Interfacing
4.	Programming with Rasberry Pi Microcontroller Board: Study on in circuit Emulators, cross compilers, debuggers
5.	Creating a Make file for an Embedded Application
6.	Task Management and Resource Management using Open Source Real-Time Kernel
7.	Inter-task Communication in Open Source Real-Time Kernel
8.	Interrupt Management and Memory Management using Open Source Real-Time Kernel
9.	Performance Evaluation of Single-core and Multi-core Scheduling Algorithms
10.	Programming & Simulation in Python Simulators/Tools/others
	Total Practical Hours 45

Course Outcome

CO1: Identify the various embedded system design
CO2: Evaluate the general and input and output interfacing
CO3: Compare various microcontrollers
CO4: Recognize the real time application
CO5: Apply the real time software development tools.

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SEMESTER-III

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES3901	DISSERTATION - I	0	0	20	10

Course Objective

1. Analyze a methodology to select a project and able to develop a hardware/software project.
2. Transform the ideas behind the project with clarity.
3. Validate the technical report.

Description of the project work

A candidate is permitted to work on projects in an Industrial / Research Organization, on the recommendations of the Head of the Department concerned.

A project must be selected either from research literature published list or the students themselves may propose suitable topics in consultation with their guide.

The aim of the project work is to strengthen the comprehension of principles by applying them to a new problem, which may be the design and manufacture of a device, a research investigation or a design problem.

The project work shall be supervised by a supervisor of the department, (and an expert in industry if it is a industrial project), and the student shall be instructed to meet the supervisor periodically and to attend the review committee meeting for evaluation of the progress.

In case of candidates not completing Phase-I of project work successfully, the candidates can undertake Phase-I again in the subsequent semester. In such cases the candidates can enroll for Phase-II, only after successful completion of Phase-I.

The Project report shall be prepared and submitted according to the approved guidelines as given by the Controller of Examination and bonafied duly signed by Supervisor and the Head of the Department.

Course Outcome

CO1: Realize the skills acquired in the previous semesters to solve complex engineering problems.
CO2: Build up an innovative model / prototype of an idea related to the field of specialization.
CO3: Create the work individually to identify, troubleshoot and build products for environmental and Societal issues.
CO4: Effective presentation of ideas with clarity.
CO5: Evaluate surveys towards developing a product, which helps in lifetime learning.

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SEMESTER IV

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES4901	DISSERTATION - II	0	0	30	15

Course Objective

1. Analyze a methodology to select a project and able to develop a hardware/software project.
2. Transform the ideas behind the project with clarity.
3. Validate the technical report.

Description of the project work

The Project work (Phase II) shall be pursued for a minimum prescribed period as per regulation.

The project work shall be supervised by a supervisor of the department, (and an expert in industry if it is a industrial project), and the student shall be instructed to meet the supervisor periodically and to attend the review committee meeting for evaluation of the progress.

The Project report shall be prepared and submitted according to the approved guidelines as given by the Controller of Examination and bonafide duly signed by Supervisor and the Head of the Department.

Course Outcome

CO1: Realize the skills acquired in the previous semesters to solve complex engineering problems.
CO2: Build up an innovative model / prototype of an idea related to the field of specialization.
CO3: Create the work individually to identify, troubleshoot and build products for environmental and Societal issues.
CO4: Effective presentation of ideas with clarity.
CO5: Evaluate surveys towards developing a product, which helps in lifetime learning.

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PROGRAMME	COURSE CODE	PROFESSIONAL ELECTIVE-I, II & III NAME OF THE COURSE	L	T	P	C
M.E.	20ES2301	ADVANCED DIGITAL SIGNAL PROCESSING	3	0	0	3

Course Objective	1.To understand Discrete-time signal transforms, digital filter design, optimal filtering 2. To analyze and design Power spectrum estimation. 3.To study and analyze the multi-rate digital signal processing 4. To study and Design adaptive Filters. 5. To understand and design multi-rate digital signal processing.

Unit	Description	Instructional Hours
I	**DISCRETE RANDOM SIGNAL PROCESSING** Weiner Khitchine relation - Power spectral density – filtering random process, Spectral Factorization Theorem, special types of random process – Signal modeling-Least Squares method, Pade approximation, Prony's method, iterative Prefiltering, Finite Data records, Stochastic Models	9
II	**SPECTRUM ESTIMATION** Non-Parametric methods - Correlation method - Co-variance estimator - Performance analysis of estimators – Unbiased consistent estimators - Periodogram estimator - Barlett spectrum estimation - Welch estimation - Model based approach - AR, MA, ARMA Signal modeling -Parameter estimation using Yule-Walker method.	9
III	**LINEAR ESTIMATION AND PREDICTION** Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion - Wiener filter - Discrete Wiener Hoff equations - Recursive estimators - Kalman filter – Linear prediction, Prediction error - Whitening filter, Inverse filter - Levinson recursion, Lattice realization, Levinson recursion algorithm for solving Toeplitz system of equations.	9
IV	**ADAPTIVE FILTERS** FIR Adaptive filters - Newton's steepest descent method - Adaptive filters based on steepest descent method - Widrow Hoff LMS Adaptive algorithm - Adaptive channel equalization - Adaptive echo canceller - Adaptive noise cancellation - RLS Adaptive filters – Exponentially weighted RLS - Sliding window RLS - Simplified IIR LMS Adaptive filter	9
V	**MULTIRATE DIGITAL SIGNAL PROCESSING** Mathematical description of change of sampling rate - Interpolation and Decimation - Continuous time model - Direct digital domain approach - Decimation by integer factor - Interpolation by an integer factor - Single and multistage realization - Poly phase realization - Applications to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.	9
	Total Instructional Hours	**45**

Course Outcome	CO1: Identify various arithmetic and geometrical operations for random signals. CO2: Analyze the spectrum estimation. CO3: Analyze linear estimation and Prediction. CO4: Design the adaptive Filters. CO5: Analyze the multirate digital signal processing

TEXT BOOKS:

T1-Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons Inc., New York, 2006

T2- Sophoncles J. Orfanidis, "Optimum Signal Processing ", McGraw-Hill, 2000

REFERENCE BOOKS:

R1 John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Prentice Hall of India, New Delhi, 2005.

R2 Simon Haykin, "Adaptive Filter Theory", Prentice Hall, Englehood Cliffs, NJ1986.

R3 P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Prentice Hall, 1992

R4 N. J. Fliege ,"Multirate Digital Signal Processing: Multirate Systems - Filter Banks – Wavelets", Wiely, 1999.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES2302	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

CO1: Observe the various approaches to do research.
CO2: Carryout the research design.
CO3: Evaluate the data collection for research activities.
CO4: Acknowledge the function of Multivariate Analysis Techniques
CO5: 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.

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Programme	Course Code	Name of the Course	L	T	P	C
M.E.	20ES2303	DIGITAL IMAGE PROCESSING	3	0	0	3

Course Objective

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.

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OFIMAGE PROCESSING** Introduction to image processing systems, sampling and quantization, color fundamentals and models, image operations arithmetic, geometric and morphological. Multi-resolution analysis–image pyramids.	9
II	**IMAGE ENHANCEMENT** Spatial domain; Gray-level transformations – histogram processing – spatial filtering, smoothing and sharpening. Frequency domain: filtering in frequency domain – DFT, FFT, DCT – smoothing and sharpening filters–Homomorphic filtering. Image enhancement for remote sensing images and medical images.	9
III	**IMAGE SEGMENTATIONAND FEATUREANALYSIS** Detection of discontinuities – edge operators – edge linking and boundary detection, thresholding –feature analysis and extraction – region based segmentation – morphological watersheds – shape skeletonization, phase congruency. Number plate detection using segmentation algorithm	9
IV	**IMAGE COMPRESSION** Image compression: fundamentals–models–elements of information theory–error free compression–lossy compression–compression standards. Applications of image compression techniques in video and image transmission	9
V	**EMBEDDED IMAGE PROCESSING** Introduction to embedded image processing. ASIC vs FPGA - memory requirement, power consumption, parallelism. Design issues in VLSI implementation of Image processing algorithms - interfacing. Hardware implementation of image processing algorithms: Segmentation and compression	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Ability to understand the fundamentals of image processing.
CO2: Able to understand the techniques involved in image enhancement.
CO3: Ability to gain the knowledge about image compression.
CO4: Ability to learn the fundamentals of image compression.
CO5:Ability to Formulate hardware for image processing applications

TEXT BOOKS:

T1 Rafael C. Gonzalez and Richard E.Woods, "Digital Image processing", 2nd edition, Pearson education,2003

T2. Anil K. Jain, "Fundamentals of digital image processing", Pearson education, 2003

REFERENCE BOOKS:

R1 Milan Sonka, Valclav Halavac and Roger Boyle, "Image processing, analysis and machine vision", 2nd Edition, Thomson learning, 2001

R2 Mark Nixon and Alberto Aguado, "Feature extraction & Image processing for computer vision", 3rd Edition, Academic press,2012

R3 Donald G.Bailey, "DesignforEmbeddedImageprocessingonFPGAs"JohnWileyandSons,2011.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES2304	COMPUTER ARCHITECTURE AND PARALLEL PROCESSING	3	0	0	3

Course Objective

1. Basic concepts of computer architecture Design and performance.
2. Learn the difference between pipeline and parallel processing concepts.
3. Study Memory Architectures, Memory Technology and Optimization
4. Basic concepts of multiprocessors.
5. Study various types of processor architectures and the importance of scalable architectures

Unit	Description	Instructional Hours
I	**COMPUTER DESIGN AND PERFORMANCE MEASURES** Fundamentals of Computer Design – Parallel and Scalable Architectures – Multiprocessors – Multi-vector and SIMD architectures – Multithreaded architectures – Stanford Dash multiprocessor – KSR1 - Data-flow architectures - Performance Measures.	9
II	**PARALLEL PROCESSING, PIPELINING AND ILP** Instruction Level Parallelism and Its Exploitation - Concepts and Challenges - Pipelining processors -Overcoming Data Hazards with Dynamic Scheduling – Dynamic Branch Prediction - Speculation - Multiple Issue Processors - Performance and Efficiency in Advanced Multiple Issue Processors.	9
III	**MEMORY HIERARCHY DESIGN** Memory Hierarchy - Memory Technology and Optimizations – Cache memory – Optimizations of Cache Performance – Memory Protection and Virtual Memory - Design of Memory Hierarchies.	9
IV	**MULTIPROCESSORS** Symmetric and distributed shared memory architectures – Cache coherence issues – Performance Issues – Synchronization issues – Models of Memory Consistency - Interconnection networks – Buses, crossbar and multi-stage switches.	9
V	**MULTI-CORE ARCHITECTURES** Software and hardware multithreading – SMT and CMP architectures – Design issues – Case-studies – Intel Multi-core architecture – SUN CMP architecture – IBM cell architecture – hp architecture.	9
	Total Instructional Hours	**45**

COURSE OUTCOME

CO1: Design and analysis of computer architecture and performance.
CO2: Learn the difference between pipeline and parallel processing concepts.
CO3: Analysis of Memory Technology and Optimization
CO4: Learn the distribution of shared memory architectures.
CO5: Design and analysis of multi core architecture.

TEXT BOOKS:

T1 David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A hardware/ software approach", Morgan Kaufmann / Elsevier, 1997

T2 Hwang Briggs, "Computer Architecture and parallel processing", McGraw Hill, 1984.

REFERENCE BOOKS:

R1 John P. Hayes, "Computer Architecture and Organization", McGraw Hill

R2 John P. Shen, "Modern processor design. Fundamentals of super scalar processors", Tata McGraw Hill 2003

R3 Kai Hwang, "Advanced Computer Architecture", McGraw Hill International, 2001

R4 William Stallings, "Computer Organization and Architecture – Designing for Performance", Pearson Education, Seventh Edition, 2006

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES2305	EMBEDDED LINUX	3	0	0	3

COURSE OBJECTIVE

1. To expose the students to the fundamentals of linux operating system, its basic commands and shell Programming
2. To teach the history of embedded linux, various distributions and basics of gnucross platform tool chain.
3. To study on different host- target setup, debug and various memory device, file systems and performance 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 over the 5 units of the subject for improved employability skills

Unit	Description	Instructional Hours
I	**FUNDAMENTALS OFLINUX** Basic Linux System Concepts: Working with Files and Directories - Introduction to Linux File system -Working with 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 BashShell.	9
II	**VARIOUS DISTRIBUTIONS AND CROSS PLATFORM TOOLCHAIN** 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 Tool chain.	9
III	**HOST-TARGET SETUP AND OVERALL ARCHITECTURE** 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.	9
IV	**KERNEL CONFIGURATION** A Practical Project Workspace-GNU Cross-Platform Development Tool chain-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 File System Structure-Libraries.	9
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.	9
	Total Instructional Hours:	**45 Hours**

Course Outcome

CO1: To use Linux desktop and GNU tool chain with Eclipse IDE

CO2: Cross compile Linux kernel and port it to target board.

CO3: Add applications and write customized application for the Linux kernel in the target board.

CO4: Students will study about distributions and cross platform tool chain.

CO5: ImprovedEmployabilityandentrepreneurshipcapacityduetoknowledgeupgradationonrecenttrends in embedded systems design.

TEXT BOOKS:

T1. Karim Yaghmour, Jon Masters, Gilad Ben-Yossef,and Philippe Gerum,'Building Embedded Linux Systems 2nd Edition', SPD -O'ReillyPublications,2008

T2.P. Raghavan, Amol Lad, Sriram Neelakandan,"EmbeddedLinux System Design &Development,AuerbachPublications,2012

REFERENCE BOOKS:

R1. Williamvon Hagen,'UbuntuLinuxBible 3rdEdition',WileyPublishing Inc.,2010

R2 Jonathan Corbet, Alessandro Rubini & Greg Kroah-Hartman,'LinuxDeviceDrivers3rdEdition',SPD-O'ReillyPublications,2011

R3 Robert Love," Linux System Programming, SPD-O' Reilly Publications, 2010.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES2306	ROBOTICS AND CONTROL	3	0	0	3

Course Objective

1. To introduce robot terminologies and robotic sensors
2. To educate forward and inverse kinematic relations
3. To educate on formulation of manipulator Jacobians and introduce path planning techniques
4. To educate on dynamic modelling
5. To introduce robot control techniques

Unit	Description	Instructional hours
I	**INTRODUCTION AND TERMINOLOGIES** Definition-Classification-History- Robots components-Degrees of freedom-Robot joints-coordinates-Reference frames-workspace-Robot languages-actuators-sensors-Position, velocity and accelerationsensors-Torque sensors-tactile and touch sensors-proximity and range sensors- vision system-social issues.	9
II	**KINEMATICS** Mechanism-matrix representation-homogenous transformation-DH representation-Inverse kinematics solution and programming-degeneracy and dexterity	9
III	**DIFFERENTIAL MOTION AND PATH PLANNING** Jacobian-differential motion of frames-Interpretation-calculation of Jacobian-Inverse Jacobian- Robot Path planning	9
IV	**DYNAMIC MODELLING** Lagrangian mechanics-Two-DOF manipulator-Lagrange-Euler formulation–Newton-Euler formulation–Inverse dynamics	9
V	**ROBOT CONTROL SYSTEM** - Linear control schemes- joint actuators- decentralized PID control- computed torque control – force control-hybrid position force control-Impedance/Torque control	9
	Total instructional hours	**45**

Course Outcome

CO1: Ability to understand the components and basic terminology of Robotics
CO2: Able to calculate the forward kinematics and inverse kinematics of serial and parallel robots.
CO3: Able to calculate the Jacobian for robot and to do the path planning for a robotic system.
CO4: Able to develop dynamic modelling.
CO5: Able to perform robot control system.

TEXT BOOKS:

T1. R.K. Mittaland I J Nagrath," Robotics and Control", Tata Mac Graw Hill, Fourth edition.
T2. Saeed B.Niku,''Introduction to Robotics'', Pearson Education, 2002.

REFERENCE BOOKS:

R1. Fu, Gonzalez and Lee Mcgrawhill,''Robotics", international edition.
R2. R.D. Klafter, T A Chmielewski and Michael Negin, "Robotic Engineering, An Integrated approach", Prentice Hall of India, 2003

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES2307	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	3	0	0	3

Course Objective

1. Familiarize with the fundamentals that are essential for electronics industry in the field of EMI/EMC
2. Provide knowledge on various EMI sources and victims.
3. Identify the various techniques used in EMC (Electromagnetic compatibility)
4. Design PCB resistant to EMI
5. Provide the various international standards in EMI Measurements

Unit	Description	Instructional hours
I	**EMI/EMC CONCEPTS** EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards.	9
II	**EMI COUPLING PRINCIPLES** Sources of Conducted, and radiated interference; Interference coupling by Conduction and Radiation. Common ground impedance coupling; Common mode and ground loop coupling ; Differential mode coupling ; Power mains and Power supply coupling	9
III	**EMI CONTROL TECHNIQUES** Shielding, Filtering, Grounding, Bonding, Isolation transformer, Transient suppressors, opto isolators, Cable routing, Signal control	9
IV	**PCB DESIGN** Transmitter, Receiver, Antenna, Power Supply, Motors, Control devices, Digital Circuits, Digital computer Integrated circuit success ability	9
V	**EMI MEASUREMENTS AND STANDARDS** Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Tx /Rx Antennas, Working Principles of EMI sensing Device; EMI Rx and spectrum analyzer; Civilian standards-CISPR, FCC, IEC, EN; Military standards-MIL461E/462.	9
	Total instructional hours	**45**

Course Outcome

CO1: Real world EMC deigns constraints and to achieve the most cost effective design that meets all requirements.
CO2: Diagnose and solve the basic electromagnetic compatibility problems.
CO3: Designing the electronic system that function without errors or problems that are related to electromagnetic compatibility.
CO4: Measuring the EMI with various methods and comparing it with standards.
CO5: Controlling techniques for EMI and EMC.

TEXT BOOKS:

T1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, Newyork, 1996.
T2. S.Sathyamurthy "Basics of Electromagnetic Compatibility "sams publishers ,2008.

REFERENCE BOOKS:

R1. Henry W.Ott.,"Noise Reduction Techniques in Electronic Systems", A Wiley Inter Science, 1992.
R2. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, 2008.
R3. C.R.Paul, "Introduction to Electromagnetic Compatibility" , John Wiley and Sons, Inc, 1992.
R4. Don R.J.White Consultant Incorporate, "Handbook of EMI/EMC", Vol I-V, 1988

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES2308	PYTHON PROGRAMMING	3	0	0	3

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 datatypes, 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

Unit	Description	Instructional Hours
I	**INTRODUCTION TOPYTHON** 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.	9
II	**PROGRAM ORGANIZATION AND FUNCTIONS** Organize Large programs into functions–Python functions including scoping rules and documentation strings–Modules and Libraries–Organize programs into modules–System administration, Text processing, Sub processes, Binary data handling, XML parsing and Database Access–Installing third-party libraries.	9
III	**CLASSES AND OBJECTS** 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.	9
IV	**TESTING, DEBUGGING AND SOFTWARE DEVELOPMENT PRACTICE** Python Software development – Use of documentation string – Program testing using doc test and unit test modules – Effective use of assertions–Python debugger and profiler–Iterators and Generators to set up data processing pipelines – An effective technique for addressing common system programming problems (e.g. processing large data files, handling infinite data streams, etc.)	9
V	**TEXTI/OHANDLING** Text generation, Template strings and Unicode-packages – Python Integration Primer – Network programming–Accessing code– Survey on how Python interacts with other language programs.	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Students will be able to develop skill in system administration and network programming by learning Python.
- CO2 Students will also learn how to effectively use Python's very powerful processing primitives, modelling
- CO3 etc
- CO4 Students will be able to design object-oriented programs with Python classes
  Able to Implement database and GUI applications.
- CO5 Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design

TEXT BOOKS:

T1 MarkLutz," Learning Python, Powerful OOPs,O'reilly,2011

T2 Robert Sedgewick, Kevin Wayne, Robert Dondero, Intr Programming in Python, Pearson, 2016.

REFERENCE BOOKS:

R1 Mark J. Guzdial, Barbara Ericson," Introduction to Computing & Programming in Python, 4th Edition Pearson, 2015.

R2 Budd, Timothy. Exploring Python. McGraw-Hillscience,2009.

R3 Guttag, John. Introduction to Computation and Programming Using Python. MITPress,2013.

R4 Zelle, John M. Python Programming: An Introduction to Computer Science. 1sted.FranklinBeedle&Associates,2003.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES2309	AUTOMOTIVE EMBEDDED SYSTEM	3	0	0	3

Course Objectives

1. To expose the students to the fundamentals and building of Electronic Engine Control systems.
2. To teach on functional components and circuits for vehicles
3. To discuss on programmable controllers for vehicles
4. To teach logics of automation & commercial techniques for vehicle communication
5. To involve Discussions/Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills

Unit	Description	Instructional Hours
I	**BASICSOF ELECTRONIC ENGINECONTROLSYSTEMS** Motivation, concept for electronic engine controls and management- Standards; introduction to fuel economy- automobile sensors-volumetric, thermal, air-fuel ratio, solenoid, hall effect- exhaust gas oxygen sensors, Oxidizing catalytic efficiency, emission limits and vehicle performance; advantages of using Electronic engine controls–open and closed loop fuel control.	9
II	**FUELCELLFORAUTOMOTIVE POWER** Fuel cell-Introduction-Proton exchange membrane FC (PEM), Solid oxide fuel cell (SOFC)-properties of fuel cells for vehicles-power system of an automobile with fuel cell based drive, and their characteristics	9
III	**VEHICLE MANAGEMENT SYSTEMS** Electronic Engine Control-engine mapping, air/fuel ratio spark timing control strategy, fuel control, electronic ignition – Vehicle cruise control – speed control – anti – locking braking system-electronic suspension - electronic steering , wiper control ; Vehicle system schematic for interfacing with EMS,ECU.	9
IV	**AUTOMOTIVE TELEMATICS** Role of Bluetooth, CAN, LIN and flex ray communication protocols in automotive applications; Multiplexed vehicle system architecture for signal and data / parameter exchange between EMS, ECUs with other vehicle system components and other control systems; Realizing bus interfaces for diagnostics, dashboard display, multimedia electronics.	9
V	**ELECTRONIC DIAGNOSTICS FOR VEHICLES** System diagnostic standards and regulation requirements –On board diagnosis of vehicles electronic units & electric units- Speedometer, oil and temperature gauges and audio system.	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Design and develop automotive embedded systems.
- CO2 Analyze various embedded products used in automotive industry.
- CO3 Evaluate the opportunities involving technology, a product or a service required for developing a start up idea used for automotive applications
- CO4 Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded systems design

TEXT BOOKS:

T1 William B.Ribbens,"Understanding Automotive Electronics", Elseiver,2012

T2 AliEmedi, Mehrdedehsani, John M Miller, "Vehicular Electric power system - land, Sea, Air and Space Vehicles" Marcel Decker, 2004.

REFERENCE BOOKS:

R1 L.Vlacic, M.Parent, F.Harahima,"Intelligent Vehicle Technologies", SAE International,2001.

R2 Jack Erjavec, Jeff Arias," Alternate Fuel Technology-Electric, Hybrid & Fuel Cell Vehicles", Cengage ,2012

R3 Electronic Engine Control technology – Ronald K Jurgen Chilton's guide to Fuel Injection – Ford

R4 Automotive Electricals/Electronics System and Components, Tom Denton, 3rd Edition, 2004.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES2310	ASIC AND FPGA DESIGN	3	0	0	3

Course Objectives

1. To gain knowledge about Design, partitioning, floor planning, placement and routing in ASIC
2. To study the design flow of different types of ASIC with high performance algorithms
3. To familiarize the different types of programming technologies and logic devices.
4. To learn the architecture of different types of FPGA.
5. To understand the design issues of SOC and to analyse, synthesis, simulate and test systems

Unit	Description	Instructional Hours
I	**OVERVIEW OF ASIC AND PLD** 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.	9
II	**ASIC PHYSICAL DESIGN** 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.	9
III	**LOGIC SYNTHESIS, SIMULATION AND TESTING** 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.	9
IV	**FPGA** 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 Case studies: Altera MAX 5000 and 7000 - Altera MAX 9000 - Spartan II and Virtex II FPGAs - Apex and Cyclone FPGAs	9
V	**SOC DESIGN** System diagnostic standards and regulation requirements –On board diagnosis of vehicles electronic units & electric units-Speedometer, oil and temperature gauges and audio system.	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Students will develop more understanding on the concepts of ASIC
- CO2 Students will understand the Design, partitioning, floor planning, placement and routing in ASIC
- CO3 Students will study about different logic synthesis, simulation and testing technologies in ASIC
- CO4 Students will acquire knowledge about different types of FPGA
- CO5 Students will learn System diagnostic standards and regulation requirements

TEXT BOOKS:

T1 Richard Munden, "ASIC and FPGA Verification: A Guide to Component Modeling (Systems on Silicon)",Morgan Kaufman Publishers, 2004

T2 M.J.S .Smith, "Application Specific Integrated Circuits", Addison -Wesley Longman Inc., 1997

REFERENCE BOOKS:

R1 S. Trimberger, "Field Programmable Gate Array Technology", Kluwer Academic Publications, 1994

R2 John V.Oldfield, Richard C Dore, "Field Programmable Gate Arrays", Wiley Publications 1995

R3 P.K.Chan & S. Mourad, "Digital Design Using Field Programmable Gate Array", Prentice Hall, 1994

R4 Parag.K.Lala, "Digital System Design using Programmable Logic Devices", BSP, 2003.

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PROFESSIONAL ELECTIVE IV& V

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES3301	SMART SENSORS	3	0	0	3

Course Objective

1. The students have theoretical understanding of various sensors
2. Physical phenomenon's behindtheoperation of different types of sensors and Microsystems
3. Students will gain an overview of the current state of smart sensors
4. To apply engineering skills to the analysis and design of Microsystems.
5. The emphasis on the integration of electronics with sensors to provide a smart system on chip with multiple integrated devices

Unit	Description	Instructional Hours
I	**MEMS DEVICES** Piezo resistive pressure sensor- Piezo resistive Accelerometer - Capacitive Sensing-Accelerometer and Microphone - Resonant Sensor and Vibratory Gyroscope - Low Power, Low Voltage Sensors- Micro Electro Mechanical Systems Analysis and Design of MEMS Devices-Nano Sensors	9
II	**INTERFACING SENSOR INFORMATION AND MCU** Amplification and Signal Conditioning- Integrated Signal Conditioning- Digital conversion-MCU Control-MCUs for Sensor Interface- Techniques and System Considerations- Sensor Integration	9
III	**COMMUNICATION FOR SMART SENSORS** Wireless Data Communications- RF Sensing- Telemetry- Automotive Protocols- Industrial Networks- Home Automation- MCU Protocols	9
IV	**PACKAGING, TESTING AND RELIABILITY IMPLICATIONS OF SMART SENSORS** Semiconductor Packaging- Hybrid Packaging- Packaging for Monolithic Sensors- Reliability Implications-Testing Smart Sensors- HVAC Sensor Chip.	9
V	**CONTROL AND IMPLICATIONS OF SMART SENSORS AND STANDARDS** Control Application using - CISC, RISC, DSP Control. Automated Remote Sensing - Process control over the Internet - Airplane Networks - Automotive Safety Network and IEEE 1451 Standards	9
	Total Instructional Hours	**45**

Course Outcomes

CO1	Ability to understand the components and basic terminology of sensors.
CO2	Ability to understand the operation of different types of sensors and Microsystems
CO3	Ability to select the smart sensors for practical applications.
CO4	Ability to design sensor based Microsystems
CO5	Ability to emphasis on the integration of electronics with sensors

TEXT BOOKS:

T1 Randy Frank, "Understanding Smart Sensors", Artech House, Second Edition, 2011Boston

T2 MinhangBao, "Analysis and design principles of MEMS devices", Elsevier Publications, 2005, USA

REFERENCE BOOKS:

R1Ananthasuresh, "Micro and Smart Systems" Wiley Publishers, 2013

R2 Rai-choudhury, "MEMS and MOEMS Technology and Applications",PHI, 2010.

R3 John A. Pelesko and David H. Bernstein, " Modeling MEMS and NEMS", CRC Press, 2002,UK

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES3302	EMBEDDED NETWORKING AND AUTOMATION OF ELECTRICAL SYSTEM	3	0	0	3

Course Objectives

1. To expose the students to the fundamentals of wired embedded networking techniques.
2. To expose the students to the fundamentals of wireless embedded networking
3. To study on design of automation in instrumentation
4. To introduce design of Programmable measurement & control of electrical Devices & grid
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired

Unit	Description	Instructional Hours
I	**EMBEDDED PROCESS COMMUNICATION WITH INSTRUMENTBUS** 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 485and USB standards–embedded ethernet–MOD bus and CAN bus.	9
II	**WIRELESS EMBEDDED NETWORKING** 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- Applications –Home Control-Building Automation-Industrial Automation	9
III	**BUILDING SYSTEM AUTOMATION** 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	9
IV	**MEASUREMENT AND EMBEDDED CONTROL OF ELECTRICAL APPARATUS** 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	9
V	**COMMUNICATION FOR LARGE ELECTRICAL SYSTEM AUTOMATION** 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.	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Comprehend the fundamentals of Embedded Networking by using different types of buses
- CO2 The learning process delivers insight into wireless embedded networking
- CO3 Improved Employability and entrepreneurship capacity due to knowledge upgradation on recent trends in embedded building system automation.
- CO4 Able to apply knowledge from measurement and embedded control of electrical apparatus
- CO5 Be capable of developing the communication for large electrical system automation

TEXT BOOKS:

T1 Control and automation of electrical power distribution systems, James Northcote-Green, Robert Wilson, CRC, Taylor and Francis,2006

T2 Krzysz tofIniewski," Smart Grid, Infrastructure & Networking", TMcGH,2012

REFERENCE BOOKS:

R1 RobertFaludi," Building Wireless Sensor Networks, O'Reilly, 2011.

R2 W.Bolton,ProgrammableLogicControllers,5th Ed, Elseiver, 2010.

R3 Shih-LinWu, Yu-CheeTseng,{"WirelessAdHocNetworking,PAN,LAN,SAN,AurebachPub,2012

R4 Jan Axelson 'Embedded Ethernet and Internet Complete', Penram publications

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES3303	SOFT COMPUTING AND OPTIMIZATION TECHNIQUES	3	0	0	3

Course Objectives

1. Understand the fundamental concepts of soft computing, artificial neural networks and optimization techniques
2. Familiarize with recent applications in Artificial neural networks and optimization techniques
3. To expose the students to the advancement of Neuro Fuzzy systems.
4. Develop the skills to gain a basic understanding of optimization techniques
5. Introduce students to advancements of optimization techniques from an engineering perspective

Unit	Description	Instructional Hours
I	**INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS** Introduction to soft computing: soft computing vs. hard computing – various types of soft computing techniques, from conventional AI to computational intelligence, applications of soft computing. Fundamentals of neural network: biological neuron, artificial neuron, activation function, single layer perceptron–limitations. Multi-layer perceptron–back propagation algorithm.	9
II	**ARTIFICIAL NEURALNETWORKS** Radial basis function networks – reinforcement learning. Hopfield / recurrent network – configuration –stability constraints, associative memory and characteristics, limitations and applications. Hopfield vs. Boltzmann machine	9
III	**FUZZYLOGICAND NEUROFUZZY SYSTEMS** Fundamentals of fuzzy set theory: fuzzy sets, operations on fuzzy sets, scalar cardinality, union and intersection, complement, equilibrium points, aggregation, projection, composition. Fuzzy membership functions. Fundamentals of neuro-fuzzy systems	9
IV	**INTRODUCTIONTOOPTIMIZATION TECHNIQUES** Classification of optimization problems – classical optimization techniques. Linear programming – simplex algorithm. Non – linear programming – steepest descent method, augmented Lagrange multiplier method–equality constrained problems.	9
V	**ADVANCEDOPTIMIZATION TECHNIQUES** Simple hill climbing algorithm, Steepest ascent hill climbing– algorithm and features. Simulated annealing – algorithm and features. Genetic algorithm: working principle, fitness function.	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Comprehend the fundamentals of artificial neural network, fuzzy systems and optimization techniques
- CO2 Understand the significance of various optimization algorithms applied to engineering problems.
- CO3 Be capable of developing ANN-based models
- CO4 Be capable of choosing appropriate optimization techniques for engineering applications
- CO5 Reveal different applications of these models to solve engineering and other problems.

TEXT BOOKS:

T1 Laurene V.Fausett,"Fundamentals of neural networks, architecture, algorithms and applications, Pearson Education, 2008.

T2 Jyh-Shing Roger Jang, Chuen-TsaiSun, Eiji Mizutani,"Neuro-Fuzzy and soft computing", Prentice Hall of India, 2003

REFERENCE BOOKS:

R1 Simon Haykin,"Neural Networks– A comprehensive foundation", Pearson Education,2005.

R2 David E. Goldberg, "Genetic algorithms in search, optimization and machine learning", Pearson Education, 2009.

R3 Singiresu S.Rao, "Engineering Optimization–Theory and Practice",4th edition, John Wiley & Sons,2009.

R4 Thomas Weise, "Global Optimization algorithms–Theory and applications", self-published, 2009

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES3304	WIRELESS AND MOBILE COMMUNICATION	3	0	0	3

Course Objectives

1. To expose the students to the fundamentals of wireless communication technologies.
2. To teach the fundamentals of wireless mobile network protocols
3. To study on wireless network topologies
4. To introduce network routing protocols
5. To study the basis for classification of commercial family

Unit	Description	Instructional Hours
I	**INTRODUCTION** Wireless Transmission– signal propagation– Free space and two ray models– spread spectrum– Satellite Networks–Capacity Allocation –FDMA–TDMA-SDMA–DAMA	9
II	**MOBILE NETWORKS** Cellular Wireless Networks– GSM– Architecture– Protocols– Connection Establishment– Frequency Allocation – Handover – Security– GPRA	9
III	**WIRELESS NETWORKS** Wireless LAN –IEEE 802.11 Standard- Architecture –Services –Hiper LAN, Bluetooth	9
IV	**ROUTING** MobileIP- SIP– DHCP– AdHoc Networks– Proactive and Reactive Routing Protocols–Multicast Routing-WSN routing–LEACH- SPIN- PEGASIS	9
V	**TRANSPORT AND APPLICATION LAYERS** TCP over Adhoc Networks– WAP– Architecture– WWW Programming Model– WDP– WTLS– WTP– WSP– WAE– WTA Architecture– WML– WMLscripts	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Knowledge of basic and advanced theories on wireless communications systems in physical, link and network layer.
- CO2 Ability to understand, model, an design mobile networks.
- CO3 Ability to understand and apply mathematically model in wireless communications.
- CO4 Wireless communication transceiver algorithm design
- CO5 Mobile system design methodology, link level simulation for wireless communications.

TEXT BOOKS:

T1 Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks' PHI/ Pearson Education, 2003

T2 C. Siva Ram Murthy and B.S. Manoj, AdHoc Wireless Networks: Architectures and protocols, Prentice Hall PTR,2004

REFERENCE BOOKS:

R1 Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile computing", Springer, New york, 2003.

R2 C.K.Toh, "AdHoc mobile wireless networks", Prentice Hall,Inc,2002.

R3 Charles E. Perkins,"Adhoc Networking", Addison-Wesley, 2001.

R4 Jochen Schiller, "Mobile communications", PHI/Pearson Education, Second Edition, 2003.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES3305	ELECTRIC VEHICLES AND POWER MANAGEMENT	3	0	0	3

Course Objectives

1. To understand the concept of electrical vehicles and its operations
2. To understand the need for energy storage in hybrid vehicles
3. To provide knowledge about various possible energy storage technologies that can be used in electric vehicles
4. To understand the concept of electrical vehicles and its operations

Unit	Description	Instructional Hours
I	**ELECTRIC VEHICLES ANDVEHICLE MECHANICS** Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics	9
II	**ARCHITECTUREOF EV's AND POWER TRAIN COMPONENTS** Architecture of EV's and HEV's– Plug- nHybrid Electric Vehicles (PHEV)-Power train components and sizing, Gears, Clutches, Transmission and Brakes	9
III	**CONTROL OF DC AND AC DRIVES** 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	9
IV	**BATTERY ENERGY STORAGE SYSTEM** Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries	9
V	**ALTERNATIVE ENERGYSTORAGE SYSTEMS** Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultracapacitors.	9
	Total Instructional Hours	**45**

Course Outcomes

CO1 Learners will understand the operation of Electric vehicles and various energy storage technologies for electrical vehicles

TEXT BOOKS:

T1 Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals, Second Edition" CRC Press, Taylor & Francis Group, Second Edition (2011).

T2 Ali Emadi, Mehrdad Ehsani, John M. Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel dekker, Inc2010.

REFERENCE BOOKS:

R1 Ahmadian, Ali, Mohammadi- Ivatloo, Behnam, Elkamel, Al "Electric Vehicles in Energy Systems", Springer group, Second Edition (2011).

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES3306	DISTRIBUTED EMBEDDED COMPUTING	3	0	0	3

Course Objectives

1. To expose the students to the fundamentals of Network communication technologies and distributed computing.
2. To teach the fundamentals of Internet
3. To study on Java based Networking and distributed computing
4. To involve Discussions/Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.
5. To Practice/Exercise familiarizing web designing skills.

Unit	Description	Instructional Hours
I	**DISTRIBUTED SYSTEM** Introduction- Communication in distribution system-Client/Server Model-Synchronization in distributed system	9
II	**EMBEDDED JAVA** Overview of JAVA – Programs- Multithreaded programming- APPLET programming- I/O streaming- RMI-Introduction to Embedded JAVA	9
III	**DISTRIBUTED COMPUTING** Definition- Model of distributed computation- Distributed shared memory- Authentication in distributed system	9
IV	**SECURITY INCOMPUTING** Security meaning- Threads in networks- Network security control- Firewall- Authentication- E-mail security-Security in web services-Case studies	9
V	**WEB BASED HOMEAUTOMATION** Components of Distributed Embedded -Protocols & Standards -Hardware/Software selection for Distributed Embedded –case study: Web based Home Automation	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Ability to apply knowledge to identify, formulate communication systems.
- CO2 Ability to understand and integrate new knowledge within the field and advanced technical knowledge in multiple contexts.
- CO3 Ability to Improve the Employability and entrepreneurship capacity
- CO4 Ability to solve novel advanced electronics engineering along with soft computing problems that require advanced knowledge within the field.
- CO5 Ability to knowledge up gradation on recent trends in embedded systems design

TEXT BOOKS:

T1 Andrew S.Tanenbaum,"Distributed operating systems", Pearson 2013

T2 E Balagurusamy,"Programming with JAVA", McGraw Hill 2013

REFERENCE BOOKS:

R1 Ajay DK shemkalyani, Mukesh Singhal, "Distributed Computing"–Principles, Algorithm and systems, Cambridge university press 2008

R2 Charles P.P fleeger, "Security in Computing", Pearson 2009.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES3307	MULTICORE ARCHITECTURE	3	0	0	3

Course Objectives

1. Students can understand the multicore within chip level design
2. Students can develop a programming model for implementing multiprocessing environment.
3. Students can learn various processors with multicore capabilities.
4. Students can analyze power PC architecture
5. Students can develop a programming model for core processors.

Unit	Description	Instructional Hours
I	**SUPERSCALAR PROCESSORS** Fundamentals of Superscalar Processor Design, Introduction to Multicore Architecture – Chip Multiprocessing, homogeneous Vs heterogeneous design - SMP - Multicore Vs Multithreading	9
II	**MEMORY ORGANIZATION** Shared memory architectures- synchronization - Memory organization -Cache Memory - Cache Coherency Protocols - Design of Levels of Caches	9
III	**MULTICORE PROGRAMMING MODEL** Shared memory model - message passing model - transaction model - Open MP and MPI Programming.	9
IV	**POWERPC ARCHITECTURE** RISC design – Power PC ISA - PowerPC Memory Management - Power 5 Multicore architecture design, Power 6 Architecture.	9
V	**PROGRAMMING SUPPORT FOR MULTI-CORE/MANY-CORE PROCESSORS** Cell Broad band engine architecture, PPE (Power Processor Element), SPE (Synergistic processing element), Cell Software Development Kit, Programming for Multicore architecture	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Ability to understand the multicore within chip level design
- CO2 Ability to develop a programming model for implementing multiprocessing environment.
- CO3 Ability to understand various processors with multicore capabilities
- CO4 Ability to analyze power PC architecture.
- CO5 Ability to develop the programming for core processors.

TEXT BOOKS:

T1 Hennessey & Paterson, "Computer Architecture A Quantitative Approach", Harcourt Asia, Morgan Kaufmann, 1999.

T2 Joseph JaJa, Introduction to Parallel Algorithms, Addison-Wesley, 1992.

REFERENCE BOOKS:

R1 Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability and Programmability" McGraw-Hill, 1993.

R2 Richard Y. Kain, "Advanced Computer Architecture: A System Design Approach", PHI, 1999.

R3 Rohit Chandra, Ramesh Menon, Leo Dagum, and David Kohr, Parallel Programming in Open MP, Morgan Kaufmann, 2000.

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OPEN ELECTIVE

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES3401	SMART GRID	3	0	0	3

Course Objectives

1. To study about Smart Grid technologies, different smart meters and advanced metering infrastructure
2. To familiarize the power quality management issues in Smart Grid to present selected case studies.
3. To familiarize the high performance computing for Smart Grid applications

Unit	Description	Instructional Hours
I	**INTRODUCTION TO SMART GRID** Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.	9
II	**SMART GRID TECHNOLOGIES** Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).	9
III	**SMART METERS AND ADVANCED METERING INFRASTRUCTURE** Evolutionary Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, MI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU), Intelligent Electronic Devices (IED) & their application for monitoring & protection.	9
IV	**POWER QUALITY MANAGEMENT IN SMART GRID** Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.	9
V	**HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS** Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.	9
	Total Instructional Hours	45

Course Outcomes

CO1 Learners will develop more understanding on the concepts of Smart Grid and its present developments.

CO2 Learners will study about different Smart Grid technologies.

CO3 Learners will acquire knowledge about different smart meters and advanced

TEXT BOOKS:

T1 Stuart Borlase "Smart Grid: Infrastructure, Technology and Solutions", CRC Press 2012

T2 Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley 2012.

REFERENCE BOOKS:

R1 Vehbi C. Güngör, DilanSahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions on Industrial Informatics, Vol. 7, No. 4, November 2011.

R2 Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey," IEEE Transaction on Smart Grids, vol. 14, 2012.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20ES3402	NANO ELECTRONICS	3	0	0	3

Course Objectives

1. To introduce the properties of electron and its implication for electronics
2. To teach the importance and the issues of Nanoscale CMOS technology.
3. To introduce the characteristics and applications of nano electronic devices, nanofabrication methods and techniques.
4. To teach the circuits and architectural features of nano memory devices.
5. To involve Discussions/Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Particles, waves, Wave mechanics, schrodinger equation, free and confined electrons, particle statistics and density of states. Electron transport in semiconductors and nanostructures, Quantumdots, Quantum Well, Quantum wire, materials and its properties, Ballistic electron transport, 1D transport, Spin electronics-Electrical and Electronics Applications of Nanotechnology.	9
II	**NANOSCALE CMOS** Survey of modern electronics and trends towards nano electronics CMOS scaling, challenges and limits, static power, device variability, interconnect - CNT-FET, HEMT, pHEMT FinFET, Ferro FET-nanoscale CMOS circuit design and analysis.	9
III	**NANO ELECTRONIC STRUCTURE AND DEVICES** Resonant-tunneling diodes- Resonant Tunnelling Transistor- Single- electron transfer devices- Potential effect transistors- Quantum-dot cellular automata, Nano Photonic Devices-Molecular electronic devices - Nano- electro mechanical system devices	9
IV	**NANO ELECTRONIC MEMORIES** Nano tube for memories- Nano RAM- Nanoscale DRAM, SRAM, Tunnel magneto resistance- Giant magneto resistance- design and applications.	9
V	**FABRICATION TECHNIQUES** Clean room standards- Microfabrication – nanofabrication- nanofabrication issues- E-beam lithography- X-ray and ion-beam lithography- nano imprint lithography- Scanning probe lithography- dip- pennano lithography- Nano-characterization techniques.	9
	Total Instructional Hours	45

Course Outcomes

CO1: Students will understand the electronic device fabrication.
CO2: The students should be able to understand basic and advanced concepts of nano electronic devices, Sensors and transducers and their applications in nanotechnology
CO3: The concepts of aquantum well, quantum transport and tunnelling effects.
CO4: Understand the impact of nano electronics onto information technology, communication and computer science.
CO5: Design integrated circuits (microchip) using state-of-the-art CMOS technology

TEXT BOOKS:

T1 Hagelstein, Peter L., Stephen D. Senturia and Terry P. Orlando, "Introduction to Applied Quantum and Statistical Physics."New York, NY: Wiley, 2004.

T2 Rainer Waser, "Nano electronics and Information Technology", Wiley 2005.

REFERENCE BOOKS:

R1 Michael A. Nielsen and Isaac L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 2000

R2 Adrian Ionesu and Kaustav Banerjeeds. "Emerging Nanoelectronics: Life with and after CMOS", Vol II, III, and Kluwer Academic, 2005, I.

R3 Kiyoo Itoh Masashi Horiguchi, Hitoshi Tanaka, Ultra Low voltage nano scale memories. Spl Indian Edition, Springer

R4 George W. Hanson, Fundamental of nano electronics, Pearson education

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Programme	Course Code	Name of the Course	L	T	P	C
M.E.	20AC1091	ENGLISH FOR RESEARCH PAPER WRITING	2	0	0	0

Course Objective

1. Teach how to improve writing skills and level of readability
2. Tell about what to write in each section
3. Summarize the skills needed when writing a Title
4. Infer the skills needed when writing the Conclusion
5. Ensure the quality of paper at very first-time submission

Unit	Description	Instructional Hours
I	**INTRODUCTION TO RESEARCH PAPER WRITING** Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	06
II	**PRESENTATION SKILLS** Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction	06
III	**TITLE WRITING SKILLS** Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check	06
IV	**RESULT WRITING SKILLS** Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	06
V	**VERIFICATION SKILLS** Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission	06
	Total Instructional Hours	**30**

Course Outcome

CO1:	Understand that how to improve your writing skills and level of readability
CO2:	Learn about what to write in each section
CO3:	Understand the skills needed when writing a Title
CO4:	Understand the skills needed when writing the Conclusion
CO5:	Ensure the good quality of paper at very first-time submission

REFERENCE BOOKS:

R1: Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

R2: Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006

R3: Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006

R4: Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

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Programme	Course Code	Name of the Course	L	T	P	C
M.E.	20AC1092	DISASTER MANAGEMENT	2	0	0	0

Course Objective

1. Summarize basics of disaster
2. Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
3. Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
4. Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
5. Develop the strengths and weaknesses of disaster management approaches

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.	06
	REPERCUSSIONS OF DISASTERS AND HAZARDS	
II	Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	06
	DISASTER PRONE AREAS IN INDIA	
III	Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post Disaster Diseases and Epidemics.	06
	DISASTER PREPAREDNESS AND MANAGEMENT	
IV	Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard;Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.	06
	RISK ASSESSMENT	
V	Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co- Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival	06
	Total Instructional Hours	**30**

Course Outcome

- CO1: Ability to summarize basics of disaster
- CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response
- CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations
- CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCE BOOKS:

R1: Goel S. L., Disaster Administration And Management Text And Case Studies",Deep & Deep Publication Pvt. Ltd., New Delhi,2009.

R2: NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company,2007.

R3: Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi,2001.

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Programme	Course Code	Name of the Course	L	T	P	C
M.E.	20AC1093	SANSKRIT FOR TECHNICAL KNOWLEDGE	2	0	0	0

Course Objective

1. Illustrate the basic sanskrit language.
2. Recognize sanskrit, the scientific language in the world.
3. Appraise learning of sanskrit to improve brain functioning.
4. Relate sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
5. Extract huge knowledge from ancient literature.

Unit	Description	Instructional Hours
I	**ALPHABETS** Alphabets in Sanskrit	06
II	**TENSES AND SENTENCES** Past/Present/Future Tense - Simple Sentences	06
III	**ORDER AND ROOTS** Order - Introduction of roots	06
IV	**SANSKRIT LITERATURE** Technical information about Sanskrit Literature	06
V	**TECHNICAL CONCEPTS OF ENGINEERING** Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	06
	Total Instructional Hours	**30**

Course Outcome

CO1: Understanding basic Sanskrit language
CO2: Write sentences.
CO3: Know the order and roots of Sanskrit.
CO4: Know about technical information about Sanskrit literature.
CO5: Understand the technical concepts of Engineering.

REFERENCE BOOKS:

R1: "Abhyaspustakam" – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi

R2: "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

R3: "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi, 2017.

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Programme	Course Code	Name of the Course	L	T	P	C
M.E.	20AC1094	VALUE EDUCATION	2	0	0	0

Course Objective

1. Understand value of education and self-development
2. Imbibe good values in students
3. Let the should know about the importance of character
4. To teach and inculcate the importance of value basedliving.
5. To give students a deeper understanding about the purpose of life.

Unit	Description	Instructional Hours
I	**VALUES AND SELF-DEVELOPMENT** Values and self-development–Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgements	7
II	**IMPORTANCE OF CULTIVATION OF VALUES** Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline	7
III	**PERSONALITY AND BEHAVIOR DEVELOPMENT** Personality and Behavior Development-Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brother hood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature	8
IV	**CHARACTER AND COMPETENCE** Character and Competence–Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.	8
	Total Instructional Hours	**30**

Course Outcome

CO1: Students will understand the importance of value based living.
CO2: Students will gain deeper understanding about the purpose of their life.
CO3: Students will understand and start applying the essential steps to become good leaders.
CO4: Students will emerge as responsible citizens with clear conviction to practice values and ethics in life.
CO5: Students will become value based professionals and building a healthy nation.

REFERENCE BOOKS:

R1: Chakroborty, S.K."Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

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Programme	Course Code	Name of the Course	L	T	P	C
M.E.	20AC1095	CONSTITUTION OF INDIA	2	0	0	0

Course Objective

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
3. Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
4. To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution
5. To understand the central and state relation, financial andadministrative.

Unit	Description	Instructional Hours
I	**HISTORY OF MAKING OF THE INDIAN CONSTITUTION & PHILOSOPHY OF THE INDIAN CONSTITUTION** History, Drafting Committee, (Composition & Working), Preamble, Salient Features	06
II	**CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES** Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.	06
III	**ORGANS OF GOVERNANCE** Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions	06
IV	**LOCAL ADMINISTRATION** District's Administration head: Role and Importance Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy	06
V	**ELECTION COMMISSION** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.	06
	Total Instructional Hours	**30**

Course Outcome

CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru

CO4: The eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO5: Discuss the passage of the Hindu Code Bill of 1956.

REFERENCE BOOKS:

R1: The Constitution of India,1950(Bare Act),Government Publication.

R2: Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.

R3: M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.

R4: D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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Programme	Course Code	Name of the Course	L	T	P	C
M.E.	20AC2091	PEDAGOGY STUDIES	2	0	0	0

Course Objective

1. Review existing evidence on there view topic to inform programme design and policy
2. Making under taken by the DfID, other agencies and researchers.
3. . Identify critical evidence gaps to guide the development.
4. Identify their Professional Development.
5. Improve the Research and Future Direction.

Unit	Description	Instructional Hours
I	**INTRODUCTION AND METHODOLOGY** Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and searching.	06
II	**THEMATIC OVERVIEW** Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.	06
III	**EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES** Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches -Teachers' attitudes and beliefs and Pedagogic strategies.	06
IV	**PROFESSIONAL DEVELOPMENT** Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes	06
V	**RESEARCH GAPS AND FUTURE DIRECTIONS** Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.	06
	Total Instructional Hours	**30**

Course Outcome

CO1:	What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?
CO2:	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
CO3:	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
CO4:	How can teacher to develop their Professional development support effective pedagogy?
CO5:	How can improve the Research and Future Direction using effective pedagogy.

REFERENCE BOOKS:

R1: Ackers J, HardmanF (2001) Classroom interaction in Kenyan primary schools, Compare, 31(2): 245- 261.

R2: Agrawal M (2004)Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36(3):361-379.

R3: Akyeampong K (2003) Teacher training in Ghana-does it count? Multi-site teacher education research project (MUSTER) country report 1.London:DFID

R4: Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33(3): 272–282.

R5: Alexander RJ(2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
R6: Chavan M(2003) Read India: Amass scale, rapid, 'learning to read' campaign.

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Programme	Course Code	Name of the Course	L	T	P	C
M.E.	20AC2092	STRESS MANAGEMENT BY YOGA	2	0	0	0

Course Objective

1. To achieve overall health of body and mind
2. To overcome stress
3. To possess emotional stability.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO YOGA** Definitions of Eight parts of yoga. (Ashtanga)	10
II	**DO`S AND DON'T'S IN LIFE** Yam and Niyam - Do`s and Don't's in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.	10
III	**ASAN AND PRANAYAM** Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayam	10
	Total Instructional Hours	**30**

Course Outcome

CO1:	Develop healthy mind in a healthy body thus improving social health also
CO2:	Improve efficiency
CO3:	The student will apply forces and exert themselves using rarely used muscle groups

REFERENCE BOOKS:

R1: Yogic Asanas for Group Tarining-Part-I":Janardan Swami Yoga bhyasi Mandal

R2: "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

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Programme	Course Code	Name of the Course	L	T	P	C
M.E.	20AC2093	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	2	0	0	0

Course Objective

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Unit	Description	Instructional Hours
I	**NEETISATAKAM-HOLISTIC DEVELOPMENT** Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)	10
II	**DAY TO DAY WORK AND DUTIES** Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2- Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.	10
III	**STATEMENTS OF BASIC KNOWLEDGE** Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 - Personality of role model - shrimad bhagwad geeta - Chapter2-Verses 17, Chapter 3-Verses 36,37,42 -Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63	10
	Total Instructional Hours	**30**

Course Outcome

CO1: Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

CO2: The person who has studied Geeta will lead the nation and mankind to peace and prosperity

CO3: Study of Neet is hatakam will help in developing versatile personality of students.

REFERENCE BOOKS:

R1: Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari's Three Satakam, Niti-sringar-vairagya, New Delhi,2010

R2: Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata, 2016.

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