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 APPLIED ELECTRONICS

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
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Curriculum & Syllabus

2021-2022

VISION AND MISSION OF THE INSTITUTION

VISION

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

MISSION

IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.

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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 and design 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 and ability to choose appropriate techniques to modernize existing infrastructure in accordance with industry standards

PSO 2. To develop effective communication skills and leadership qualities and ethical responsibilities to meet society's and the electrical industry's global technological challenges.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1. Post Graduates shall have a good understanding in analyzing and designing embedded systems, as well as technical and professional experience.

PEO 2. Post Graduates shall work in industry as engineers, innovators, or entrepreneurs on technology development, deployment, or engineering system implementation.

PEO 3. Post Graduates adhere to high ethical and technical standards and contribute to society's advancement through scientific research.

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CURRICULUM

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

POSTGRADUATE PROGRAMMES

M.E APPLIED ELECTRONICS – R2020

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	20MA1102	Advanced Mathematics for Electrical and Electronics Engineering	BS	3	0	0	3	40	60	100
2	20AE1201	Advanced Digital System Design	PC	3	0	0	3	40	60	100
3	20AE1202	Embedded System Design	PC	3	0	0	3	40	60	100
4	20AE1203	Digital Image Processing	PC	3	0	0	3	40	60	100
5	20AE1204	Research Methodology	PC	3	0	0	3	40	60	100
PRACTICAL										
6	20AE1001	Electronic System Design Laboratory	PC	0	0	4	2	50	50	100
7	20AE1002	Embedded System Laboratory	PC	0	0	4	2	50	50	100
MANDATORY COURSE										
8	20AC10XX	AUDIT COURSE I	AC	2	0	0	0	100	0	100
Total Credits:				**17**	**0**	**8**	**19**	**400**	**400**	**800**

SEMESTER II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20AE2201	Analog Integrated Circuit Design	PC	3	0	0	3	40	60	100
2	20AE2202	VLSI Design Techniques	PC	3	0	0	3	40	60	100
3	20AE23XX	**Professional Elective I**	PE	3	0	0	3	40	60	100
4	20AE23XX	**Professional Elective II**	PE	3	0	0	3	40	60	100
5	20AE23XX	**Professional Elective III**	PE	3	0	0	3	40	60	100
PRACTICAL										
6	20AE2001	VLSI Design Laboratory	PC	0	0	4	2	50	50	100
7	20AE2901	MINI PROJECT	PC	2	0	0	2	50	50	100
MANDATORY COURSE										
8	20AC20XX	AUDIT COURSE II	AC	2	0	0	0	100	0	100
Total Credits:				**19**	**0**	**4**	**19**	**400**	**400**	**800**

LIST OF PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20AE2301	Advanced Digital Signal Processing	PE	3	0	0	3	40	60	100
2	20AE2302	Advanced Microprocessors and Microcontrollers	PE	3	0	0	3	40	60	100
3	20AE2303	ASIC and FPGA Design	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20AE2304	Computer Architecture and Parallel Processing	PE	3	0	0	3	40	60	100
2	20AE2305	CAD for VLSI Design	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE III

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20AE2307	Electromagnetic Interference and Compatibility	PE	3	0	0	3	40	60	100
2	20AE2308	Wireless Adhoc and Sensor Networks	PE	3	0	0	3	40	60	100
3	20AE2309	Robotics and Intelligent Systems	PE	3	0	0	3	40	60	100

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	20AE33XX	**Professional Elective IV**	PE	3	0	0	3	40	60	100
2	20AE33XX	**Professional Elective V**	PE	3	0	0	3	40	60	100
3	20AE34XX	**OPEN ELECTIVE**	OE	3	0	0	3	40	60	100
PRACTICAL										
4	20AE3901	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	20AE4901	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 IV

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20AE3301	Intelligent Systems and Control	PE	3	0	0	3	40	60	100
2	20AE3302	An Introduction to Electronics Systems Packaging	PE	3	0	0	3	40	60	100
3	20AE3303	IOT System Design and Security	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE V

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	20AE3304	Hardware and Software Co-design	PE	3	0	0	3	40	60	100
2	20AE3305	Electronics for solar Power	PE	3	0	0	3	40	60	100
3	20AE3306	PCB Design And Fabrication	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	20AE3401	Robotics	OE	3	0	0	3	40	60	100
2	20AE3402	Artificial intelligence and Optimization Techniques	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

R2020

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.	20MA1102	ADVANCED MATHEMATICS FOR ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	0	3

Course Objective

1. Apply testing of hypothesis to infer outcome of experiments.
2. Formulate and construct a mathematical model for a linear programming problem in real life situation.
3. Understand the network modeling for planning and scheduling the project activities.
4. Develop the ability to use the concepts of Linear Algebra and Special functions for
5. Acquire knowledge of Fuzzy logic and Fuzzy Algebra.

Unit	Description	Instructional Hours
I	**TESTING OF HYPOTHESES** Sampling distributions -Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions -Tests for Independence of attributes and Goodness of fit.	9
II	**LINEAR PROGRAMMING** Formulation - Graphical solution - Simplex method - Artificial variable Techniques - Transportation and Assignment Models	9
III	**SCHEDULING BY PERT AND CPM** Network Construction - Critical Path Method - Project Evaluation and Review technique - Resource Analysis in Network Scheduling.	9
IV	**LINEAR ALGEBRA** Vector spaces – norms - Inner Products - Eigen values using QR Factorization - generalized eigenvectors - Canonical forms - singular value decomposition and applications -pseudo inverse - least square approximations -Toeplitz matrices and some applications.	9
V	**FUZZY LOGIC AND FUZZY ALGEBRA** Basic principles of Fuzzy logic - Fuzzy sets of operations - Fuzzy membership Matrix.	9
	Total Instructional Hours	**45**

Course Outcome

CO1:Acquire the basic concepts of Probability and Statistical techniques for solving mathematical problem which will be useful in solving engineering problems.
CO2:Apply transportation and assignment models to find optimal solution in warehousing and travelling.
CO3:Prepare project scheduling using PERT and CPM.
CO4:Achieve an understanding of the basic concepts of algebraic equations and method of solving
CO5:Apply the Fuzzy logic in power system problems.

TEXT BOOK

T1 -Richard Bronson, Gabriel B.Costa, "Linear Algebra", Academic Press, Second Edition,2007.
T2 -Richard Johnson, "Miller & Freund's Probability and Statistics for Engineer", Prentice –Hall, 7th Edition, 2007.
T3 - Taha H.A,"Operations Research, An Introduction "8th Edition, Pearson Education, 2008.

REFERENCE BOOKS

R1 -Gupta S.C. and Kapoor V.K."Fundementals of Mathematical Statistics", Sultan an Sons,2001.
R2 -Prem Kumar Gupta,D.S.Hira,"Operations Research," S.Chand &Company Ltd, New Delhi,3rd edition,2008.
R3- Panner Selvam,Operations Research",Prentice Hall of India,2002.
R4- George J.Klir and Yuan,B., Fuzzy sets and fuzzy logic, Theory and applications, Prentice Hall of India Pvt.Ltd., 1997.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE1201	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.	20AE1202	EMBEDDED SYSTEM DESIGN	3	0	0	3

Course Objective

1. Understand the design challenges and methodologies of embedded system
2. Study general and single purpose processor and its 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 SYSTEM OVERVIEW** 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 SINGLE PURPOSE 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 CONCURRENT PROCESS MODELS** 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 TOOLS AND 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 p0rocessor design", Pearson

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE1203	DIGITAL IMAGE PROCESSING	3	0	0	3

COURSE OBJECTIVE

1. To understand the fundamentals of Digital Image
2. To analyze and design the Image transforms and Enhancement.
3. To study and analyze the operation of Image restoration and construction.
4. To study and understand the Image compression & Segmentation.
5. To understand color and multispectral image processing.

Unit	Description	Instructional Hours
I	**Digital Image Fundamentals.** Introduction: Digital Image- Steps of Digital Image Processing Systems-Elements of Visual Perception -Connectivity and Relations between Pixels. Simple Operations- Arithmetic, Logical, Geometric Operations. Mathematical Preliminaries - 2D Linear Space Invariant Systems - 2D Convolution - Correlation 2D Random Sequence - 2D Spectrum.	9
II	**Image Transforms and Enhancement.** Image Transforms: 2D Orthogonal and Unitary Transforms-Properties and Examples. 2D DFT-FFT – DCT -Hadamard Transform - Haar Transform - Slant Transform - KL Transform - Properties And Examples.Image Enhancement:- Histogram Equalization Technique- Point Processing-Spatial Filtering-In Space And Frequency - Nonlinear Filtering-Use Of Different Masks.	9
III	**Image restoration and construction.** Image Restoration: Image Observation And Degradation Model, Circulant And Block Circulant Matrices and Its Application In Degradation Model - Algebraic Approach to Restoration-Inverse By Wiener Filtering – Generalized Inverse-SVD and Interactive Methods - Blind Deconvolution-Image Reconstruction From Projections.	9
IV	**Image compression & segmentation** Image Compression: Redundancy And Compression Models -Loss Less And Lossy. Loss Less-Variable-Length, Huffman, Arithmetic Coding - Bit-Plane Coding, Loss Less Predictive Coding, LossyTransform (DCT) Based Coding, JPEG Standard - Sub Band Coding. Image Segmentation: Edge Detection - Line Detection - Curve Detection - Edge Linking And Boundary Extraction, Boundary Representation, Region Representation And Segmentation, Morphology-Dilation, Erosion, Opening And Closing. Hit And Miss Algorithms Feature Analysis	9
V	**Color and multispectral image processing** Color Image-Processing Fundamentals, RGB Models, HSI Models, Relationship Between Different Models. Multispectral Image Analysis - Color Image Processing Three Dimensional Image Processing-Computerized Axial Tomography-Stereometry-Stereoscopic Image Display-Shaded Surface Display.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

COURSE OUTCOME

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

CO1: Identify various arithmetic and geometrical operations of image fundamental.
CO2: Analyze the operation Image transforms and Enhancement.
CO3: Design Image compression and restoration techniques.
CO4: Design the Image compression and Segmentation.
CO5: Create models for color and multispectral image processing.

TEXT BOOKS:

T1 Digital Image Processing, Gonzalez.R.C & Woods. R.E., 3/e, Pearson Education, 2008.
T2 Digital Image Processing, Kenneth R Castleman, Pearson Education,1995.

REFERENCES:

R1 1. Digital Image Procesing, S. Jayaraman, S. Esakkirajan, T. Veerakumar, McGraw Hill Education ,2009
R2 2.Fundamentals of Digital image Processing, Anil Jain.K, Prentice Hall of India, 1989.
R3 3.Image Processing, Sid Ahmed, McGraw Hill, New York, 1995
R4 4.Image Processing: The Fundamentals, Maria Petrou,Costas Petrou,Wiley,2010

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE1204	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.	20AE1001	ELECTRONIC SYSTEM DESIGN 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	Study of different interfaces (using Embedded Microcontroller).
2	Flash Controller Programming Data flash, with erase, verify and Fusing.
3	Design of Wireless Data Modem.
4	PCB layout design using CAD tool.
5	Design of Process Control Timer.
6	Design of AC/DC voltage regulator using SCR.
7	Design of an Instrumentation Amplifier.
8	Implementation of Adaptive filters and multistage multi-rate system in DSP processor.
9	Sensor design using simulation tools.
10	Design of Temperature sensor using Instrumentation Amplifier.

Total Practical Hours 45

Course Outcome

CO1: Design various analog / digital transceiver systems and control different process.
CO2: Analyze flash controller programming and wireless data modem.
CO3: Analyze PCB designing for various circuits.
CO4: Propose interfaces using modulator and demodulator.
CO5: Design and analysis of operational and instrumentation amplifiers.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE1002	EMBEDDED SYSTEMS LABORATORY	0	0	4	2

Course Objective

1. Impart the knowledge on various analog / digital transceiver systems and control different process.
2. Design system using 8086 and 8051 Microcontroller.
3. Study and design wireless network using embedded systems.
4. Study the different interfaces using Embedded Microcontroller.
5. Intend and analysis of real time operating system.

Expt. No.	Description of the experiments
1	System design using PIC Micro controller and its applications.
2	Testing of RTOS environment and system programming using ARM7 Processor.
3	System design using 8051 Micro Controller, 8086 Micro Processor.
4	RTC using PIC Micro Controller.
5	Elevator controller using PIC Micro Controller.
6	Modern Train Controller using PIC micro controller.
7	Study of MSP430 and 8086-16 bit Microprocessor its applications
8	Designing of Wireless Network using Embedded System.
9	Sensor design using simulation tools.
10	Study of 32 bit ARM7 microcontroller RTOS and its applications

Total Practical Hours 45

Course Outcome

CO1: Design various analog / digital transceiver systems and control different process.
CO2: Propose interfaces using embedded Microcontroller.
CO3: Experiment Wireless Network Using Embedded Systems.
CO4: Analyze the system using 8086 and 8051 Microcontroller.
CO5: Design and Analysis of Real Time Operating System

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SEMESTER-II

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE2201	ANALOG INTEGRATED CIRCUIT DESIGN	3	0	0	3

Course Objectives

1. Design the single stage amplifiers using pmos and nmos driver circuits with different loads.
2. Analyze high frequency concepts of single stage amplifiers and noise characteristics associated with differential amplifiers.
3. Study the different types of current mirrors and to know the concepts of voltage and current reference circuits.
4. Gain the various applications in operational amplifier.
5. Learn the different concepts in stability and frequency compensation

Unit	Description	Instructional hours
I	**SINGLE STAGE AMPLIFIERS** Basic MOS physics and equivalent circuits and models, CS, CG and Source Follower differential with active load, Cascode and folded cascode configurations with active load, Design of differential and cascode amplifiers – to meet specified SR, noise, gain, BW, ICMR and power dissipation, voltage swing, High gain amplifier, structures.	9
II	**HIGH FREQUENCY AND NOISE OF CHARACTERISTICS AMPLIFIERS** Miller effect, association of poles with nodes, frequency response of CS, CG and source follower, cascode and differential pair stages, Statistical characteristics of noise, noise in single stage amplifiers, noise in differential amplifiers.	9
III	**FEEDBACK AND ONE STAGE OPERATIONAL AMPLIFIERS** Properties and types of negative feedback circuits, effect of loading in feedback networks, operational amplifier performance parameters, One-stage Op Amps, Two-stage Op Amps, Input range limitations, Gain boosting, slew rate, power supply rejection, noise in Op Amps.	9
IV	**STABILITY AND FREQUENCY COMPENSATION OF TWO STAGE AMPLIFIER** Analysis of two stage Op amp – two stage Op amp single stage CMOS Cs as second stage and using cascode second stage, multiple systems, Phase Margin, Frequency Compensation, and Compensation of two stage Op Amps, Slewing in two stage Op Amps, Other compensation techniques.	9
V	**BANDGAP REFERENCES** Current sinks and sources, Current mirrors, Wilson current source, Wildar current source, Cascode current source, Design of high swing cascode sink, current amplifiers, Supply independent biasing, temperature independent references, PTAT and CTAT current generation, Constant-Gm Biasing.	9
	Total instructional hours	**45**

Course Outcomes

CO1: Design and analysis of amplifiers.
CO2: Aquire of frequency response and noise analysis.
CO3: Familiarize the Operational Amplifiers.
CO4: Compose different types of Biasing Circuits.
CO5: Gain knowledge about the engineering applications of Analog Integrated Circuits

TEXT BOOKS:

T1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, 2001
T2. Willey M.C. Sansen, "Analog Design Essentials", Springer, 2006.

REFERENCE BOOKS:

R1. Grebene, "Bipolar and MOS Analog Integrated Circuit Design", John Wiley & sons,Inc.,2003.
R2. Phillip E.Allen, Douglas R.Holberg, "CMOS Analog Circuit Design", Oxford University Press, 2nd Edition, 2002.
R3. Jacob Baker "CMOS: Circuit Design, Layout, and Simulation", Wiley IEEE Press, 3rd Edition, 2010..

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE2202	VLSI DESIGN TECHNIQUES	3	0	0	3

COURSE OBJECTIVE

To impart knowledge on

1. To understand the fundamentals of MOS transistor theory.
2. To analyze and design the CMOS technologies.
3. To study and discuss characteristics and performance estimation.
4. To study and understand the VLSI system components.
5. To understand Verilog programming.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO MOS TRANSISTOR THEORY** MOS transistors, CMOS logic, MOS transistor theory–Introduction, Enhancement mode transistor action, Ideal I-V characteristics, Simple MOS capacitance Models, Detailed MOS gate capacitance model, Detailed MOS Diffusion capacitance model,Non ideal I-V effects, DC transfer characteristics, VLSI Design flow	9
II	**CMOS TECHNOLOGY AND DESIGN RULE** CMOS fabrication and Layout, CMOS technologies, P-Well process, N-Well process, twin-tub process, MOSlayers stick diagrams and Layout diagram, Layout design rules, Latch up in CMOS circuits, CMOS process enhancements, Technology–related CAD issues, Fabrication and packaging.	9
III	**CIRCUIT CHARACTERISATION & PERFORMANCE ESTIMATION** Determination of Pull-up to Pull-down ratio for NMOS inverter, super buffers, Driving large capacitance loads,Circuits families, transmission gates, Delay estimation, Power dissipation, Design margin, Scaling of MOSCircuits.	9
IV	**VLSI SYSTEM COMPONENTS CIRCUITS** Multiplexers, Decoders, comparators, priority encoders, Shift registers. Arithmetic circuits– Ripple carryadders, Carry look ahead adders, High-speed adders, Multiplier	9
V	**VERILOG HARDWARE DESCRIPTION LANGUAGE** Overview of digital design with Verilog HDL, hierarchical modeling concepts, basic concepts, modules and port definitions, gate level modeling, data flow modeling, behavioral modeling, task & functions, Test Bench.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

COURSE OUTCOME

CO1: Identify various MOS transistor theory
CO2: Analyze the CMOS technology and to design.
CO3: Design and analyze circuit characteristics and Performance.
CO4: Design the VLSI system components and circuits.
CO5: Create models using Verilog programming.

TEXT BOOKS:

T1 Neil H.E.Weste, David Harris and Ayan Banerjee, "CMOS VLSI Design a circuits and systems perspective, Third Edition, Pearson Education, 2010

T2 Douglas A.Pucknell and Kamran Eshraghian, "Basic VLSI Design", Third Edition, Prentice-Hall of India 2004.

REFERENCES:

R1 Samir Palnitkar, "Verilog HDL a Guide to Digital Design and Synthesis", Second Edition, Pearson Education, 2010.

R2 John P.Uyemura "Introductionto VLSI Circuits and Systems", Wiley India Edition, 2006.

R3 Neil H.E. Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Pearson Education ASIA, 2nd edition, 2000.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE2001	VLSI DESIGN LABORATORY	0	0	4	2

Course Objective

1. Learn new software tools for VLSI.
2. Study various design methods for VLSI circuits.
3. Gain the knowledge about circuit designing.
4. Analyze various applicationsusing VHDL and Verilog.
5. Analysis the digital system and simulator.

EXPT. No	Description of the Experiments
1.	Design and Simulation of Arithmetic /logic operator circuits using verilog/VHDL
2.	Design and 8-bit signed multiplication algorithm using verilog / VHDL
3.	Modeling of Combinational/Sequential Circuits Using Verilog HDL
4.	Simulation of Digital Circuits using Xilinx ISE.
5.	Design and Simulation of Digital Circuits using VHDL and Porting them into FPGA.
6.	Layout of Simple NMOS/CMOS Circuits.
7.	Analysis of Asynchronous and clocked synchronous sequential circuits.
8.	Design and Implementation of ALU in FPGA using VHDL and Verilog.
9.	Modeling of Sequential Digital system using Verilog and VHDL.
10.	Modeling of MAC unit using verilog / VHDL
	Total Practical Hours **45**

Course Outcome

CO1: Use the software tools for designing and simulation.
CO2: Design the various VLSI circuits using VHDL programming.
CO3: Familiarize the applications of VLSI circuits.
CO4: Analysis the MAC unit using verilog.
CO5: Design the VLSI circuits using Xillinx ISE tool.

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PROFESSIONAL ELECTIVE-I

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE2301	ADVANCED DIGITAL SIGNAL PROCESSING	3	0	0	3

COURSE OBJECTIVE

To impart knowledge on

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 Squaresmethod, 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 analysisof estimators – Unbiased consistent estimators - Periodogram estimator - Barlett spectrumestimation - 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 - Linearprediction, 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

REFERENCES:

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.	20AE2302	ADVANCED MICROPROCESSORS & MICROCONTROLLERS	3	0	0	3

Course Objective

1. To expose the students to the fundamentals of microprocessor architecture.
2. To explore the high performance features in CISC architecture
3. To familiarize the high performance features in RISC architecture
4. To introduce the basic features in Motorola microcontrollers.
5. To enable the students to understand PIC Microcontroller

Unit	Description	Instructional Hours
I	**MICROPROCESSOR ARCHITECTURE** Instruction Set – Data formats –Addressing modes – Memory hierarchy –register file – Cache – Virtual memory and paging – Segmentation- pipelining –the instruction pipeline – pipeline hazards – instruction level parallelism – reduced instruction set –Computer principles – RISC versus CISC.	9
II	**HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM** CPU Architecture- Bus Operations – Pipelining – Brach predication – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.	9
III	**HIGH PERFORMANCE RISC ARCHITECTURE – ARM** Organization of CPU – Bus architecture –Memory management unit - ARM instruction set- Thumb Instruction set- addressing modes – Programming the ARM processor.	9
IV	**MSP430 16 - BIT MICROCONTROLLER** The MSP430 Architecture- CPU Registers - Instruction Set, On-Chip Peripherals - MSP430 - Development Tools, ADC - PWM - UART - Timer Interrupts - System design using MSP430Microcontroller.	9
V	**PIC MICROCONTROLLER** CPU Architecture – Instruction set – interrupts- Timers- I2C Interfacing –UART- A/D Converter – PWM and introduction to C-Compilers.	9
	Total Instructional Hours	**45 Hours**

Course Outcome

CO1: To understand the fundamentals of microprocessor architecture.
CO2: To know and appreciate the high performance features in CISC architecture.
CO3: To know and appreciate the high performance features in RISC architecture.
CO4: To perceive the basic features in Motorola microcontrollers.
CO5: To interpret and understand PIC Microcontroller.

TEXT BOOKS:

T1. Daniel Tabak , "Advanced Microprocessors", McGraw Hill.Inc., 1995.
T2. James L. Antonakos , "The Pentium Microprocessor" Pearson Education, 1997.

REFERENCE BOOKS:

R1. Steve Furber, "ARM System – On – Chip architecture", Addision Wesley, 2000.
R2. Andrew N.Sloss, Dominic Symes and Chris Wright "ARM System Developer's Guide : Designing and Optimizing System Software", First edition, Morgan Kaufmann Publishers, 2004.
R3 John. B. Peatman, "Design with PIC Microcontroller", Prentice hall, 1997.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE2303	ASIC AND FPGA DESIGN	3	0	0	3

Course Objective

1. Describe the design flow of different types of ASIC and PLD
2. Gain knowledge about floor planning, placement and routing in ASIC
3. Implement the digital design using Verilog and VHDL
4. Infer the architecture of different types of FPGA
5. Describe the design issues of SOC

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 , FPGA Design : FPGA Physical Design Tools -Technology Mapping - Placement & Routing - Register Transfer (RT) / Logic Synthesis - Controller/Data Path Synthesis - Logic Minimization	9
V	**SOC DESIGN** Design Methodologies – Processes and Flows - Embedded Software Development for SOC - Techniques for SOC Testing – Configurable SOC – Hardware / Software CoDesign - Case studies: Digital Camera, Bluetooth Radio / Modem, SDRAM and USB.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Summarize the concepts of ASIC and PLD
CO2: Apply the different high performance algorithms in ASICs
CO3: Demonstrate the synthesis, simulation and testing of digital systems
CO4: Outline the different architectures of FPGA
CO5: Discuss the design issues of SOC

TEXT BOOKS:

T1 - David A.Hodges, Analysis and Design of Digital Integrated Circuits ,3rd Edition, Tata Mc Graw Hill , 2004.
T2 - M.J.S. Smith: Application Specific Integrated Circuits, Pearson, 2003.

REFERENCE BOOKS:

R1 - Parag.K.Lala, Digital System Design using Programmable Logic Devices, BSP, 2003.
R2 - Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
R3 - Sudeep Pasricha and NikilDutt, On-Chip Communication Architectures System on Chip Interconnect, Elsevier,2008.
R4 - Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003.

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PROFESSIONAL ELECTIVE-II

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE2304	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.	20AE2305	CAD FOR VLSI DESIGN	3	0	0	3

Course Objective

1. Recall the various physical design methods in VLSI.
2. Understand the concepts behind the VLSI design rules.
3. Infer the concept of floor planning and routing techniques.
4. Interpret the simulation techniques at various levels in VLSI design flow.
5. Illustrate the concepts of various algorithms used for floor planning and routing techniques.

Unit	Description	Instructional Hours
I	**VLSI DESIGN METHODOLOGIES** Introduction to VLSI Design methodologies, Basics of VLSI design automation tools, Algorithmic Graph Theory and Computational Complexity, Tractable and Intractable problems, General purpose methods for combinatorial optimization.	9
II	**DESIGN RULES** Layout Compaction-Design rules-problem formulation-algorithms for constraint graph compaction-placement and partitioning-Circuit representation-Placement algorithms-partitioning	9
III	**FLOOR PLANNING** Floor planning concepts, Shape functions and floorplan sizing, Types of local routing problems, Area routing, Channel routing, Global routing, Algorithms for global routing.	9
IV	**SIMULATION AND LOGIC SYNTHESIS** Simulation, Gate-level modeling and simulation, Switch-level modeling and simulation, Combinational Logic Synthesis, Binary Decision Diagrams, Two Level Logic Synthesis.	9
V	**HIGH LEVEL SYNTHESIS** Hardware models for high level synthesis, internal representation, allocation, assignment and scheduling, scheduling algorithms, Assignment problem, High level transformations.	9
	Total Instructional Hours	**45 Hours**

Course Outcome

CO1: Summarize the various physical design methods in VLSI
CO2: Apply the various VLSI design rules.
CO3: Outline the concept of floor planning and routing
CO4: Demonstrate the concept of Simulation and Logic Synthesis
CO5: Discuss the hardware models for high level synthesis

TEXT BOOKS:

T1. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002.
T2. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.

REFERENCE BOOKS:

R1. Sadiq M. Sait, Habib Youssef, "VLSI Physical Design automation: Theory and Practice",World Scientific 1999.
R2. Steven M.Rubin, "Computer Aids for VLSI Design", Addison Wesley Publishing 1987.
R3. S.M. Sait and H. Youssef, "VLSI physical design automation: theory and practice", World Scientific Pub. Co., 1999.
R4. D.D. Gajski, N.D. Dutt, A.C. Wu and A.Y. Yin, "High-level synthesis: introduction to chip and system design", Kluwer Academic Publishers, 1992.

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PROGRAMME	COURSE CODE	PROFESSIONAL ELECTIVE-III NAME OF THE COURSE	L	T	P	C
M.E.	20AE2307	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 sucessapility	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.	20AE2308	WIRELESS ADHOC AND SENSOR NETWORKS	3	0	0	3

Course Objectives

1. To understand the basics of Ad-hoc & Sensor Networks.
2. To learn various fundamental and emerging protocols of all layers
3. To study about the issues pertaining to major obstacles in establishment and efficient management of Ad-hoc and sensor networks.
4. To understand the nature and applications of Ad-hoc and sensor networks.
5. To understand various security practices and protocols of Ad-hoc and Sensor Networks.

Unit	Description	Instructional Hours
I	**MAC & TCP IN AD HOC NETWORKS** Fundamentals of WLANs – IEEE 802.11 Architecture - Self configuration and Auto configuration-Issues in Ad-Hoc Wireless Networks – MAC Protocols for Ad-Hoc Wireless Networks – Contention Based Protocols - TCP over Ad-Hoc networks-TCP protocol overview - TCP and MANETs – Solutions for TCP over Ad-Hoc Networks.	9
II	**ROUTING IN AD HOC NETWORKS** Routing in Ad-Hoc Networks- Introduction-Topology based versus Position based Approaches-Proactive, Reactive, Hybrid Routing Approach-Principles and issues – Location services - DREAM – Quorums based location service – Grid – Forwarding strategies – Greedy packet forwarding – Restricted directional flooding- Hierarchical Routing- Issues and Challenges in providing QoS.	9
III	**MAC, ROUTING & QOS IN WIRELESS SENSOR NETWORKS** Introduction – Architecture - Single node architecture – Sensor network design considerations – Energy Efficient Design principles for WSNs – Protocols for WSN – Physical Layer : Transceiver Design considerations – MAC Layer Protocols – IEEE 802.15.4 Zigbee – Link Layer and Error Control issues - Routing Protocols – Mobile Nodes and Mobile Robots - Data Centric & Contention Based Networking – Transport Protocols & QOS – Congestion Control issues – Application Layer support	9
IV	**SENSOR MANAGEMENT** Sensor Management - Topology Control Protocols and Sensing Mode Selection Protocols - Time synchronization - Localization and positioning – Operating systems and Sensor Network programming – Sensor Network Simulators.	9
V	**SECURITY IN AD HOC AND SENSOR NETWORKS** Security in Ad-Hoc and Sensor networks – Key Distribution and Management – Software based Anti-tamper techniques – water marking techniques – Defense against routing attacks - Secure Adhoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Identify different issues in wireless ad hoc and sensor networks.
- CO2 Analyze protocols developed for ad hoc and sensor networks.
- CO3 Identify and address the security threats in ad hoc and sensor
- CO4 Establish a Sensor network environment for different type of applications.
- CO5 Understand the security in Ad hoc and Sensor networks

TEXT BOOKS:

T1 C.Siva Ram Murthy and B.S.Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2004.

T2 Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley and Sons, 2010.

REFERENCE BOOKS:

R1 Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition), World Scientific Publishing, 2011.

R2 C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2002.

R3 Holger Karl, Andrea's willig, "Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, Inc .2005.

R4 Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, "Ad Hoc Mobile Wireless Networks", Auerbach Publications, 2008.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE2309	ROBOTICS AND INTELLIGENT SYSTEMS	3	0	0	3

Course Objectives

1. To Teach the basic concepts in robotics.
2. To expose the various design aspects in robot grippers.
3. To make learn various drives and control systems.
4. To impart knowledge on machine vision systems.
5. To apply robot based concepts for automation

Unit	Description	Instructional Hours
I	**INTRODUCTION** Basic Concepts such as Definition, three laws, DOF, Misunderstood devices etc., Elements of Robotic Systems i.e. Robot anatomy, Classification, Associated parameters i.e. resolution, accuracy, repeatability, dexterity, compliance, RCC device, etc. Automation-Concept, Need, Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, introduction to automation productivity.	9
II	**ROBOT GRIPPERS** Types of Grippers, Design aspect for gripper, Force analysis for various basic gripper system. Sensors for Robots:- Characteristics of sensing devices, Selections of sensors, Classification and applications of sensors. Types of Sensors, Need for sensors and vision system in the working and control of a robot.	9
III	**DRIVES AND CONTROL SYSTEMS** Types of Drives, Actuators and its selection while designing a robot system. Types of transmission systems, Control Systems -Types of Controllers, Introduction to closed loop control .Control Technologies in Automation:- Industrial Control Systems, Process Industries Verses Discrete-Manufacturing Industries, Continuous Verses Discrete Control, Computer Process and its Forms. Control System Components such as Sensors, Actuators and others.	9
IV	**MACHINE VISION SYSTEM** Vision System Devices, Robot Programming: - Methods of robot programming, lead through programming, motion interpolation, branching capabilities, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages: Introduction to various types such as RAIL and VAL II etc, Features of type and development of languages for recent robot systems.	9
V	**MODELING AND SIMULATION FOR MANUFACTURING PLANT AUTOMATION** Introduction, need for system Modeling, Building Mathematical Model of a manufacturing Plant,Modern Tools- Artificial neural networks in manufacturing automation, AI in manufacturing,Fuzzy decision and control, robots and application of robots for automation.Artificial Intelligence:- Introduction to Artificial Intelligence, AI techniques, Need and application of AI. Other Topics in Robotics:- Socio-Economic aspect of robotisation. Economical aspects for robot design, Safety for robot and associated mass, New Trends & recent updates in robotics.	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Ability to implement simple concepts associated with Robotics and Automation
- CO2 Ability to use various Robotic sub-systems
- CO3 Ability to use kinematics and dynamics to design exact working pattern of robots
- CO4 Ability to implement computer vison algorithms for robots
- CO5 Be aware of the associated recent updates in Robotics

TEXT BOOKS:

T1 John J. Craig," Introduction to Robotics (Mechanics and Control)", Addison-Wesley, 2nd Edition, 2004

T2 Mikell P. Groover et. Al., "Industrial Robotics: Technology, Programming and Applications", McGraw – Hill International, 1986

REFERENCE BOOKS:

R1 Shimon Y. Nof , "Handbook of Industrial Robotics" , John Wiley Co,2001.

R2 Automation, "Production Systems and Computer Integrated Manufacturing", M.P. Groover, Pearson Education.

R3 Richard D. Klafter , Thomas A. Chemielewski, Michael Negin, "Robotic Engineering : An Integrated Approach" , Prentice Hall India, 2002.

R4 R.C. Dorf, "Handbook of design, manufacturing & Automation" John Wiley and Sons.

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SYLLABUS

SEMESTER-III

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE3901	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 life time learning.

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SEMESTER IV

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE4901	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 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 life time learning.

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PROFESSIONAL ELECTIVE IV

Programme	Course Code	Name of the Course	L	T	P	C
M.E.	20AE3301	INTELLIGENT SYSTEMS AND CONTROL	3	0	0	3

Course Objective

1. Introduce about Neural Networks.
2. Classify on various neural network.
3. To learn about Neuro controller
4. Gain knowledge about fuzzy system
5. Build application on fuzzy controller.

Unit	Description	Instructional Hours
I	**NEURAL NETWORKS – I** Linear Neural network, Multilayer Neural Network, Back Propagation Algorithm, Nonlinear system analysis part I, Nonlinear System Analysis part II , Radial basis function network, Adaptive learning rate, weight update rules, Recurrent Network back propagation through time, self-organizing map- Multidimensional network.	9
II	**NEURAL NETWORKS - II** Associative memory networks: Training algorithms for pattern association. Auto associative, Hetero associative, Hopfield and iterative auto associative memory networks. Unsupervised Learning networks: Fixed weight competitive nets, Kohenen self-organizing feature map	9
III	**NEURO CONTROLLER -III** Neural controller a review, Network Inversion and Control, Neural model for robot manipulator, Indirect adaptive controller of robot manipulator, Adaptive Neural for affine system SISO, MIMO, Visual motor co- ordination with KSOM. Direct adaptive controller of manipulator.	9
IV	**FUZZY SYSTEMS- I** Introduction to fuzzy logic, classical sets, Fuzzy sets. Fuzzy relations Fuzzy arithmetic and fuzzy measures - Fuzzy rule base and approximate reasoning, Fuzzy logic controller.	9
V	**FUZZY CONTROL -II** Fuzzy controller a review, Mamdani type flc and parameter optimization, Fuzzy controller for PH reactor, Fuzzy lyapunav controller- computing with words, Controller design for a T-S fuzzy model, Linear Controller using T-S fuzzy model.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Infer the concepts of Neural Networks.
CO2: Summarize the various neural networks architectures and its training algorithms
CO3: Design the neural network/fuzzy logic control for real time applications.
CO3: Discover the concept of fuzzy logic set theory.
CO4: Implement the fuzzy mechanism for suitable control problems.

TEXT BOOKS:

T1 Laurene V. Fausett, "Fundamentals of Neural Networks:Architectures, algorithms and applications", Pearson Education, New Delhi, 2004.
T2 Timothy J Ross, "Fuzzy Logic with Engineering Applications", John Willey and Sons, 2005.

REFERENCE BOOKS:

R1 S.N.Sivanandam & S.N Deepa., "Principles of soft computing" ,2nd edition, Wiley India Pvt Ltd , 2013.
R2 George J.Klir, Bo.Yuan, "Fuzzy Sets and Fuzzy logic: Theory and Applications", PHI Learning Pvt Ltd, 2012
R3 Zimmerman H.J., "Fuzzy set theory and its applications", Allied Publishers, 2001.
R4 -Jack M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishing Co, 2002

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE3302	AN INTRODUCTION TO ELECTRONICS SYSTEMS PACKAGING	3	0	0	3

Course Objectives

1. To introduce and discuss various issues related to the system packaging.
2. The course will discuss all the important facets of packaging at three major levels, namely, chip level, board level and system level.
3. The entire spectrum of microelectronic systems packaging from design to fabrication.
4. Current trends in packaging of electronic systems
5. Concepts of printed wiring board technologies, surface mount technology and embedded passives technology.

Unit	Description	Instructional Hours
I	**OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING** Introduction - Definition of a system and history of semiconductors - Products and levels of packaging - Packaging aspects of handheld products- - Definition of PWB - Basics of Semiconductor and Process flowchart, Wafer fabrication, inspection and testing, Wafer packaging; Packaging evolution; Chip connection choices, Wire bonding, TAB and flip chip	9
II	**SEMICONDUCTOR PACKAGES** Single chip packages or modules (SCM)- Commonly used packages and advanced packages; Materials in packages- Thermal mismatch in packages; Current trends in packaging- Multichip modules (MCM)-types;System-inpackage (SIP);Packaging roadmaps; Hybrid circuits-Electrical Design considerations in systems packaging-Resistive, Capacitive and Inductive Parasitics, Layout guidelines and the Reflection problem, Interconnection	9
III	**CAD FOR PRINTED WIRING BOARDS** Benefits from CAD; Introduction to DFM, DFR & DFT- Components of a CAD package and its highlights- Design Flow considerations;Beginning a circuit design with schematic work and component layout- examples of layout and routing- Technology file generation from CAD; DFM check list and design rules; Design for Reliability.	9
IV	**PRINTED WIRING BOARD TECHNOLOGIES** Review of CAD output files for PCB fabrication; Photo plotting and mask generation- Process flow-chart;Vias;PWB substrates- Substrates continued;Video highlights; Surface preparation-Photoresist and application methods; UV exposure and developing;Printing technologies for PWBs- PWB etching; Resist stripping;Screen-printing technology- Through-hole manufacture process steps; Panel and pattern plating methods- Video highlights on manufacturing;Solder mask for PWBs; Multilayer PWBs; Introduction to microvias.	9
V	**SURFACE MOUNT TECHNOLOGY** SMD benefits; Design issues; Introduction to soldering - Wave Soldering methods to attach SMDs - Wetting of solders; Flux and its properties; Defects in wave soldering - Vapour phase soldering,BGA soldering and Desoldering-SMT failures - Tin-lead and lead-free solders-Thermal profiles for reflow soldering; Lead-free alloys - Lead-free solder considerations-Green electronics; RoHS compliance and e-waste-Thermal Design considerations in systems packaging-Introduction to Embedded Passives Technology.	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Give a comprehensive introduction to the various packaging types used along with the associated thermal, speed, signal and integrity power issues.
- CO2 Enable design of packages which can withstand higher temperature, vibrations and shock
- CO3 Design of PCBs which minimize the EMI and operate at higher frequency
- CO4 Analyze the concepts of printed wiring board Technologies and Surface Mount Technology.
- CO5 Design of Embedded Passives Technology

TEXT BOOKS:

T1 Rao R. Tummala, "Fundamentals of Microsystems Packaging", McGraw Hill, NY, 2001

T2 Bosshart, Printed Circuit Boards Design and Technology, TataMcGraw Hill, 1988.

REFERENCE BOOKS:

R1 Blackwell (Ed), The electronic packaging handbook, CRC Press, 2000.

R2 Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.

R3 R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011

R4 R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE3303	IOT SYSTEM DESIGN AND SECURITY	3	0	0	3

Course Objectives

1. To understand the basics of IoT.
2. To get an idea about the various services provided by IoT.
3. To familiarize themselves with various communication techniques.
4. To get an idea of some application area where IoT can be applied.
5. To understand the various issues in IoT.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO INTERNET OF THINGS** Rise of the machines – Evolution of IoT – Web 3.0 view of IoT – Definition and characteristics of IoT – Physical design of IoT – Logical design of IoT – IoT enabling technologies – IoT levels and deployment templates – A panaromic view of IoT applications.	9
II	**ARCHITECTURE OF IoT** Identifaction and Access to objects and services in the IoT environment(Current technologies for IoT naming-Solutions proposed by research projects-Research and Future development trends and forecast) – Middleware technologies for IoT system (IoT Ecosystem Overview – Horizontal Architecture Approach for IoT Systems-SOA-based IoT Middleware)Middleware architecture of RFID,WSN,SCADA,M2M–Challenges Introduced by 5G in IoT Middleware(Technological Requirements of 5G Systems-5G-based IoT Services and Applications Requirements-5G-based Challenges for IoT Middleware) - Perspectives and a Middleware Approach Toward 5G (COMPaaS Middleware) – Resource management in IoT	9
III	**SECURITY CONSIDERATIONS IN IOT SMART AMBIENT SYSTEMS** Security in Smart Grids and Smart Spaces for Smooth IoT Deployment in 5G (5G and the Internet of Things-Smart Spaces-Smart Grids Security and Privacy - Services that Need to Be Secure - Security Requirements -Security Attacks-Security Measures and Ongoing Research) - Security Challenges in 5G-Based IoT Middleware Systems(Security in 5G-Based IoT Middleware-Security Challenges Toward 5G).	9
IV	**IOT ENABLERS AND THEIR SECURITY AND PRIVACY ISSUES** Internet of Things layer wise Protocols and Standards- EPC global (architecture, specifications, industry adaptation, security and vulnerabilities , advantages and disadvantages)WirelessHART-Zigbee-Near Field Communication-6LoWPAN-Dash7-Comparative Analysis.	9
V	**APPLICATIONS AND CASE STUDIES** Home automations - Smart cities – Environment – Energy – Retail – Logistics – Agriculture – Industry - Health and life style – Case study	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Articulate the main concepts, key technologies, strength and limitations of IoT. CO2:
- CO2 Identify the architecture, infrastructure models of IoT.
- CO3 Analyze the core issues of IoT such as security, privacy and interoperability.
- CO4 Analyze and design different models for network dynamics.
- CO5 Identify and design the new models for market strategic interaction.

TEXT BOOKS:

T1 Honbo Zhou, "Internet of Things in the cloud:A middleware perspective", CRC press 2012.

T2 Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", VPT, 1st Edition, 2014

REFERENCE BOOKS:

R1 Constandinos X. Mavromoustakis, George Mastorakis, Jordi Mongay Batalla, "Internet of Things (IoT) in 5G Mobile Technologies" Springer International Publishing, Switzerland, 2016.

R2 Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer-Verlag Berlin Heidelberg, 2011.

R3 http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

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PROFESSIONAL ELECTIVE V

PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE3304	HARDWARE - SOFTWARE CO-DESIGN	3	0	0	3

Course Objectives

1. To acquire the knowledge about system specification and modeling.
2. To learn the formulation of partitioning
3. To analyze about co-synthesis
4. To study the different technical aspects about prototyping and emulation.
5. To formulate the design specification and validate its functionality by simulation.

Unit	Description	Instructional Hours
I	**SYSTEM SPECIFICATION AND MODELLING** Embedded Systems, Hardware/Software Co-Design, Co-Design for System Specification and Modelling, Co-Design for Heterogeneous Implementation - Processor Synthe Single-Processor Architectures with one ASIC, Single-Processor Architectures with many ASICs, Multi-Processor Architectures, Comparison of Co- Design Approaches, Models of Computation, Requirements for Embedded System Specification.	9
II	**HARDWARE/SOFTWARE PARTITIONING** The Hardware/Software Partitioning Problem, Hardware-Software Cost Estimation, Generation of the Partitioning Graph, Formulation of the HW/SW Partitioning Problem , Optimization , HW /SW Partitioning based on Heuristic Scheduling, HW /SW Partitioning based on Genetic Algorithms .	9
III	**HARDWARE/SOFTWARE CO-SYNTHESIS** The Co-Synthesis Problem, State-Transition Graph, Refinement and Controller Generation, Distributed System Co-Synthesis	9
IV	**PROTOTYPING AND EMULATION** Introduction, Prototyping and Emulation Techniques, Prototyping and Emulation Environments ,Future Developments in Emulation and Prototyping ,Target Architecture-Architecture Specialization Techniques ,System Communication Infrastructure, Target Architectures and Application System Classes, Architectures for Control-Dominated Systems, Architectures for Data-Dominated Systems ,Mixed Systems and Less Specialized Systems	9
V	**DESIGN SPECIFICATION AND VERIFICATION** Concurrency, Coordinating Concurrent Computations, Interfacing Components, Verification, Languages for System-Level Specification and Design System-Level Specification, Design Representation for System Level Synthesis, System Level Specification Languages, Heterogeneous Specification and Multi-Language Co- simulation	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 To outline and apply design methodologies
- CO2 To appreciate the fundamental building blocks of the using hardware and software co-design
- CO3 To implementation and testing environments and techniques and their inter-relationships
- CO4 To modern hardware/software tools for building prototypes
- CO5 To demonstrate practical competence in these areas.

TEXT BOOKS:

T1 Jorgen Staunstrup, "Hardware / Software Co- Design Principles and Practice", Wayne Wolf – 2009, Springer

T2 Giovanni De Micheli, Mariagiovanna Sami, "Hardware / Software Co- Design", 2002, Kluwer Academic Publishers

REFERENCE BOOKS:

R1 Patrick R. Schaumont, "A Practical Introduction to Hardware/Software Co-design", 2010, Springer

R2 Ralf Niemann , "Hardware/Software Co-Design for Data Flow Dominated Embedded Systems", Kluwer Academic Pub, 1998.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE3305	ELECTRONICS FOR SOLAR POWER	3	0	0	3

Course Objectives

1. Study the behavior of photovoltaic solar energy systems, focusing on the behavior of "stand-alone" systems.
2. Do a first order, conceptual design of a stand-alone system for a location anywhere in India
3. Introduce the hardware elements and their behavior.
4. Select battery for a PV system and battery sizing
5. Simulate standalone and grid tied PV system

Unit	Description	Instructional Hours
I	**INTRODUCTION TO SOLAR POWER** Semiconductor – properties - energy levels - basic equations of semiconductor devices physics - Basic characteristics of sunlight - Solar angles - day length - angle of incidence on tilted surface – Sun path diagrams – Equivalent circuit of PV cell, PV cell characteristics (VI curve, PV curve) - Maximum power point, Vmp, IMP, Voc, ISC – types of PV cell - Block diagram of solar photo voltaic system, PV array sizing.	9
II	**DC-DC CONVERTER** Principles of step-down and step-up converters – Analysis and design issues of buck, boost, buckboost and Cuk converters – time ratio and current limit control – Full bridge converter – Resonant and quasi – resonant converters.	9
III	**MAXIMUM POWER POINT TRACKING** Direct Energy transmission, Impedance Matching, Maximum Power Point Tracking (MPPT) - Function of MPPT, P&O method, INC Method, Fractional Open circuit voltage method, Fractional short circuit current method, parasitic capacitance and other MPPT techniques, Development of hardware, algorithms using processors for Standalone and Grid tied systems.	9
IV	**BATTERY** Types of Battery, Battery Capacity – Units of Battery Capacity-impact of charging and discharging rate on battery capacity-Columbic efficiency-Voltage Efficiency, Charging – Charge Efficiency, Charging methods, State of Charge, Charging Rates, Discharging - Depth of discharge-Discharge Methods, Circuits for Battery Management System (BMS), selection of Battery and sizing.	9
V	**SIMULATION OF PV MODULE & CONVERTERS** Simulation of PV module - VI Plot, PV Plot, finding VMP, IMP, Voc, Isc of PV module, Simulation of DC to DC converter -buck, boost, buck-boost and Cuk converters, standalone and grid tied photo voltaic system.	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Ability to collect solar power characteristics at a given location
- CO2 Ability to design and realize dc-dc converters for solar power utilization
- CO3 Ability to design algorithms for improving solar power utilization
- CO4 Ability to deal with battery issues and selection
- CO5 Ability to design and simulate PV systems to validate its performance.

TEXT BOOKS:

T1 Chetan Singh Solanki, "Solar Photovoltaic: Fundamentals, Technologies and Applications", PHI Ltd., 2013.

T2 Tommarkvart, Luis castaner, "Solar cells; materials, manufacture and operation", Elsevier, 2005.

REFERENCE BOOKS:

R1 G.D .Rai, "Solar energy utilization ", Khanna publishes, 1993.

R2 Ned Mohan, Undeland and Robbin, "Power Electronics: converters, Application and Design", John Wiley and sons.Inc, Newyork, 1995.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE3306	PCB DESIGN AND FABRICATION	3	0	0	3

Course Objectives

1. To expose the students to the basics of PCB design
2. To lead the new users of the software through a very simple design
3. To address the mechanical aspect of PCB design and to aid in understanding the design issues, manufacturing processes
4. To address the electrical aspect of PCB design
5. To expose the students to the state of art technology in PCB design and manufacturing.

Unit	Description	Instructional Hours
I	**BASICS OF PCB DESIGN AND TOOLS** Printed Circuit Board Fabrication- PCB cores and layer stack-up. PCB fabrication process- Photolithography and chemical etching, Mechanical Layer registration. Function of the Layout in the PCB Design Process. Design Files Created by Layout - Layout format files, Post process (Gerber) files, PCB assembly layers and files. Introduction to the Standards Organizations, Classes and Types of PCBs.	9
II	**PCB DESIGN FLOW USING CAD TOOL** Overview of Computer-Aided Design. Project structures and the layout toolset- Project Setup and Schematic Entry Details, the Layout Environment and Tool Set. Creating a Circuit Design with Capture-Starting a new project placing parts, Wiring (connecting) the parts, creating the Layout netlist in Capture. Designing the PCB with Layout- Starting Layout and importing the netlist, Performing a design rule check, Making a board outline, Placing the parts, Auto routing the board Manual routing, Cleanup Locking traces, Post processing the board design for manufacturing.	9
III	**DESIGN FOR MANUFACTURING** PCB Assembly and Soldering Processes- Component Placement and Orientation Guide, Component Spacing for Through-hole Devices. Component Spacing for Surface Mounted Devices SMDs, Mixed THD and SMD Spacing Requirements. Footprint and Padstack Design for PCB Manufacturability- Land Patterns for Surface-Mounted Devices- Land Patterns for Through-hole Devices, Padstack design, Hole-to-lead ratio, PTH land dimension (annular ring width), Clearance between plane layers and PTHs Soldermask and solder paste dimensions.	9
IV	**PCB DESIGN FOR SIGNAL INTEGRITY** Circuit Design Issues Not Related to PCB Layout, Issues Related to PCB Layout, Ground Planes and Ground Bounce, PCB Electrical Characteristics, PCB Routing Topics, Making and editing capture parts, The Capture Part Libraries, Types of Packaging, Pins, Part Editing Tools, Constructing Capture Parts, making and editing layout footprints.	9
V	**EMERGING ADDITIVE PROCESSES FOR PCB MANUFACTURING** Fundamentals of additive manufacturing, classification, advantages and standards on Additive manufacturing. Stereo lithography (SL), Stereo lithography (SL), Fused Deposition Modelling (FDM), Three Dimensional Printing (3DP), Materials, Applications. Voltera-V-one PCB double side Printer, Bot Factory- SV2-multi layer PCB printer, LPKF circuit board plotter and LDS Prototyping.	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 To understand the basics, industry standards organizations related to the design and fabrication of PCBs.
- CO2 Leads new users of the software through a very simple design
- CO3 To know and guide in designing plated through-holes, surface-mount lands, and Layout footprints in general.
- CO4 To know to construct Capture parts using the Capture Library Manager and Part Editor and the PSpice Model Editor.
- CO5 To understand and to fabricate PCBs

TEXT BOOKS:

T1 Kraig Mitzner, "Complete PCB Design Using OrCad Capture and Layout", Newness, 1st Edition, 2009.

T2 Simon Monk, "Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards", McGraw-Hill Education TAB; 2nd Edition, 2017.

REFERENCE BOOKS:

R1 Douglas Brooks, "Signal Integrity Issues and Printed Circuit Board Design", Prentice Hall PTR, 2003.

R2 Lee W. Ritchey , John Zasio, Kella J. Knack, "Right the First Time: a Practical Handbook on High Speed PCB and System Design", Speeding Edge , 2003.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE3401	ROBOTICS	3	0	0	3

Course Objectives

1. Understand robot locomotion and mobile robot kinematics.
2. Articulate perception in robotics
3. Outline mobile robot localization.
4. Understand mobile robot mapping.
5. Explain robot planning and navigation.

Unit	Description	Instructional Hours
I	**LOCOMOTION AND KINEMATICS** Introduction to Robotics – key issues in robot locomotion – legged robots – wheeled mobile robots – aerial mobile robots – introduction to kinematics – kinematics models and constraints – robot maneuverability	9
II	**ROBOT PERCEPTION** Sensors for mobile robots – vision for robotics – cameras – image formation – structure from stereo – structure from motion – optical flow – color tracking – place recognition – range data sensors, linear variable differential transformers (LVDT), Hall Effect sensors.	9
III	**MOBILE ROBOT LOCALIZATION** Introduction to localization – challenges in localization – localization and navigation – belief representation – map representation – probabilistic map-based localization – Markov localization – EKF localization – UKF localization – Grid localization – Monte Carlo localization – localization in dynamic environments	9
IV	**MOBILE ROBOT MAPPING** Autonomous map building – occupancy grip mapping – MAP occupancy mapping – SLAM – extended Kalman Filter SLAM – graph-based SLAM – particle filter SLAM – sparse extended information filter – fast SLAM algorithm.	9
V	**PLANNING AND NAVIGATION** Introduction to planning and navigation – planning and reacting – path planning – obstacle avoidance techniques – navigation architectures – basic exploration algorithms	9
	Total Instructional Hours	45

Course Outcomes

CO1: Understand robot locomotion and mobile robot kinematics.
CO2: Understand perception in robotics.
CO3: Apply robot localization techniques.
CO4: Apply robot mapping techniques.
CO5: Explain planning and navigation in robotics.

TEXT BOOKS:

T1. Gregory Dudekand Michael Jenkin, "Computational Principles of Mobile Robotics", Second Edition, Cambridge University Press, 2010.
T2. Howie Choset et al., "Principles of Robot Motion: Theory, Algorithms, and Implementations", A Bradford Book, 2005.

REFERENCE BOOKS:

R1. Maja J. Mataric, "The Robotics Primer", MIT Press, 2007.
R2. Roland Seigwart, "Introduction to autonomous mobile robots", Second Edition, MIT Press, 2011.
R3. Sebastian Thrun, Wolfram Burgard, and Dieter Fox, "Probabilistic Robotics", MIT Press, 2005.
R4. Mikell.P.Groover, "Industrial Robotics – Technology, Programming and applications", Tata McGraw Hill 2008.

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PROGRAMME	COURSE CODE	NAME OF THE COURSE	L	T	P	C
M.E.	20AE3402	ARTIFICIAL INTELLIGENCE AND OPTIMIZATION TECHNIQUES	3	0	0	3

Course Objectives

1. To introduce the techniques of computational methods inspired by nature, such as neural networks, genetic algorithms and other evolutionary computation systems, ant swarm optimization and artificial immune systems.
2. To present main rules underlying in these techniques.
3. To present selected case studies.
4. To adopt these techniques in solving problems in the real world.

Unit	Description	Instructional Hours
I	**NEURAL NETWORKS** Neural Networks: Back Propagation Network, generalized delta rule, Radial Basis Function Network, interpolation and approximation RBFNS, comparison between RBFN and BPN, Support Vector Machines: Optimal hyperplane for linearly separable patterns, optimal hyperplane for nonlinearly separable patterns, Inverse Modeling.	9
II	**FUZZY LOGIC SYSTEMS** Fuzzy Logic System: Basic of fuzzy logic theory , crisp and fuzzy sets, Basic set operation like union , interaction , complement , T-norm , T-conorm , composition of fuzzy relations, fuzzy if-then rules , fuzzy reasoning, Neuro-Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference System (ANFIS) , ANFIS architecture , Hybrid Learning Algorithm.	9
III	**EVOLUTIONARY COMPUTATION & GENETIC ALGORITHMS** Evolutionary Computation (EC) – Features of EC – Classification of EC – Advantages – Applications. Genetic Algorithms: Introduction – Biological Background – Operators in GA-GA Algorithm – Classification of GA – Applications	9
IV	**ANT COLONY OPTIMIZATION** Ant Colony Optimization: Introduction – From real to artificial ants- Theoretical considerations – Convergence proofs – ACO Algorithm – ACO and model based search – Application principles of ACO.	9
V	**PARTICLE SWARM OPTIMIZATION** Particle Swarm Optimization: Introduction – Principles of bird flocking and fish schooling – Evolution of PSO – Operating principles – PSO Algorithm – Neighborhood Topologies – Convergence criteria – Applications of PSO, Honey Bee Social Foraging Algorithms, Bacterial Foraging Optimization Algorithm.	9
	Total Instructional Hours	45

Course Outcomes

CO1: Ability to design and train neural networks with different rules
CO2: Ability to devise fuzzy logic rules
CO3: Ability to implement genetic algorithms
CO4: Ability to implement ANT colony optimization technique for various problems
CO5: Ability to use PSO technique

TEXT BOOKS:

T1 David E. Goldberg, "Genetic Algorithms in search, Optimization & Machine Learning", Pearson Education, 2006
T2 Christopher M. Bishop, "Neural Networks for Pattern Recognition", Oxford University Press, 1995

REFERENCE BOOKS:

R1 N P Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2005.
R2 Engelbrecht, A.P., "Fundamentals of Computational Swarm Intelligence", Wiley, 2005.
R3 Kenneth A DeJong,"Evolutionary Computation A Unified Approach", Prentice Hall of India, New Delhi, 2006.
R4 Marco Dorigo and Thomas Stutzle, "Ant Colony optimization", Prentice Hall of India, New Delhi, 2004.

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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
I	**INTRODUCTION** Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.	06
II	**REPERCUSSIONS OF DISASTERS AND HAZARDS** 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
III	**DISASTER PRONE AREAS IN INDIA** 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
IV	**DISASTER PREPAREDNESS AND MANAGEMENT** 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
V	**RISK ASSESSMENT** 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 based living.
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 and administrative.

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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