SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY :: PUTTUR

(AUTONOMOUS)

M.Tech. (Electronics and Communication Engineering)

Specialization: Embedded Systems

I M.Tech - I Sem

S.No	Course Code	Course Name	L	T	P	Credits
1	19HS0823	Research Methodology and IPR	2	-	-	2
2	19EC4101	Embedded System Design	3	-	-	3
3	19EC4102	Sensors and Actuators	3	-	-	3
Programme Elective - I						
4	19EC4103	Structural Digital System Design	3	-	-	3
	19EC4209	FPGA Architectures & Applications				
	19EC4104	Real Time Operating Systems				
Programme Elective - II						
5	19EC4105	Embedded Networking	3	-	-	3
	19EC4011	Wireless Communications				
	19EC4106	Internet Protocols				
6	19EC4107	Embedded System Design Lab	-	-	4	2
7	19EC4108	Structural Digital System Design Lab	-	-	4	2
Audit Course - I						
8	19HS0818	English for Research Paper Writing	2	-	-	-
Contact Periods / Week			16	-	8	18
			Total/Week: 24			

I M. Tech - II Sem

S.No	Course Code	Course Name	L	T	P	Credits
1	19EC4109	Introduction to IoT	3	-	-	3
2	19EC4110	Advanced Microcontrollers	3	-	-	3
Programme Elective - III						
3	19EC4111	Hardware Software Co-Design	3	-	-	3
	19EC4213	Testing & Testability				
	19EC4112	Micro Electromechanical Systems				
Programme Elective - IV						
4	19EC4201	VLSI Technology	3	-	-	3
	19EC4202	Digital IC Design				
	19EC4008	Wireless Sensor Networks				
5	19EC4113	Internet of Things Lab	-	-	4	2
6	19EC4114	Microcontrollers & Interfacing Lab	-	-	4	2
7	19EC4115	Mini Project	-	-	4	2
Audit Course - II						
8	19HS0829	Constitution of India	2	-	-	-
Contact periods / Week			14	-	12	18
			Total/Week:26			

II M. Tech. – I Sem

S.No	Course Code	Course Name	L	T	P	Credits
Programme Elective - V						
1	19EC4002	Advanced Digital Signal Processing	3	-	-	3
	19EC4116	Radio Frequency Identification				
	19EC4117	System on Chip Architecture				
Open Elective						
2	19HS0824	Business Analytics	3	-	-	3
	19CE1028	Cost Management of Engineering Projects				
	19EE2128	Waste to Energy				
	19ME3121	Industrial Safety				
	19ME3021	Advances in Operations Research				
	19ME3022	Composite Materials				
3	19EC4118	Dissertation Phase-I	-	-	20	10
Contact periods / Week			6	-	20	16
			Total/Week:26			

II M. Tech. – II Semester

S.No	Course Code	Course Name	L	T	P	Credits
1	19EC4119	Dissertation Phase -II	-	-	32	16
Contact periods / Week			Total/Week:32			16

NOTE: L- Lecture, T- Theory, P-Practical

LIST OF SUBJECTS

S. No	Course Code	Course Title
1.	19EC4101	Embedded System Design
2.	19EC4102	Sensors and Actuators
3.	19EC4103	Structural Digital System Design
4.	19EC4209	FPGA Architectures & Applications
5.	19EC4104	Real Time Operating Systems
6.	19EC4105	Embedded Networking
7.	19EC4011	Wireless Communications
8.	19EC4106	Internet Protocols
9.	19EC4107	Embedded System Design Lab
10.	19EC4108	Structural Digital System Design Lab
11.	19HS0823	Research Methodology and IPR
12.	19HS0818	English for Research Paper Writing
13.	19CE1029	Disaster Management
14.	19HS0825	Sanskrit for Technical Knowledge
15.	19HS0826	Value Education
16.	19EC4109	Introduction to IoT
17.	19EC4110	Advanced Microcontrollers
18.	19EC4111	Hardware Software Co-Design
19.	19EC4213	Testing & Testability
20.	19EC4112	Micro Electromechanical Systems
21.	19EC4201	VLSI Technology
22.	19EC4202	Digital IC Design
23.	19EC4008	Wireless Sensor Networks
24.	19EC4113	Internet of Things Lab
25.	19EC4114	Microcontrollers & Interfacing Lab
26.	19EC4115	Mini Project
27.	19HS0829	Constitution of India
28.	19HS0827	Pedagogy Studies
29.	19HS0828	Stress Management by Yoga
30.	19HS0819	Personality Development Through Life Enlightenment Skills.
31.	19EC4002	Advanced Digital Signal Processing
32.	19EC4116	Radio Frequency Identification
33.	19EC4117	System on Chip Architecture
34.	19HS0824	Business Analytics
35.	19CE1028	Cost Management of Engineering Projects
36.	19EE2128	Waste to Energy
37.	19ME3121	Industrial Safety
38.	19ME3021	Advances in Operations Research
39.	19ME3022	Composite Materials
40.	19EC4118	Dissertation Phase -I
41.	19EC4119	Dissertation Phase -II

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(19HS0823) RESEARCH METHODOLOGY AND IPR

COURSE OBJECTIVES
The objectives of this course:

1. *Understand some basic concepts of research and its methodologies*
2. *Identify appropriate research topics*
3. *Enrich knowledge to their research field*
4. *Process for filing Patent*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *Recognize appropriate research problem, errors in selecting a research problem, Scope and objectives of research*
2. *Critically assess research methods pertinent to technology innovation research*
3. *Identify, explain, compare, and prepare the key elements of a research proposal/report*
4. *Skill to understand the need of intellectual property rights, IPR protection to inventors*
5. *Develop procedural knowledge to Legal System and solving the problem relating to intellectual property rights for further research work and investment in R & D*

UNIT – I

Research: Meaning of research problem - Sources of research problem - Criteria - Characteristics ofa good research problem - Errors in selecting a research problem - Scope and objectives of research problem - Approaches of investigation of solutions for research problem - data collection, analysis, interpretation - Necessary instrumentations

UNIT – II

Literature survey in Research: Effective literature studies approaches - analysis - Plagiarism - Research ethics

UNIT – III

Project Report: Effective technical writing - how to write report – Paper - Developing a Research Proposal - Format of research proposal -A presentation and assessment by a review committee

UNIT – IV

Intellectual Property Rights: Nature of Intellectual Property – Patents, Designs, Trade and Copyrights - Process of Patenting and Development - Technological research, innovation, patenting, development - International Scenario - International cooperation on Intellectual Property - Procedure for grants of patents - Patenting under PCT

UNIT – V

Patent Rights: Scope of Patent Rights - Licensing and transfer of technology –Patentinformation and databases - Geographical Indications - New Developments in IPR - Administration of Patent System - New developments inIPR - IPR of Biological Systems, Computer Software - Traditional knowledge, Case Studies - IPR and IITs

TEXTBOOKS

1. CR Kothari, "*Research Methodology: Methods and Techniques*" 3rd Edition, New Age International(P) Limited, Publishers, 2013
2. Neeraj Pandey & Khushdeep Dharani, "*Intellectual Property Rights*" Eastern Economy Edition, PHI Learning Private Limited,

REFERENCES

1. John W. Creswell, "Research Design – Qualitative, Quantitative and Mixed Methods Approaches" 4th Edition, SAGE Publications, New Delhi 2014
2. Ranjit Kumar, , "*Research Methodology: A Step by Step Guide for beginners*" SAGE Publications, New Delhi, 4thEdition ,2014.
3. Ramakrishna B & Anil Kumar H.S, "*Fundamentals of Intellectual Property Rights- for students, Industrialist and Patent Lawyers*", First Published, Notion Press, Chennai, 2017.
4. Ahuja VK, "*Intellectual Property Rights in India*", Second Edition, Mittal Books India, 2015.
5. KC Kankanala, AK Narasani& V Radhakrishnan, "*Indian Patent Law and Practice*", Oxford India Paperbacks, Edition, 2012.

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(19EC4101)EMBEDDED SYSTEM DESIGN
(Common to ES & VLSI)

COURSE OBJECTIVES
The objectives of this course:

1. *Able to understand fundamentals of embedded systems.*
2. *Able to familiarize students with Embedded Computing Platform.*
3. *Able to learn various tools for design & development of embedded systems.*
4. *Able to understand the instruction set of various processors in embedded systems.*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *Apply and analyse the applications in various processors and domains of embedded system*
2. *Analyse and develop embedded hardware and software development cycles and tools.*
3. *Analyseand understand a microprocessor and core of the embedded system.*
4. *Analyse to understand different concepts of a RTOS, sensors, memory interface, and communication interface.*
5. *Solve real world problems by doing projects using embedded systems.*

UNIT – I
Introduction: Embedded System Overview - Embedded Hardware Units - Embedded Software ina System - Embedded System on Chip (SoC) - Design Process - Classification of Embedded Systems.

UNIT – II
Embedded Computing Platform: CPU Bus - Memory Devices - Component Interfacing - Networks for Embedded Systems - Communication Interfacings: RS232/UART (a), RS422/RS485 (b) &IEEE 488 Bus(c).
Survey of Software Architecture: Round Robin, Round Robin with Interrupts, Function Queue Scheduling Architecture, Selecting an Architecture Saving Memory Space.

UNIT – III
Embedded Software Development Tools: Host and Target Machines – Linkers - Locations for Embedded Software - Getting Embedded Software into Target System - Debugging Technique.
RTOS Concepts: Architecture of the kernel - Interrupt Service Routines - Semaphores, Message Queues - Pipes.

UNIT – IV
Instruction Sets: Introduction – Preliminaries - ARM Processor - SHARC Processor - System Design Techniques: Design Methodologies (a), Requirement Analysis (b), Specifications(c) & System Analysis and Architecture Design (d).

UNIT – V

Design Examples: Telephone PBX - Ink Jet Printer - Water Tank Monitoring System – GPRS - Personal Digital Assistants - Set Top Boxes.

TEXTBOOKS

1. Wayne Wolf**,***Computers as a component: principles of embedded computing system design*,The Morgan Kaufmann publications,1st Edition, 2001
2. David E.Simon**,** *Mechatronics,* Addison-Wesley Professional, 1st s Edition, 1999

REFERENCES

1. Sri Ram V Iyer, Pankajgupta, *Embedded real time systems programming,* Tata McGraw-Hill, 1st Edition, 2004
2. Frank Vahid, Ton D. Givargis**,** *Embedded system design a unified hardware/software introduction*,John Willey3rd Edition, 2009
3. KVKK Prasad,*Embedded / Real time systems*,Dreamtech press,1st Edition, 2005

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(19EC4102) SENSORS AND ACTUATORS

COURSE OBJECTIVES

The objectives of this course:

1. *Able to learn about sensor Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), and Characterization.*
2. *Able to know about different sensors like Thermal sensors, Magnetic sensors.*
3. *Able to know about Smart Sensors, Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for SmartSensor Interface and the Automation.*
4. *Able to understand basic laws and phenomena on which operation of sensors and actuators-transformation of energy is based.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Describe basic laws and phenomena that define behaviour of sensors and actuator.,*
2. *Analyse various premises, approaches, procedures and results related to sensors and actuators.*
3. *Create analytical design and development solutions for sensors and actuator.*
4. *Conduct experiments and measurements in laboratory and on real components, sensors and actuators.*
5. *Describe development and application of sensors and actuators,*
6. *Take part in team work and be able to independently present various professional materials.*

UNIT – I

Sensors/Transducers: Classification – Parameters – Characteristics - Environmental Parameters (EP) – Characterization Mechanical and Electromechanical Sensors: Introduction – Resistive Potentiometer – Strain Gauge Resistance – Strain Gauge – Semiconductor StrainGauges.

UNIT – II

Thermal Sensors: Introduction – Gas Thermometric Sensors – Thermal Expansion Type Thermometric Sensors – Acoustic Temperature Sensor – Dielectric Constant and Refractive Index Thermo sensors – Helium Low Temperature Thermometer – Nuclear Thermometer – Magnetic Thermometer – Resistance Change Type Thermometric Sensors –Thermo EMF Sensors– Junction Semiconductor Types– Thermal Radiation Sensors –Quartz Crystal Thermoelectric Sensors – NQR Thermometry – Spectroscopic Thermometry – Noise Thermometry.

UNIT – III

Radiation Sensors: Introduction, Basic Characteristics – Types of Photo sensistors/Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors Electro Analytical Sensors: Introduction – The Electrochemical Cell – The Cell Potential - Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Polarization – Concentration Polarization-– Reference Electrodes - Sensor Electrodes – Electro ceramics in Gasmedia.

UNIT – IV

Smart Sensors: Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation Sensors –Applications: Introduction – On-board Automobile Sensors (Automotive Sensors)– Home Appliance Sensors – Aerospace Sensors — Sensors for Manufacturing – Sensors for environmental Monitoring.

UNIT – V

Actuators: Pneumatic and Hydraulic Actuation Systems- Actuation systems – Pneumatic and Hydraulic systems - Directional Control valves – Pressure control valves – Cylinders - Servo and Proportional control valves – Process control valves – Rotary actuators Mechanical actuation Systems- Types of Motion – Kinematic chains – Cams – Gears – Ratchet and Pawl – Belt and Chain drives – Bearings.

TEXTBOOKS

1. D.Patranabis**,** *Sensors and Transducers,* PHI Learning Pvt Ltd, 3rdEdition, 2001
2. W.Bolton**,** *Mechatronics,* Pearson Education Limited, 3rdEdition, 2003

REFERENCES

1. D.Patranabis**,** *Sensors and Actuators,* PHI Learning Pvt Ltd, 3rdEdition, 2013
2. Manfred Kaltenbacher**,** *Numerical Simulation of Mechatronic Sensors and Actuators: Finite Elements for Computational Multiphysics,*Springer,3rdEdition, 2015
3. EvgeniGusev, Eric Garfunkel, and Arthur Dideikin**,** *Advanced Materials and Technologies for Micro/Nano-Devices, Sensors and Actuators*,Springer, 1stEdition, 2010

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I M.Tech – I Sem.

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(19EC4103) STRUCTURAL DIGITAL SYSTEM DESIGN
(Programme Elective-I)

COURSE OBJECTIVES
The objectives of this course:

1. *To study about structural functionality of different Digital blocks (Both combinational and Sequential)*
2. *To provide an exposure to ASM charts, their notations and their realizations.*
3. *To provide an exposure to VHDL and different styles of modelling using VHDL.*
4. *To introduce concept of micro programming and study issues related to micro programming*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *Understand structural functionality of different digital blocks*
2. *Represent their designs in ASM charts*
3. *Realize their designs in ASM charts*
4. *Represent their designs in different modelling styles by using VHDL*
5. *Understand concept of Micro program and issues related to micro programming*

UNIT – I
Building Blocks for Digital Design: Multiplexer - De-Multiplexer – Decoder – Encoder – Comparator – Adder – ALU - Carry-Look-Ahead Adder.
Building Blocks with Memory: Clocked Building Blocks&Register Building Blocks – RAM – ROM – PLA – PAL - Timing Devices.

UNIT – II
Design Methods: Elements of Design Style - Top-Down Design - Separation of Controller and Architecture - Refining Architecture and Control Algorithm - Algorithmic State Machines - ASM Chart Notations.

UNIT – III
Realizing ASMs: Traditional Synthesis from ASM Chart - Multiplexer Controller Method, One- Shot Method&ROM Based Method.
Asynchronous Inputs and Races: Asynchronous ASMs - Design for Testability - Test Vectors - Fault Analysis Tools.

UNIT – IV
Micro programed Design: Classical Microprogramming with Modem Technology - Enhancing the Control Unit - The 2910 Micro program Sequencer - Choosing a Micro Program Memory - A Development System for Microprogramming - Designing a Micro Programmed Minicomputer.

UNIT – V

Modeling with VHDL: CAD Tools – Simulators - Schematic Entry - Synthesis from VHDL.
Design Case Studies: Single Pulse - System Clock - Serial to Parallel Data Conversion - Traffic Light Controller.

TEXTBOOKS

1. Franklin P. Prosser and David E. Winkel, *The Art of Digital Design,*Prentice Hall,Subsequent Edition, 1987.
2. Charles H Roth, *Digital System Design using VHDL,* Mc. Graw Hill,

REFERENCES

1. William Fletcher, *An Engineering Approach to Digital Design*, PrenticeHall India, 1st Edition, 1997.
2. William J Dally and John W Poulton, *Digital Systems Engineering*, Cambridge University Press, 2008
3. Jayaram Bhasker**,** *A VHDL Primer*, 3rd edition, PrenticeHall India, 2009.
4. Kevin Skahill, *VHDL for Programmable Logic*, Cypress Semiconductors.

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(19EC4209) FPGA ARCHITECTURES & APPLICATIONS
(Programme Elective-I)

COURSE OBJECTIVES
The objectives of this course:

1. *Know FPGA Architecture, Interconnect and Technologies.*
2. *Know Different FPGA's and Implementation Methodologies.*
3. *Understand Configuring and Implementing Digital Embedded System, Microcontrollers, Microprocessors, FSM Systems on FPGA.*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *Acquire Knowledge about Various Architectures and Device Technologies Of PLD's*
2. *Comprehend FPGA Architectures.*
3. *Describe FSM and Different FSM Techniques like Petrinets & Different Case Studies.*
4. *Acquire Knowledge on Hot Design Method*
5. *Analyze System Level Design and Their Application for Combinational and Sequential Circuits*

UNIT – I
Programmable Logic: ROM, PLA, PAL, PLD, PGA – Features, Programming and Applications using Complex Programmable Logic Devices Altera Series – Max 5000/7000 Series and Altera FLEX Logic – 10000 Series CPLD, AMD's – CPLD (Mach 1 To 5); Cypres FLASH 370 Device Technology, Lattice PLSI's Architectures – 3000 Series – Speed Performance and in System Programmability.

UNIT – II
FPGA: Field Programmable Gate Arrays – Programming Technologies, Logic Blocks, Routing Architecture, Design Flow, Technology Mapping for FPGAs.

Case Studies: Xilinx XC4000 & ALTERA's FLEX 8000/10000 FPGAs: AT & T–ORCA's (Optimized Reconfigurable Cell Array): ACTEL's – ACT-1, 2, 3 and Their Speed Performance.

UNIT – III
Finite State Machines (FSM): Top Down Design – State Transition Table, State Assignments for FPGAs, Problem of Initial State Assignment for One Hot Encoding, Derivations of State Machine Charges.

Realization Of State Machine: Charts with a PAL, Alternative Realization for State Machine Chart using Microprogramming, Linked State Machines. One – Hot State Machine, Petrinets for State Machines – Basic Concepts, Properties, Extended Petrinets for Parallel Controllers. Finite State Machine Case study, Meta Stability, Synchronization.

UNIT – IV

FSM Architectures and Systems Level Design: Architectures Centered around Non-Registered PLDs. State Machine Designs Centered around Shift Registers, one – Hot Design Method, Use of ASMs in One – Hot Design, Application of One – Hot Method, System Level Design – Controller, Data Path and Functional Partition.

UNIT – V

Case Studies: Combinational Logic Circuits - Parallel Adder Cell, Parallel Adder Sequential Circuits - Decade Counters, Multipliers, Parallel Controller design

TEXTBOOKS

1. P.K.Chan & S. Mourad, Prentice Hall (Pte), *Digital Design Using Field Programmable Gate Array*, 1994.
2. S.Brown, R.Francis, J.Rose, Z.Vransic, "Field Programmable Gate Array", Kluwer Publications, 1992.

REFERENCES

1. J. Old Field, R.Dorf, "Field Programmable Gate Arrays", John Wiley & Sons, New York, 1995.
2. S.Trimberger, Edr,"Field Programmable Gate Array Technology", Kluwer Academic Publications, 1994.
3. Bob Zeidman, "Designing with FPGAs & CPLDs", CMP Books, 2002.

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(19EC4104) REAL TIME OPERATING SYSTEMS
(Programme Elective-I)

COURSE OBJECTIVES
The objectives of this course:

1. *To deal with issues in real time operating systems,*
2. *To understand the importance of deadlines and concept of task scheduling.*
3. *Student will be able to understand and design real time operating systems which are backbone of embedded industry.*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *Summarize the issues in real time computing*
2. *Explain and give examples of real time operating systems.*
3. *Solve scheduling problems and can apply them in real time applications in industry.*
4. *Design an RTOS and will be able to interpret the feasibility of a task set to accomplish or not.*
5. *Analyse the situation of fault occurrence and will be able to apply solutions accordingly.*

UNIT I
Operating Systems: Overview - Time Services and Scheduling Mechanisms - Other Basic Operating System Function - Processor Reserves and Resource Kernel - Capabilities of Commercial Real Time Operating Systems.

UNIT II
Introduction to UNIX: Overview of Commands - File I/O: Open, Create, Close, Lseek, Read, and Write - Process Control: Fork, Vfork, Exit, Wait, Waitpid& Exec – Signals - Inter Process Communication: Pipes, FIFOs, Message Queues, Semaphores & Shared Memory.

UNIT III
Real Time Systems: Typical Real Time Application - Hard Vs Soft Real Time Systems - A Reference Model of Real Time Systems: Processors and Resources - Temporal Parameters of Real Time Workload - Periodic Task Model - Precedence Constraints and Data Dependency Functional Parameters - Resource Parameters of Jobs and Parameters of Resources

UNIT IV
Approaches to Real Time Scheduling: Clock Driven - Weighted Round Robin - Priority Driven - Dynamic Vs. State Systems - Effective Release Times and Dead Lines - Offline Vs Online Scheduling.

Fault Tolerance Techniques Introduction - Fault Causes, Types, Detection, Fault and Error Containment - Redundancy: Hardware, Software - Time - Integrated Failure Handling.

UNIT V

Case Studies-Vx Works: Memory Managements Task- State Transition Diagram - Pre- Emptive Priority – Scheduling - Context Switches – Semaphore – Binary Mutex - Counting: Watch Dugs - I/O System.

RT Linux: Process Management – Scheduling - Interrupt Management - Synchronization.

TEXT BOOKS

1. RichardStevens,*Advanced Unix Programming*, Pearson Education, 2003.
2. Jane W.S.Liu ,*Real Time Systems*, PearsonEducation, 2013.

REFERENCES

1. Vx Works Programmers Guide
2. www.tidp.org
3. www.kernel.org

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(19EC4105) EMBEDDED NETWORKING
(Programme Elective-II)

COURSE OBJECTIVES
The objectives of this course:

1. *To understand the serial and parallel communication protocol related to embedded networking.*
2. *To familiarize the concepts of USB & CAN bus.*
3. *To learn the principles of Ethernet communication.*
4. *To understand the concepts of Embedded Ethernet.*
5. *To recognize the need for wireless protocols to indulge in Real world interfacing.*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *Analyse the use of embedded networks in real time applications.*
2. *Analyse fundamentals of embedded communication protocols.*
3. *Apply the concepts of embedded Ethernet in embedded networking.*
4. *Apply the knowledge of wireless embedded networking in the design of network embedded systems.*

UNIT – I
Embedded Communication Protocols: Embedded Networking: Introduction – Serial/Parallel Communication – Serial Communication Protocols - RS232 Standard &RS485 – Synchronous Serial Protocols -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) – PC Parallel Port Programming - ISA/PCI Bus Protocols – Fire wire.

UNIT II
USB and CAN Bus: USB bus – Introduction – Speed Identification on the bus – USB States – USB bus communication: Packets – Data flow types – Enumeration – Descriptors – PIC 18 Microcontroller USB Interface – C Programs - CAN Bus: Introduction - Frames – Bit stuffing – Types of errors – Nominal Bit Timing – PIC microcontroller CAN Interface – A simple application with CAN.

UNIT III
Ethernet Basics: Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components – Ethernet Controllers – Using the internet in local and internet communications – Inside the Internet protocol.

UNIT IV
Embedded Ethernet: Exchanging messages using UDP and TCP – Serving web pages with Dynamic Data – Serving web pages that respond to user Input – Email for Embedded Systems – Using FTP – Keeping Devices and Network Secure.

UNIT V

Wireless Embedded Networking: Wireless Sensor Networks – Introduction – Applications – Network Topology – Localization –Time Synchronization - Energy Efficient MAC Protocols – SMAC – Energy Efficient and Robust Routing – Data Centric Routing.

TEXT BOOKS

1. Frank Vahid, Tony Givargis, *Embedded Systems Design: A Unified Hardware/Software Introduction* , John & Wiley Publications,2002
2. Jan Axelson,*Parallel Port Complete: Programming, interfacing and using the PCs parallel printer port* ,PenramPublications,1996.

REFERENCE BOOKS

1. Dogan Ibrahim,*Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F series,* Elsevier, 2008.
2. Jan Axelson, *Embedded Ethernet and Internet Complete,* Penram publications,2003.

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(19EC4011) WIRELESS COMMUNICATIONS
(Programme Elective-II)

COURSE OBJECTIVES
The objectives of this course:

1. *To provide an overview of Wireless Communication and its applications in communication engineering.*
2. *To appreciate the contribution of Wireless Communication networks to overall technological growth.*
3. *To understand the various terminology, principles, devices, schemes, concepts, algorithms and different methodologies used in Wireless Communication.*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *To understand the basics of Wireless Communication.*
2. *To motivate the students to pursue research in the area of wireless communication.*
3. *Analyze and design receiver and transmitter diversity techniques*
4. *Analyze Multiuser Systems, SSMA, CDMA network planning.*
5. *Summarize the principles of MIMO and specifications of communication standards.*

Unit–I
Introduction to Wireless Communications Systems: Evolution, Examples of Wireless Communication Systems, Comparison – Second Generation Cellular Networks, WLL, Bluetooth and Personal Area Networks.

Unit–II
Mobile Radio Propagation: Large-Scale Path Loss, Introduction to Radio Wave Propagation, Free Space Propagation Model, Propagation Mechanisms, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering. Small-Scale Fading and Multipath, Impulse Response Model of a Multipath Channel, Small- Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small-Scale Fading, Rayleigh and Ricean Distributions, Statistical Models for Multipath Fading Channels, Theory of Multipath Shape Factors for Small-Scale Fading Wireless Channels.

Unit–III
Diversity Techniques: Repetition Coding and Time Diversity – Frequency and Space Diversity, Receive Diversity – Concept of Diversity Branches and Signal Paths – Combining Methods – Selective Diversity Combining – Switched Combining – Maximal Ratio Combining – Equal Gain Combining – Performance Analysis for Rayleigh Fading Channels.

Cellular Communication: Cellular Networks, Multiple Access: FDM/TDM/FDMA/TDMA, Spatial Reuse, Co-Channel Interference Analysis, Hand Over Analysis, Erlang Capacity Analysis, Spectral Efficiency and Grade of Service- Improving Capacity – Cell Splitting andSectorization.

Unit–IV

Spread Spectrum and CDMA: Motivation – Direct Sequence Spread Spectrum– Frequency Hopping Systems, Time Hopping., Anti-Jamming – Pseudo Random (PN) Sequence, Maximal Length Sequences, Gold Sequences, and Generation of PN Sequences.

Diversity in DS-SS Systems: Rake Receiver- Performance Analysis. Spread Spectrum Multiple Access, CDMA Systems – Interference Analysis for Broadcast and Multiple Access Channels, Capacity of Cellular CDMA Networks – Reverse Link Power Control, Hard and Soft Hand Off Strategies.

Unit–V

Fading Channel Capacity: Capacity of Wireless Channels – Capacity of Flat and Frequency Selective Fading Channels – Multiple Input Multiple Output (MIMO) Systems,Narrow Band Multiple Antenna System Model, Parallel Decomposition of MIMO Channels – Capacity of MIMO Channels.

Cellular Wireless Communication Standards: GSM Specifications and Air Interface, Specifications, IS 95 CDMA- 3G Systems: UMTS & CDMA 2000 Standards and Specifications.

TEXT BOOKS

1. Andrea Goldsmith, *Wireless Communications*, Cambridge Universitypress.
2. T.S. Rappaport, *Wireless Communications*, Principles & Practice, PHI,2001.

REFERENCES

1. G.L Stuber, *Principles of Mobile Communications,* 2nd edition, Kluwer Academic Publishers.
2. KamiloFeher,*Wireless Digital Communication,* PHI,1995.
3. R.L Peterson, R.E. Ziemer and David E. Borth, *Introduction to Spread Spectrum Communication,* PearsonEducation.
4. A.J.Viterbi, *CDMA- Principles of Spread Spectrum,* Addison Wesley,1995.
5. Simon Haykin and MichaelMoher, *Modern Wireless Communications,* Person Education.

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(19EC4106) INTERNET PROTOCOLS
(Programme Elective-II)

COURSE OBJECTIVES
The objectives of this course:

1. *To get familiar with the Internetworking concepts, internet addressing and TCP/IP protocol Suite.*
2. *To Understand Mobile IP and multicasting & unicasting routing protocols.*
3. *To Understand the IP security and the firewalls*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *Independently understand basic computer network technology.*
2. *Understand and explain Data Communications System and its components.*
3. *Enumerate the layers of the OSI model and TCP/IP.*
4. *Identify the different types of network devices and their functions within a network*
5. *Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.*

UNIT- I
Internetworking Concepts: Principles of Internetworking - Connectionless Internetworking - Application level Interconnections - Network level Interconnection - Properties of the Internet - Internet Architecture - Wired LANS & Wireless LANs - Point-to-Point WANs &Switched WANs, Connecting Devices, TCP/IP Protocol Suite.
IP Address: Classful Addressing: Introduction - Classful Addressing - Other Issues - Sub-netting and Super-netting.
Classless Addressing: Variable length Blocks - Sub-Netting - Address Allocation – Delivery - Forwarding - Routing of IP Packets - Delivery, Forwarding, Routing &Structure of Router.
ARP and RARP: ARP - ARP Package - RARP.

UNIT- II
Internet Protocol (IP): Datagram – Fragmentation – Options – Checksum - IP V.6.
Transmission Control Protocol (TCP): TCP Services - TCP Features – Segment - A TCP Connection - State Transition Diagram - Flow Control, Error Control & Congestion Control - TCP Times.
Stream Control Transmission Protocol (SCTP): SCTP Services - SCTP Features - Packet Format - Flow Control, Error Control &Congestion Control.
Mobile IP: Addressing – Agents - Three Phases - Inefficiency in Mobile IP.
Classical TCP Improvements: Indirect TCP, Snooping TCP & Mobile TCP - Fast Retransmit/ Fast Recovery - Transmission/ Time out Freezing - Selective Retransmission - Transaction OrientedTCP.

UNIT- III

Unicast Routing Protocols (RIP, OSPF, and BGP): Intra and Inter Domain Routing - Distance Vector Routing – RIP - Link State Routing – OSPF - Path Vector Routing - BGP.

Multicasting and Multicast Routing Protocols: Unicast, Multicast & Broadcast - Multicast Applications - Multicast Routing - Multicast Link State Routing: MOSPF - Multicast Distance Vector: DVMRP.

UNIT- IV

Domain Name System (DNS): Name Space, Domain Name Space & Distribution of Name Space - DNS in the internet.

Remote Login TELNET: Concept - Network Virtual Terminal (NVT).

File Transfer FTP and TFTP: File Transfer Protocol (FTP).

Electronic Mail: SMTP and POP.

Network Management-SNMP: Concept - Management Components - World Wide Web- HTTP Architecture.

UNIT -V

Multimedia: Digitizing Audio and Video - Network Security - Security in The Internet Firewalls - Audio and Video Compression - Streaming Stored Audio/Video, Streaming Live Audio/Video &Real-Time Interactive Audio/ Video - RTP, RTCP & Voice Over IP - Network Security - Security in the Internet - Firewalls.

TEXT BOOKS

1. *Behrouz A.* Forouzan, *TCP/IP Protocol Suite,*Third Edition,TMH.
2. Comer, *Internetworking with TCP/IP*, Third Edition,PHI.

REFERENCE BOOKS

1. Mahbub Hassan, Raj Jain, *High performance TCP/IP Networking*, PHI,2005.
2. *B.A.* Forouzan, *Data Communications & Networking,*2ndEdition,TMH.
3. William Stallings, *High Speed Networks and Internets,* PearsonEducation,2002.
4. William Stallings, *Data and Computer Communications,* PEI, 7thEdition.
5. AdrinFarrel,*The Internet and Its Protocols,* Elsevier,2005.

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(19EC4107) EMBEDDED SYSTEM DESIGN LAB

COURSE OBJECTIVES

The objectives of this course:

1. *Use embedded C for reading data from port pins.*
2. *Understand the interfacing of data I/O devices with microcontroller.*
3. *Understand serial communication, port RTOS on microcontroller.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Experience with a set of tools for embedded systems programming and debugging.*
2. *Experience with implementing several embedded systems with particular focus on the interaction ARM-926 with RTOS devices.*
3. *Design products using ARM-CORTEX processor and various analog and digital ICs.*

List of Experiments

Part-I

Experiments using ARM-926 with RTOS

1. Register a new command inCLI.
2. Create a newTask.
3. Interrupthandling.
4. Allocate resource usingsemaphores.
5. Share resource usingMUTEX.
6. Avoid deadlock using BANKER'Salgorithm.
7. Synchronize two identical threads usingMONITOR.
8. Reader's Writer's Problem for concurrentTasks.

Part-II

Experiments on ARM-CORTEX processor using any open source RTOS. (Coo-Cox- Software-Platform)

1. Implement the interfacing of display with the ARM- CORTEXprocessor.
2. Interface ADC and DAC ports with the Input and Output sensitivedevices.
3. Simulate the temperature DATA Logger with the SERIAL communication withPC.
4. Implement the developer board as a modem for data communication using serial port Communication between twoPC's.

Lab Requirements:

Software:

1. Eclipse IDE for C and C++ (YAGARTO Eclipse IDE), Perfect RTOS Library,COO-COX Software Platform, YAGARTO TOOLS, and TFTPSERVER.
2. LINUX Environment for the compilation using Eclipse IDE & Java with latestversion.

Hardware:

1. The development kits of ARM-926 Developer Kits and ARM-CortexBoards.
2. Serial Cables, Network Cables and recommended power supply for theboard

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(19EC4108) STRUCTURAL DIGITAL SYSTEM DESIGN LAB

COURSE OBJECTIVES

The objectives of this course:

1. *To understand about VHDL and Verilog Programming in all available styles.*
2. *To understand differences between Verilog and VHDL.*
3. *To represent the different digital blocks in Verilog and VHDL in all available styles of modelling*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Different modeling styles available in VHDL and Verilog and difference between them*
2. *Difference between Verilog and VHDL*
3. *Representation of different digital modules in different modelling styles available in VHDL and Verilog*

List of Experiments

Using VHDL or VERILOG do the following experiments

1. Design of 4-bit adder /subtractor
2. Design of BoothMultiplier
3. Design of 4-bitALU
4. Design SISO, SIPO, PISO, PIPORegisters
5. Design of Ripple, Johnson and Ringcounters
6. Design of MIPSprocessor
7. Design of Washing machinecontroller
8. Design of Traffic LightController
9. Design “1010” pattern detector using Mealy StateMachine
10. Design “1100” recursive pattern detector using Moore stateMachine
11. Design simple Security System UsingFSM/ASM
12. MiniProject

Tools Required: VHDL or VERILOG

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(19HS0818) ENGLISH FOR RESEARCH PAPER WRITING
(Audit Course-I)

COURSE OBJECTIVES

The objectives of this course:

1. *To understand that how to improve writing skills and level of readability.*
2. *To learn about what to write in each section.*
3. *To understand the skills needed when writing a Title.*
4. *To ensure the good quality of paper at very first-time submission.*
5. *To know the strategies and techniques for preparing academic projects.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Familiarize students with the key concepts of linguistics and develop awareness of the latest trends in language study.*
2. *Lead to a greater understanding of the human communicative action through an objective study of language.*
3. *Know and appreciate the location of literature within humanities.*
4. *Gain knowledge of research methods in literary studies and advanced knowledge of literature in the English language and literary theory.*
5. *Carry out an independent, limited research project under supervision, in accordance with applicable norms, ideals and conditions for literary research.*
6. *Improve common and basic scholarly requirements of logical and empirical rigor.*

UNIT- I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT- II

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts and Introduction.

UNIT- III

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT- IV

Key Skills Needed When Writing a Title, Key Skills Needed When Writing Abstract, Key Skills Needed When Writing an Introduction, Skills When Writing a Review of the Literature.

UNIT- V

Skills Needed When Writing the Methods, Skills Needed When Writing the Results, Skills Needed When Writing the Discussion, Skills Needed When Writing the Conclusions.

TEXT BOOKS

1. Goldbort R, *Writing for Science,* Yale University Press. 2006.

2. Day R , *How to Write and Publish a Scientific Paper,* Cambridge University Press. 2006.

REFERENCES

1. Highman N, *Handbook of Writing for the Mathematical Sciences,* SIAM. Highman's Books,1998.

2. Adrian Wall, *English for Writing Research Papers,* Springer New York Dordrecht. Heidelberg London, 2011.

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(19EC4109) INTRODUCTION TO IoT

COURSE OBJECTIVES

The objectives of this course:

1. *To explore the world of current technologies.*
2. *To understand with the concepts of internet of things.*
3. *To get a knowledge basics in the history and developments of internet.*
4. *To be familiar with the big data and cloud in the IoT basis.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Discuss the world of current technologies.*
2. *Describe the major application areas of IoT.*
3. *Describe about the networking in IoT.*
4. *Apply the concepts of python programming in IoT.*
5. *Design & develop IoT applications using python.*

UNIT – I

Introduction & Concepts: Introduction to Internet of Things - Physical Design of IOT - Logical Design of IoT - IoT Enabling Technologies - IoT Levels.

UNIT – II

Domain Specific IoTs: Home Automation – Cities – Environment – Energy – Retail - Logistics – Agriculture – Industry - Health & Life Style.

UNIT – III

M2M & System Management with NETCONF-YANG: M2M - Difference between IoT and M2M - SDN and NFV for IoT - Software defined Networking - Network Function Virtualization - Need for IOT Systems Management - Simple Network Management Protocol - Limitations of SNMP - Network Operator Requirements – NETCONF – YANG - IOT Systems management with NETCONF-YANG.

UNIT – IV

Developing Internet of Things & Logical Design using Python: Introduction, IoT Design Methodology - Installing Python - Python Data Types & Data Structures - Control Flow - Functions – Modules – Packages - File Handling - Date/ Time Operations – Classes - Python Packages.

UNIT – V

IoT Physical Devices & Endpoints: What is an IoT Device - Exemplary Device - Board, Linux on Raspberry Pi - Interfaces and Programming IoT Devices.

TEXTBOOKS

1. Vijay Madisetti, ArshdeepBahga**,***Internet of Things a Hands-on Approach,*University press,,1st Edition, 2014
2. Adrian McEwen**,***Designing the Internet of Things,*Wiley Publishers, 1st Edition, 2013

REFERENCES

1. Daniel Kellmereit,Daniel Obodovski,*The Silent Intelligence: The Internet of Things,*DND Ventures LLC , 1st Edition, 2013
2. Samuel Greenland,*The Internet of Things,*MIT Press,,1st Edition, 2015
3. Patrick Grossetete, Gonzalo Salgueiro, David Hanes,*IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things,*Pearson,,1st Edition, 2015

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(19EC4110) ADVANCED MICROCONTROLLERS

COURSE OBJECTIVES

The objectives of this course:

1. *To understand the fundamentals of embedded system*
2. *To learn the fundamentals of ARM processors.*
3. *To learn and understand the principles of ARM Programming using C & Assembly*
4. *To learn the architecture of advanced ARM processors*
5. *To understand and program the serial communication devices of MSP430 Processor*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Describe the fundamentals of embedded systems*
2. *Describe the fundamentals of ARM Processors*
3. *Apply the knowledge of C & Assembly to program processor*
4. *Examine the architecture of MSP430 Processor.*
5. *Design applications based on MSP430 processors*

UNIT I

ARM Embedded Systems: An Embedded System – Definition - Embedded System Design and Development - Life Cycle - Embedded System Architecture - Embedded Systems Classification - The RISC Design Philosophy - The ARM Design Philosophy - Embedded System Hardware - Embedded System Software - ARM Processor Families - Core Extensions - Architecture Revisions.

UNIT II

ARM Processor Fundamentals: Registers &Current Program Status Register – Pipeline – Exceptions - Interrupts and Interrupt Vector Table - ARM Instruction Set - Thumb Instruction Set - Single Register and Multiple Register Load / Store Instructions – Stack - Software Interrupt Instructions.

UNIT III

ARM Programming using C and Assembly: Simple C Programs Using Function Calls – Pointers – Structures - Integer and Floating-Point Arithmetic - Assembly Code Using Instruction Scheduling - Register Allocation - Conditional Execution and Loops.

UNIT IV

Architecture of MSP430 Processor: Central Processing Unit & Registers - Instruction Formats - Addressing Modes - Constant Generator and Emulated Instructions - Instruction Set – Resets - Clock

System - Memory Organization - Interrupts and Interrupt Vector Table - Low- Power Modes - Parallel Ports - Digital Inputs - Switch Debounce - Digital Outputs - Pull Up / Down Resistors - Timers - Watchdog Timer, Timer A, Timer A Modes &Timer B - Timer B Modes - Real-Time Clock.

UNIT V

MSP430 Communication: Communication Peripherals in The MSP430 - Serial Peripheral Interface, SPI with The USI & SPI with The USCI - A Thermometer Using SPI Modes - Inter- Integrated Circuit Bus(I^2C) And Its Operations - State Machines for I^2C Communication - A Thermometer Using I^2C - Asynchronous Serial Communication - Asynchronous Communication with The USCI_A - A Software UART Using Timer A - Programming Examples with MSP 430.

TEXT BOOKS

1. Andrew N. Sloss, Dominic Symes, Chris Wright, *ARM Systems Developer's Guide- Designing & Optimizing System Software*, Elsevier, 2008.
2. John H. Davies, *MSP430 Microcontroller Basics*, Elsevier Ltd Publications, 2008.

REFERENCES

1. Tammy Noergaard, *Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers*, Elsevier(Singapore) Pvt.Ltd.Publications, 2005.
2. Frank Vahid, Tony D. Givargis,*Embedded system Design: A Unified Hardware/Software Introduction*, John Wily & Sons Inc,2002.
3. Peter Marwedel,*Embedded System Design*, Science Publishers, 2007.

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(19EC4111) HARDWARE SOFTWARE CO-DESIGN
(Programme Elective-III)

COURSE OBJECTIVES

The objectives of this course:

1. *To provide a broad understanding of the specific requirement of Hardware and software integration for embedded system.*
2. *To define a concurrent specification from an algorithm, analyze its behavior and partition the specification into software and hardware components.*
3. *To introduce students to the design issues of embedded systems.*
4. *To describe the broad range of system architectures that currently exist and define their fundamental attributes including speed, energy, area, design complexity, design cost, etc.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Acquire the knowledge on various models*
2. *Explore the interrelationship between Hardware and software in embedded system*
3. *Acquire the knowledge of firmware development process and tools*
4. *Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems.*
5. *Understand validation methods and adaptability*

UNIT- I

Co-Design Issues: Co- Design Models – Architectures – Languages - A Generic Co- Design Methodology.

Co-Synthesis Algorithms: Hardware Software Synthesis Algorithms - Hardware – Software Partitioning Distributed System Co-Synthesis.

UNIT- II

Prototyping and Emulation: Prototyping and Emulation Techniques - Prototyping and Emulation Environments - Future Developments in Emulation - Prototyping Architecture Specialization Techniques - System Communication Infrastructure.

UNIT -III

Target Architectures: Architecture Specialization Techniques - System Communication Infrastructure - Target Architecture and Application System Classes - Architecture for Control Dominated Systems (8051-Architectures for High Performance Control) - Architecture for Data Dominated Systems (Adsp21060, Tms320c60) - Mixed Systems.

UNIT -IV

Compilation Techniques and Tools for Embedded Processor Architectures: Modern Embedded Architectures - Embedded Software Development Needs - Compilation Technologies - Practical Consideration in A Compiler Development Environment.

Design Specification and Verification: Design - Co-Design - The Co-Design Computational Model - Concurrency Coordinating Concurrent Computations - Interfacing Components - Design Verification - Implementation Verification - Verification Tools - Interface Verification.

UNIT- V

Languages for System – Level Specification and Design-I: System – Level Specification - Design Representation for System Level Synthesis - System Level Specification Languages**.**

Design-II: Heterogeneous Specifications - Multi-Language Co-Simulation - the Cosyma System and Lycos System.

TEXT BOOKS

1. Jorgen Staunstrup, Wayne Wolf, *Hardware/software co- design Principles and Practice,* Springer, 2009.
2. Kluwer, *Hardware/Software Co-Design Principles and Practice,* academic publishers,*2002.*

REFERENCES

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

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(19EC4213)TESTING & TESTABILITY
(Programme Elective-III)

COURSE OBJECTIVES
The objectives of this course:

1. *Fundamentals of Testing and Testability, different levels of modeling and simulation.*
2. *Fault models and Automatic Test Pattern Generation.*
3. *Testability Trade-Offs, Scan Architectures and Compression Techniques.*
4. *BIST Concepts, Test Pattern Generation and Advanced BIST Concepts.*
5. *Memory Test Architectures, In Circuit Testing (ICT), JTAG Testing Features.*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *Understand the elementary concepts of Testing and Testability.*
2. *Understand different types of faults associated with logic circuits and types of testing byemploying fault models to the logic circuits.*
3. *Get complete knowledge about different methods of simulation and algorithms associated withtesting.*
4. *Analyze BIST concepts and design self-test at Board Level.*
5. *Analyze Memory Test Requirements for MBIST and Embedded Core Testing.*

UNIT – I
Introduction to Test and Design for Testability (DFT) Fundamentals: Modeling: Modeling Digital Circuits at Logic Level, Register Level and Structural Models, Levels of Modeling, Logic Simulation: Types of Simulation, Delay Models, Element Evaluation, Hazard Detection, Gate Level Event Driven Simulation.

UNIT – II
Fault Modeling: Logic Fault Models, Fault Detection and Redundancy, Fault Equivalence and Fault Location. Single Stuck and Multiple Stuck – Fault Models. Fault Simulation Applications, General Techniques for Combinational Circuits.

Testing for Single Stuck Faults (SSF): Automated Test Pattern Generation (ATPG/ATG) for SSFs in Combinational and Sequential Circuits, Functional Testing with Specific Fault Models.

UNIT – III
Design For Testability: Testability Trade-Offs, Techniques, Scan Architectures and Testing – Controllability and Absorbability, Generic Boundary Scan, Full Integrated Scan, Storage Cells for Scan Design, Board Level and System Level DFT Approaches, Boundary Scans Standards, Compression Techniques – Different Techniques, Syndrome Test and Signature Analysis.

UNIT – IV

Built-In Self-Test (BIST): BIST Concepts and Test Pattern Generation. Specific BIST Architectures: CSBL, BEST, RTS, LOCST, STUMPS, CBIST, CEBS, RTD, SST, CATS, CSTP, BILBO. Brief Ideas on Some Advanced BIST Concepts and Design for Self- Test at Board Level

UNIT – V

Memory BIST (MBIST): Memory Test Architectures and Techniques – Introduction to Memory Test, Types of Memories and Integration, Embedded Memory Testing Model. Memory Test Requirements for MBIST

Brief Ideas on Embedded Core Testing: Introduction to Automatic in Circuit Testing (ICT), JTAG Testing Features.

TEXT BOOKS

1. MironAbramovici, Melvin A. Breur, Arthur D.Friedman,*Digital Systems Testing and Testable Design*,Jaico Publishing House, 2001.
2. Alfred Crouch, *Design for Test for Digital ICs & Embedded Core Systems*, PrenticeHall.

REFERENCES

1. Robert J.Feugate, Jr., Stevenm, Mentyn, *Introduction to VLSI Testing, Prentice Hall*, Englehood Cliffs, 1998.

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(19EC4112) MICRO ELECTROMECHANICAL SYSTEMS
(Programme Elective-III)

COURSE OBJECTIVES
The objectives of this course:

1. *Become familiar with the operation principles of selected MEMS sensors and actuators*
2. *To examine the MEMS-specific design issues and constraints*
3. *Become familiar with the MEMS fabrication processes*
4. *To describe Dynamics and modelling of microsystems*
5. *To understand the Applications of microsensors and micro actuators*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *Develop an understanding of microscale physics for use in designing MEMS system applications.*
2. *Understand concepts of basic MEM devices and systems.*
3. *Acquires knowledge on mechanical terms used in MEMS.*
4. *Understand the two terminal MEMS and its characteristics.*
5. *Design digital and analog applications in various silicon-based MEMS structures.*

UNIT – I
Introduction: Introduction Basic structures of MEM devices – (Canti-Levers, Fixed Beams diaphragms) - Broad Response of Micro electromechanical systems (MEMS) to Mechanical (Force, pressure etc.)(a), Thermal(b),Electrical(c), Optical(d) and Magnetic Stimuli(e), Compatibility of MEMS from the Point of Power Dissipation and Leakage.

UNIT – II
Study of Characteristics: Review of Mechanical Concepts Like Stress(a), Strain(b), Bending Moment(c) and Deflection Curve(d) - Differential Equations Describing the Deflection Under Concentrated Force(a), Distributed Force(b) - Distributed Force - Deflection Curves for Canti-Levers - Fixed Beam - Electrostatic Excitation – Columbic Force Between the Fixed and Moving Electrodes - Deflection with Voltage in C.L - Deflection Vs Voltage Curve - Critical Fringe Field – Field Calculations Using Laplace Equation - Discussion On the Approximate Solutions – Transient Response of the MEMS.

UNIT – III
MEMS Structures: Types Two Terminal MEMS - Capacitance Vs Voltage Curve – Variable Capacitor - Applications of Variable Capacitors - Two Terminal MEM Structures - Three Terminal MEM Structures – Controlled Variable Capacitors – MEM as A Switch and Possible Applications.

UNIT – IV

MEM Configurations and Applications:MEM Circuits & Structures for Simple GATES- AND(a), OR(b), NAND(c), NOR(d) and Exclusive OR(e) - Simple MEM Configurations for Flip -Flops - Triggering Applications to Counters(a) and Converters(b). Applications for Analog Circuits Like Frequency Converters(a), Wave Shaping(b) - RF Switches for Modulation - MEM Transducers for Pressure(a), Force Temperature(b) and Optical MEMS(c).

UNIT – V

MEM Technologies: MEM Technologies Silicon Based MEMS- Process Flow – Brief Account of Various Processes and Layers Like Fixed Layer(a), Moving Layers(b), Spacers(c) and Etching Technologies - Metal Based MEMS: Thin and Thick Film Technologies for MEMS - Process Flow and Description of the Processes - Status of MEMS in the Current Electronics Scenario.

TEXTBOOKS

1. Gabriel M. Rebeiz,*MEMS Theory, Design and Technology*,Wiley Publishers, 1st Edition, 2003
2. ThimoShenko**,***Strength of Materials*,CBS publishers &Distributors, 5th Edition, 2000

REFERENCES

1. Ristic L*Sensor Technology and Devices*,Artech House, London,1st Edition, 1994.
2. *ServeyE.Lyshevski*,*MEMS and NEMS, Systems Devices and Structures*,CRT Press, 1st Edition, 2002.
3. Stephen D. Senturia,*Microsystem Design*,Springer US,1st Edition, 2001.

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(19EC4201) VLSI TECHNOLOGY
(Programme Elective-III)

COURSE OBJECTIVES

The objectives of this course:

1. *Understand the electrical properties of MOS, CMOS and BICMOS.*
2. *Design and Analysis of logic gates and Layouts.*
3. *Conceptual view of VLSI design flow.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Understands various parameters of MOSFET based logic circuits.*
2. *Draw layout of a given circuit.*
3. *Design and Analyze Combinational and sequential Circuits.*
4. *Floor Planning and Physical Design Flows.*
5. *Familiar with basics of Chip Design*

UNIT – I

Review Of Microelectronics And Introduction To Mos Technologies: (MOS, CMOS, Bi-CMOS) Technology Trends and Projections.

Basic Electrical Properties Of Mos, Cmos &Bicmos Circuits: I_{ds} - V_{ds} Relationships, Threshold Voltage V_t, gm, g_{ds} & ω_o - Pass Transistor - MOS, CMOS, Bi-CMOS Inverters & $Z_{p.u}/Z_{p.d}$ - MOS Transistor Circuit Model - Latch-Up in CMOS Circuits.

UNIT – II

Layout Design and Tools:

Logic Gates & Layouts: Static Complementary Gates - Switch Logic - Alternative Gate Circuits - Low Power Gates - Resistive and Inductive Interconnect Delays.
Power Optimization - Design Validation and Testing.

UNIT – III

Transistor Structures - wires and vias - Scalable Design Rules - Layout Design Tools.

Combinational Logic Networks: Layouts, Simulation, Network delay, Interconnect Design & Power Optimization - Switch Logic Networks, Gate and Network Testing.

Sequential Systems: Memory Cells and Arrays -Clocking Disciplines, Design - Power Optimization - Design Validation and Testing.

UNIT – IV

Floor Planning & Architecture Design: Floor Planning Methods, Off-Chip Connections, High Level Synthesis, Architecture for Low Power, SOCs and Embedded CPUs, Architecture Testing.

UNIT – V

Introduction To Cad Systems (Algorithms) And Chip Design:

Layout Synthesis and Analysis - Scheduling and Printing - Hardware-Software Co-design, Chip Design Methodologies- A Simple Design Example.

TEXTBOOKS

1. Wayne Wolf,*Modern VLSI Design*, 3rd Edition, Pearson Education, fifth Indian Reprint, 2005.
2. K. Eshraghian et.al (3 authors),*Essentials of VLSI Circuits and Systems*, PHI of India Ltd., 2005.

REFERENCES

1. N.H. E Weste, K. Eshraghian, *Principals of CMOS Design*, Adison Wesley, 2ndEdition.
2. Fabricius, *Introduction to VLSI Design*, MGH International Edition, 1990.
3. Neil H E West and Kamran Eshranghian, *Principles of CMOS VLSI Design - A System Perspective*, Addision-Wesley, 2nd Edition,2002.

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I M.Tech – II Sem.	**L**	**T**	**P**	**C**
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(19EC4202) DIGITAL IC DESIGN
(Programme Elective-III)

COURSE OBJECTIVES

The objectives of this course:

1. *Able to Understand the Static & Dynamic Behavior of CMOS &BiCMOS circuits.*
2. *Able to design CMOS based Subsystems.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Understand Static and dynamic power consumption in Integrated Chips.*
2. *Design CMOS based Combinational circuits and Memory modules.*
3. *Demonstrate the delay and power consumption in BiCMOS circuits.*
4. *Design and Analyse Layout of given circuit interms of various parameters.*
5. *Able to mimic and implement simple subsystems design.*

UNIT – I

CMOS Inverters -Static and Dynamic Characteristics, Static and Dynamic CMOS Design- Domino and NORA Logic - Combinational and Sequential Circuits.

UNIT –II

Method of Logical Effort for Transistor Sizing -Power Consumption in CMOS gates- Low Power CMOS Design, Arithmetic Circuits in CMOS VLSI - Adders- Multipliers- Shifter - CMOS Memory Design - SRAM and DRAM

UNIT – III

Bipolar Gate Design- BiCMOS Logic - Static and Dynamic Behavior -Delay and Power Consumption in BiCMOS Logic.

UNIT – IV

Layout Design Rules: Need for Design Rules - Mead Conway Design Rules for the Silicon Gate NMOS Process, CMOS Based Design Rules & Simple Layout Examples, Sheet Resistance - Area Capacitance - Wire Capacitance - Drive Large Capacitive Load**.**

UNIT – V

Subsystem Design Process: General arrangement of 4-bit Arithmetic Processor- Design of 4-bit shifter - Design of ALU Sub-System - Implementing ALU Functions with an Adder, Carry-look-ahead Adders, Multipliers, Serial Parallel Multipliers, Pipeline Multiplier Array & Modified Booth's Algorithm.

TEXT BOOKS

1. Sung-Mo Kang & Yusuf Leblebici, *CMOS Digital Integrated Circuits - Analysis & Design*, MGH, Second Ed.,1999.
2. Jan M Rabaey, *Digital Integrated Circuits - A Design Perspective*, Prentice Hall, 1997.

REFERENCES

1. Ken Martin, *Digital Integrated Circuit Design*, Oxford University Press, 2000.
2. Neil H E West and Kamran Eshranghian,*Principles of CMOS VLSI Design - A System Perspective*, Addison-Wesley 2nd Edition,2002.
3. R. J. Baker, H. W. Li, and D. E. Boyce,*CMOS circuit design, layout, and simulation*, New York: IEEE Press, 1998.
4. David A. Hodges, Horace G. Jackson and Resve A. Saleh, *Analysis and Design of Digital Integrated Circuits*, Third Edition, McGraw-Hill, 2004.
5. Eugene D Fabricus, *Introduction to VLSI Design*, McGraw Hill InternationalEdition.1990.

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(19EC4008) WIRELESS SENSOR NETWORKS
(Programme Elective-III)

COURSE OBJECTIVES
The objectives of this course:

1. *To understand the basic WSN technology with basic sensor systems and provide a survey of sensor technology*
2. *To understand the medium access control protocols, routing and transport layer protocols for sensor networks and address physical layer issues*
3. *To understand the Sensor management, sensor network hardware, operating systems.*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *Able to understand the basic WSN technology and supporting protocols, with emphasis.*
2. *Able to understand the sensor network hardware and operating systems.*
3. *Able to understand the sensor network protocols and addresses physical layer issues.*
4. *Able to understand and differentiate database management systems, data storage and Query processing.*
5. *Able to design and deploy the sensor networks.*

UNIT – I
Introduction and Overview of Sensor Network, Architecture and its Applications **–** Sensor Network Comparison with Adhoc Networks **–** Sensor Node Architecture with Hardware and Software Details.

UNIT–II
Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT
Software (Operating Systems):tinyOS, MANTIS, Contiki, and RetOS – Programming Tools, C, nesC **–** Performance Comparison of Wireless Sensor Networks **–** Simulation and Experimental Platforms like Open source (ns-2) and Commercial (QualNet, Opnet)

UNIT–III
Overview of Sensor Network Protocols: Physical, MAC and Routing/ Network Layer Protocols, Node Discovery Protocols, Multi-hop and Cluster based Protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy) and UWB.

UNIT–IV
Data Dissemination and Processing, Differences Compared with other Database Management Systems, Data Storage and Query Processing.

UNIT–V
Specialized Features: Energy Preservation and Efficiency **–** Security Challenges – Fault Tolerance **–** Issues related to Localization **–** Connectivity and Topology.
Sensor Deployment Mechanisms: Coverage issues, sensor Web, Sensor Grid - Open Issues for Future

Research, and Enabling Technologies in Wireless Sensor Network.

TEXT BOOKS

1. H. Karl and A.Willig, John Wiley & Sons, *Protocols and Architectures for Wireless Sensor Networks,* India,2012.
2. C.S. Raghavendra, K.M. Sivalingam, and T.Znati,*Wireless Sensor Networks,* Editors, Springer Verlag, 1st Indian reprint,2010.

REFERENCES

1. F. Zhao and L. Guibas, Morgan Kaufman, *Wireless Sensor Networks: An Information Processing Approach,*1st Indian reprint, 2013.
2. YingshuLi, MyT. Thai, Weili Wu, *Wireless sensor Network and Applications,* Springer series on signals and communication technology, 2008.
3. J. Pan, Y. Hou, L. Cai, Y. Shi and S. Shen, *Topology Control for Wireless Sensor Networks,* in proceedings of 9th International Conference on Mobile Computing and Networking, San Diego, CA, Sept. 2003, pp. 286-299.

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(19EC4113) INTERNET OF THINGS LAB

COURSE OBJECTIVES

The objectives of this course:

1. *Address the real world problems and find the required solution.*
2. *Design the problem solution as per the requirement analysis done.*
3. *Study the basic concepts of programming/ hardware/ emulator for Raspberry pi/Arduino/ ARM Cortex/ Intel Galileo etc.*
4. *Fabricate and implement the mini project intended solution for project based learning.*
5. *Improve the team building, communication and management skills of the students.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Identify the requirements for the real-world problems.*
2. *Conduct a survey of several available literatures in the preferred field of study.*
3. *Study and enhance software/ hardware skills.*
4. *Demonstrate and build the project successfully by hardware requirements, coding, emulating and testing.*
5. *Demonstrate an ability to work in teams and manage the conduct of the research study.*

LIST OF EXPERIMENTS

Using Python script:

1. Interfacing light sensor/ LDR sensor –lightdependent
2. Interfacing air qualitysensor
3. Interfacing proximitysensor
4. Create an account inwww.way2sms.com to your mobile number and sending anSMS
5. Give an alert to owner and cyber security cell through e-mail, when thief entered into thehouse.
6. Email based home automation electrical appliances should be controlled by sendingan email from youraccount.
7. Interfacing temperature humiditysensor.
8. Reading data fromcloud.
9. Running webserver on raspberrypi
10. Communicate multiple devices oversocket.

Equipment Required:

1. Raspberry pi 2 model B

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(19EC4114) MICROCONTROLLERS & INTERFACING LAB

COURSE OBJECTIVES

The objectives of this course:

1. *To become familiar with the architecture and Instruction set of MSP430 microcontroller.*
2. *To provide practical hands on experience with Assembly Language Programming.*
3. *To familiarize the students with interfacing of various peripheral devices with MSP430 microcontroller.*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Design and Implement basic circuits that are used in embedded systems.*
2. *Develop code using appropriate tools.*
3. *Test the circuit performance with standard benchmark circuits.*
4. *Provide solid foundation on interfacing the external devices to the processor according to the user requirements to create novel products and solutions for the real time problems*

List of Experiments

CYCLE-I

Using Embedded C:

1. Write a simple program to print “helloworld”
2. Write a simple program to Flash a light by a softwaredelay.
3. Write a loop application to copy values from P1 toP2
4. Write a c program for counting the no of times that a switch is pressed &released.
5. Illustrate the use of port header file (port M) using an interface consisting of a keypadand liquid crystaldisplay.
6. Develop a simple EOS showing traffic light sequencing.
7. Write a program to display elapsed time over RS-232Link.

CYCLE-II

Interfacing displaying characters onLCD:

1. Serial Communication usingUART.
2. Basic Input and Output using MSP430 UART.
3. Interrupt Handling usingMSP430.
4. Analog to Digital Conversion usingMSP430.
5. Interfacing external Devices to GPIOPorts.

Equipment required:

1.Computers with latestconfiguration

2.Code Composer Studio v6.1 (Preferably Latestversion)

3.MSP430/ARM based Hardware kits and add-onboards.

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(19HS0829) CONSTITUTION OF INDIA

COURSE OBJECTIVES

The objectives of this course:

1. *To know the premises informing the twin themes of liberty and freedom from a civil rightsperspective.*
2. *To address the growth of Indian opinion regarding modern Indian intellectuals 'constitutional role*
3. *To address entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indiannationalism.*
4. *To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the IndianConstitution*
5. *To acquire knowledge for various competitive examinations*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Explain the key concepts of political economy*
2. *Analyse the significant developments in the political ideologies*
3. *Describe the salient features of the constitution of India interpret, integrate and critically*
4. *Analyse the political economy of Indian international relations and gain knowledge in Judiciary system*
5. *Apply their knowledge and skills acquired to write various competitive examinations*

UNIT-I

Introduction to the Constitution.

UNIT-II

Historical Perspective of the Constitution ofIndia- Salient features and characteristics of the Constitution of India.

UNIT-III

Scheme of the fundamentalrights-The scheme of the Fundamental Duties and its legalstatus-The Directive Principles of State Policy – Its importance andimplementation.

UNIT-IV

Parliamentary Form of Government in India – Powers and Functions-The President of India - Status and Powers -The historical perspectives of the constitutional amendments inIndia-Judiciary system - Powers and Functions

UNIT-V

Local Self Government – Constitutional Scheme inIndia - Election Commission: Role and Functions.

TEXT BOOKS

1. Government of India Ministry of Law and Justice (Legislative Department)*The Constitution of India, 1950 (Bare Act)* GovernmentPublication, 2015

2. Dr. S. N. Busi*Dr. B. R. Ambedkar framing of Indian Constitution*, 1st Edition,GovernmentPublication 2015.

REFERENCES

1. M. P.Jain,*Indian Constitution Law* Lexis Nexis, 7th Edn.,2014.

2. D.D. Basu,*Introduction to the Constitution of India,* Lexis Nexis,2015

3.P.M.Bakshi,*Constitution of India* Universal Law Publishing,15th Edition,2018

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(19EC4002) ADVANCED DIGITAL SIGNAL PROCESSING
(Common to ES & DECS)
(Programme Elective-V)

COURSE OBJECTIVES
The objectives of this course:

1. *Comprehend mathematical description and modeling of discrete time random signals.*
2. *Familiar with important theorems and algorithms of Digital Signal Processing*.
3. *Understand the concepts of estimation, prediction and filtering concepts and techniques.*

COURSE OUTCOMES(COs)
On successful completion of this course, the student will be able to

1. *Analyze the Discrete-time signals*
2. *Understand the digital Signal Processing algorithms and its applications*
3. *Apply the knowledge of usage of Digital systems in real time applications*
4. *Apply the algorithms for recent trend applications in Digital Signal Processing*
5. *Understand the modern filter design and their implementation*
6. *Able to understand the parametric method for estimation of power spectral density*

UNIT – I
Overview: Discrete-Time Signals, Sequences and sequence Representation, Discrete-Time Systems, Time-Domain Characterization and Classification of LTI Discrete-Time Systems. The Continuous-Time Fourier Transform, The Discrete-Time Fourier Transform, Energy Density Spectrum of a Discrete-Time Sequence, Band-Limited Discrete-Time signals, The Frequency Response of LTI Discrete-Time System.
LTI Systems: Types of Linear-Phase transfer functions, Simple Digital Filters, Complementary Transfer Function, Inverse Systems, System Identification, Digital Two-Pairs, AlgebraicStabilityTest.

UNIT – II
Digital Filter Structure and Design: All Pass Filters, Tunable IIR Digital Filter, IIR Tapped Cascade Lattice Structures, FIR Cascaded Lattice Structures, Parallel All Pass Realization of IIR Transfer Functions, State Space Structures, Polyphase Structures, Digital Sine-Cosine Generator, Computational Complexity of Digital Filter Structures, Design of IIR Filter using pade approximation, Least Square Design Methods, Design of Computationally Efficient FIR Filters.

UNIT– III
FFT Algorithms: Fast DFT algorithms based on Index mapping, Sliding Discrete Fourier Transform, DFT Computation Over a narrow Frequency Band, Split Radix FFT, Linear filtering approach to Computation of DFT using ChirpZ-Transform.

Multi Rate Signal Processing: Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Filter design & Implementation for Sampling rate conversion.

UNIT– IV

Power Spectral Estimation: Estimation of Spectra from Finite duration observation of Signals, Non-parametric methods: Bartlett, Welch & Blackmann &Tukey methods.

Parametric Methods for Power Spectrum Estimation: Relation between auto correlation & Model parameters, Yule-Waker& Burg Methods, MA & ARMA models for Power spectrum estimation.

UNIT – V

Analysis of Finite Word length Effects in Fixed-Point DSP Systems: Fixed, Floating Point Arithmetic – ADC quantization, Noise & Signal Quality-Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

Applications of Digital Signal Processing: Dual Tone Multi-Frequency Signal Detection, Spectral Analysis of Sinusoidal Signals, Spectral Analysis of Non-Stationary Signals, Musial Sound Processing, Over Sampling A/D Converter, Over Sampling D/A Converter, Discrete-Time Analytic Signal Generation.

TEXT BOOKS

1. Sanjit K Mitra, *Digital Signal Processing*, Tata MCgraw Hill Publications.
2. J G Proakis, D G Manolokis, *Digital Signal Processing Principles*, Algorithms, Applications PHI.

REFERENCES

1. *Discrete-Time Signal Processing*, A V Oppenhiem, R W Schafer, PearsonEducation.
2. *DSP- A Practical Approach*, Emmanuel C Ifeacher Barrie. W. Jervis, PearsonEducation.
3. *Modern spectral Estimation techniques*, S. M. Kay, PHI,1997.

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(19EC4116) RADIO FREQUENCY IDENTIFICATION
(Programme Elective-V)

COURSE OBJECTIVES

The objectives of this course:

1. *Familiarize with RFID technology.*
2. *Understand the applications of RFID technology.*
3. *Familiarize with privacy policy and regulations of RFID technology*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Understand the fundamentals of RFID technology.*
2. *Recognize the development history of RFID technology.*
3. *Understand the global privacy policy and regulations of RFID technology.*
4. *Analyze the impact of RFID in various sectors.*
5. *Describe various applications of RFID technology.*
6. *Analyze the implementation of RFID technology in various application areas.*

UNIT – I

Understanding RFID Technology: Introduction, RFID Technology, The Elements of an RFID system, Coupling, Range, and Penetration, RFID Applications, Veri Chip and Mark of the Beast.

UNIT – II

A History of the EPC: Introduction, The Distributed Intelligent Systems Center, Meanwhile, at Procter & Gamble, "Low-Cost" RFID Protocols, "Low-cost" Manufacturing, The Software and the Network, Privacy, Harnessing the Juggernaut, The Six Auto-ID Labs, The Evolution of the Industry, The Creation of EPCglobal.

UNIT – III

RFID and Global Privacy Policy: Introduction, Definitions of Privacy, Definitions of Personal Information, History of Current Privacy Paradigm, Mapping the RFID Discovery process, Functions and Responsibilities for chips, Readers, and Owners, Privacy as a Fundamental Human Right, Constitutional Rights.

UNIT – IV

RFID,Privacyand Regulation: Introduction, Understanding RFIDs Privacy &Threats,RFID and the United States Regulatory Landscape: Introduction, Current State of RFID Policy, Individuals, Business, Government, Miscellaneous, Integrity and Security of the System, Government Access,

Health Impact, Labor Impact

UNIT – V

Applications: RFID Payments at ExxonMobil, Exxon Mobil Corporation, Transforming the Battlefield with RFID, Logistics and the Military, RFID in the Pharmacy, CVS and Auto-ID, Project Jump Start, RFID in theStore.

TEXT BOOKS

1. Simson Garfinkel and Beth Rosenberg, *RFID Applications, Security and privacy*, Pearson Education. 1st Edition, 2008.
2. Steven Shepard,*Radio Frequency Identification*, McGraw-HillProfessional, 1st Edition, 2013

REFERENCES

1. Narayanan, A., Sanjay singh, & Soma sekharan, M. *Implementing RFID in Library: Methdologies, Advantages and Disadvantage*s. 1st Edition, 2012.
2. Patil, S.K., Wadekar, P., Chikate, R.V. & Joshi, S, *Implementation of RFID Technology in Jayakar Library*. 1st Edition, 2012

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(19EC4117) SYSTEM ON CHIP ARCHITECTURE
(Programme Elective-V)

COURSE OBJECTIVES

The objectives of this course:

1. *Describe the architecture of System on Chip (SOC).*
2. *Develop project based on SOC using System C or any HDL language.*
3. *Select memory for specific SOC operating system.*
4. *Build the complex logic circuit using minimal logic blocks.*
5. *Explain the SOC interconnect architectures.*
6. *Compare SOC architectures suitable for current needs.*

COURSE OUTCOMES (COs)

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

1. *Design processors keeping area, power and speed as constraints and to Deepen CMOS VLSIdesign knowledge.*
2. *Design full custom/ semicustom/ standard cells for ASIC.*
3. *Implement both hardware and software solutions, formulate hardware/software tradeoffs, and perform hardware/software codesign.*
4. *Implement network on chip technologies.*
5. *Analyze memories using reconfigurable architectures for rapid prototyping*
6. *Analyze system on chip and board based systems.*

UNIT –I

Introduction to the System Approach: System Architecture **–** Components of the System, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

UNIT –**II**

Processors: Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: Minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT– III

Memory Design for SOC: Overview of SOC External Memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at Miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory Interaction.

UNIT – IV

Interconnect Customization and Configuration: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus Transactions and Contention Time. SOC Customization: An Overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance-Specific design, Customizable Soft Processor, Reconfiguration - Overhead Analysis and Trade-off analysis on Reconfigurable Parallelism.

UNIT – V

Application Studies / Case Studies: SOC Design approach, AES algorithms, Design and Evaluation, Image compression – JPEG compression.

TEXT BOOKS

1. Michael J. Flynn and Wayne Luk, *Computer System Design System-On-Chip*, Wiely India Pvt.Ltd, 1st Edition, 2011.
2. Steve Furber Addison, *ARM System on Chip Architecture*, Wesley Professional, 2nd Edition, 2000.

REFERENCES

1. Ricardo Reis, *Design of System on a Chip: Devices and Components*, Springer,1st Edition, 2004.
2. Jason Andrews, *Co-Verification of Hardware and Software for ARM System on Chip Design(Embedded Technology)*– Newnes, 1st Edition, 2004
3. Prakash Rashinkar, Peter Paterson and Leena Singh L,*System on Chip Verification – Methodologies and Techniques*, Kluwer AcademicPublishers, 1st Edition, 2007.

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(19HS0824) BUSINESS ANALYTICS
(Open Elective)

COURSE OBJECTIVES
The objectives of this course:

1. *Understand the concepts and methods of business analytics.*
2. *To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.*
3. *Identify the management related issues and processes to resolve*
4. *Understand the significance of forecasting models helpful in decision making*
5. *To become familiar with processes needed to develop, report, and analyze business data.*

COURSE OUTCOMES (COS)
On successful completion of course, the student will be able to

1. *Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.*
2. *Design alternatives to solve business problems utilizing quantitative analysis, critical thinking and sound ethical decision making.*
3. *Summarize, process and transform data for obtaining meaningful conclusions*
4. *Interpret data using latest data analytics tools to address organisational problems*
5. *Organize and critically apply the concepts and methods of business analytics*
6. *Assess decision problems and build models for creating solutions using business analytical tools.*

UNIT- I
Business analytics: Overview of Business analytics - Scope of Business analytics - Business Analytics Process - Relationship of Business Analytics Process and organisation - competitive advantages of Business Analytics - Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT- II
Trendiness and Regression Analysis: Modelling Relationships and Trends in Data - simple Linear Regression - Important Resources - Business Analytics Personnel - Data and models for Business analytics - problem solving - Visualizing and Exploring Data, Business Analytics Technology.

UNIT- III
Organization Structures of Business analytics: Team management - Management Issues - Designing Information Policy – Outsourcing - Ensuring Data Quality - Measuring contribution of Business

analytics - Managing Changes - Descriptive Analytics - predictive analytics - predicative Modelling - Predictive analytics analysis - Data Mining - Data Mining Methodologies - Prescriptive analytics and its step in the business analytics Process - Prescriptive Modelling - nonlinear Optimization.

UNIT- IV

Forecasting Techniques: Qualitative and Judgmental Forecasting - Statistical Forecasting Models - Forecasting Models for Stationary Time Series - Forecasting Models for Time Series with a Linear Trend - Forecasting Time Series with Seasonality - Regression Forecasting with Casual Variables - Selecting Appropriate Forecasting Models - Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform - New-Product Development Model - Newsvendor Model - Overbooking Model - Cash Budget Model.

UNIT- V

Decision Analysis: Formulating Decision Problems - Decision Strategies with the Outcome Probabilities - Decision Trees - The Value of Information - Utility and Decision Making - Recent Trends in Embedded and collaborative business intelligence - Visual data recovery - Data Storytelling and Data journalism.

TEXT BOOKS

1. S. Christian Albright & Wayne Winston, *Business Analytics: Data analysis & Decision making*, 6th Edition, Cengage Learning, 2019
2. James Evans, *Business Analytics*, 2nd Edition, Pearson Education, 2013.

REFERENCES

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, *Business analytics Principles, Concepts, and Applications*,1st Edition, Pearson FT Press, 2014.
2. SeemaAcharya& RN Prasad, *Fundamentals of Business Analytics*, 2ndEdition,WILEY
3. Galit Shmueli, Peter C. Bruce, Nitin R. Patel, *Data mining for business analytics: Concepts, Techniques and Applications in Microsoft Office Excel with XLMiner*, WILEY, 2008.

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(19CE1028) COST MANAGEMENT OF ENGINEERING PROJECTS

(Open Elective)

COURSE OBJECTIVES

The objectives of this course:

1. *To establish systems to help streamline the transactions between corporate support departments and the operating units.*
2. *To devise transfer pricing systems to coordinate the buyer-supplier interactions between decentralized organizational operating units.*
3. *To use pseudo profit centres to create profit maximizing behaviour in what were formerly cost centres.*

COURSE OUTCOMES (COs)

On successful Completion of this course the student will be able to

1. *Summarise the concept of strategic cost management, strategic cost analysis – target costing, life cycle costing and Kaizen costing and the cost drive concept.*
2. *Describe the decision-making; relevant cost, differential cost, incremental cost and opportunity cost, objectives of a costing system.*
3. *Summarise the meaning and different types of project management and project execution, detailed engineering activities.*
4. *Understand the project contracts,*
5. *Describe the cost behaviour and profit planning types and contents, Bar charts and Network diagram.*
6. *Analyse by using quantitative techniques for cost management like PERT/CPM.*

UNIT – I

Introduction and Overview of the Strategic Cost Management Process.

UNIT-II

Cost Concepts: Cost concepts in decision-making - Relevant cost - Differential cost - Incremental cost and Opportunity cost - Objectives of a Costing System - Inventory valuation - Creation of a Database for operational control - Provision of data for Decision Making.

UNIT – III

Project Management: Project: meaning - Different types - why to manage - cost overruns centers - various stages of project execution: conception to commissioning - Project execution as conglomeration of technical and nontechnical activities - Detailed Engineering activities - Pre project execution main clearances and documents - Project team: Role of each member - Importance Project site: Data required with significance - Project contracts - Types and contents - Project execution Project cost control - Bar charts and Network diagram - Project commissioning: mechanical and process.

UNIT – IV

Cost Behavior and Profit Planning: Cost Behavior and Profit Planning Marginal Costing - Distinction between Marginal Costing and Absorption Costing - Break-even Analysis - Cost-Volume-Profit Analysis - Various decision-making problems - Standard Costing and Variance Analysis - Pricing strategies: Pareto Analysis - Target costing - Life Cycle Costing - Costing of service sector - Just-in-time approach - Material Requirement – Planning - Enterprise Resource Planning -Total Quality Management and Theory of constraints - Activity-Based Cost Management - Bench Marking - Balanced Score Card and Value-Chain Analysis - Budgetary Control - Flexible Budgets - Performance budgets - Zero-based budgets - Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT-V

Quantitative Techniques: Quantitative techniques for cost management - Linear Programming, PERT/CPM - Transportation Problems - Assignment problems – Simulation - Learning Curve Theory.

TEXT BOOKS

1. Robert S Kaplan Anthony A. Alkinson, *Management & Cost Accounting.*
2. N.D. Vohra, *Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.*

REFERENCES

1. *Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi*.
2. Charles T. Horngren and George Foster *Advanced Management Accounting.*
3. Ashish K. Bhattacharya, *Principles & Practices of Cost Accounting A. H. Wheeler publisher.*

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2. https://nptel.ac.in/courses/105104161/

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(19EE2128) WASTE TO ENERGY

(Open Elective)

COURSE OBJECTIVES

The objectives of this course:

1. *To learn different types of waste materials available for energy conversion*
2. *To understand Pyrolytic oil and gases*
3. *To introduce gasification methods for biomass*
4. *To learn concepts of biomass resources, combustion types and biogas plant technology*

COURSE OUTCOMES (COs)

On successful completion of this course, the student will be able to

1. *Analyse agro based, forest residue and industrial waste conversion processes.*
2. *Manufacture of Pyrolytic oils and gases*
3. *Manufacture of charcoal, yields and applications*
4. *Understand various types of gasifiers operation*
5. *Understand inclined and fluidized bed combustors operation*
6. *Understand types of biogas plants and biomass energy programme in India*

UNIT- I

Introduction to Energy from waste: Classification of waste as fuel – Agro based- Forest residue- Industrial waste- MSW- conversion devices- Incinerators- Gasifiers-Digestors.

UNIT- II

Bio-mass Pyrolysis: Pyrolysis- Types- Slow-Fast- Manufacture of Charcoal- methods- yields and application. Manufacture of Pyrolytic oils and gases – yields and applications.

UNIT- III

Biomass Gasification: Gasifiers- Fixed bed system- Downdraft and Updraft gasifiers- Fluidized bed gasifiers- construction and operation- Gasifier burner arrangement for thermal heating.

UNIT- IV

Biomass Combustion: Biomass stoves- Types- Inclined combustors- Fluidized bed combustors- construction and operation of above biomass combustors.

UNIT- V

Properties of Biogas: Biogas plant Technology and status – Biomass resources and their classification- Biomass conversion processes- thermo chemical conversion – Direct Combustion-

Biomass gasification- Pyrolysis and liquefaction – bio-chemical conversion- anaerobic digestion-Types of biogas plants- applications-Biomass Energy Programme in India.

TEXT BOOKS

1. Non-Conventional Energy- Desai Ashok V. Wiley Eastern Ltd 1990.
2. Biogas Technology – A Practical Hand Book – Khandelwal K.C. and Mahdi SS, Vol I & II. Tata McGraw Hill Publishing Co Ltd.,1983.

REFERENCES

1. Food, Feed and Fuel from Biomass – Challal D.S., IBH Publishing Co Pvt Ltd.,1991.
2. Non-conventional Energy Sourcrs- GD Roy, Khanna Publishers, 6th Edition
3. Biomass & Bioenergy – Khahid RehmanHekeem, Mohammad Jawald., Umar Rashid- Springer International Publishing Ltd.

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II M.Tech.- I Sem.

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(19ME3121) INDUSTRIAL SAFETY
(Open Elective)

COURSE OBJECTIVES
The objectives of this course:

1. *To learn about mechanical and electrical hazards.*
2. *To learn about Fundamentals of Maintenance Engineering.*
3. *To learn about Wear and Corrosion and their prevention.*
4. *To know about Fault Tracking*
5. *To learn about Periodic and preventive maintenance.*

COURSE OUTCOMES(COs)
On successful completion of this course, the student will be able to

1. *Explain the Points of factories act 1948 for health and safety.*
2. *Define the term Cost & its relation with replacement economy.*
3. Recognize the Concept of Wear, Corrosion and its Prevention methods
4. Understand the Concept of sequence of fault finding activities and the importance of decision tree
5. *Elaborate the importance of scheduled preventive maintenance of mechanical and electrical equipment.*
6. *Distinguish between Periodic and Preventive maintenance of equipments*

UNIT-I
Industrial Safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II
Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III
Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick

feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

TEXT BOOKS

1. Higgins & Morrow, *Maintenance Engineering Handbook*,McGraw-Hill, 2008
2. H. P. Garg, *Maintenance Engineering*, S. Chand and Company, 1987.

REFERENCES:

1. Audels, *Pump-hydraulic Compressors*, McGraw Hill Publication.
2. Winterkorn, *Foundation Engineering Handbook,* Chapman& Hall London.

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(19ME3021) ADVANCES IN OPERATIONS RESEARCH
(Open Elective)

COURSE OBJECTIVES
The objectives of this course:

1. *To enumerate the fundamentals of Linear Programming*
2. *To learn classical optimization techniques*
3. *To develop the best strategy of Game and identifying the Queuing theory.*
4. *To understand about sequence and optimum Duration of the Project*
5. *To develop the importance of Replacement models and Inventory control*

COURSE OUTCOMES (COs)
On successful Completion of this course the student will be able to

1. *Create mathematical models of the real time situations.*
2. *Implement Transportation and Assignment problems to solve in real time industry*
3. *Choose the best strategy of Game and capable of identifying the suitable queuing theory*
4. *Enumerate fundamental techniques and apply it to solve various optimization areas*
5. *Investigate, study, Apply knowledge in Replacement models and*
6. *Understand the Inventory control Models*

UNIT-I
Introduction to OR and Linear Programming-OR definition–Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Degeneracy - Problems

UNIT-II
Transportation Problem – Formulation; Initial Basic Feasible Solution-North-West Corner Rule, Least Cost Method, Vogel‘s Approximation Method, Modified Distribution (MODI) Method, Unbalanced Transportation - Problems
Assignment Problem – Formulation, Optimal Solution -Traveling Salesman problem.

UNIT-III
Game Theory - Introduction – Minimax (Maxi mini) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy and Mixed Strategies – 2 X 2 Games – Dominance Principle.
Queuing Theory- Introduction to queuing system–Service Channel, Arrival Pattern, Size of Population, Service Pattern, Queue Discipline, Customer Behavior, Probability Distribution-Birth & Death Process, Simple Problems on Single Service channel only.

UNIT-IV
Sequencing –Terminology - Johnson’s Algorithm for n-jobs x 2 Machines and n-jobs x 3 machines models - Problems

PERT & CPM: Introduction, Difference between PERT and CPM, Terminology- Activities, Events, Predecessor, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float; CPM- Deterministic Model; PERT- Probabilistic Model, Critical Path, Optimal Project Duration, Least Possible Project Duration- Problems.

UNIT-V

Replacement – Failure Mechanism of Items**,** Types of Replacements- Individual Replacement policy, Group Replacement policy, Replacement of items fail suddenly – problems

Inventory - Necessity for maintaining inventory, inventory costs, classification of fixed order quantity inventory models, selective inventory management techniques.

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TEXT BOOKS

1. S D. SHARMA, *Operations Research*, KNRN Publications, 17th edition 2015
2. Hamdy A Taha , *Operations Research*,Pearson Publications, 9th edition 2015

REFERENCES

1. Manohar Mahajan, *Operations Research*, Dhanpat Rai & Co 2016
2. Er. Premkumar Guptha & Dr.D.S.Hira, *Operations Research*, Schand publications 2012.
3. R Panneer selvam, *Operations Research*, PHI, 2nd edition, 2012

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II M.Tech.- I Sem.

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(19ME3022) COMPOSITE MATERIALS
(Open Elective)

COURSE OBJECTIVES
The objectives of this course:

1. *To understand the mechanical behavior of composite materials*
2. *To get an overview of the methods of manufacturing composite materials.*
3. *To know the fundamentals of composite materials.*
4. *To understand the fabrication and process of composites.*
5. *To recognize the applications of composite materials.*

COURSE OUTCOMES (COs)
On successful completion of this course, the student will be able to

1. *Explain the Fundamental concept of composite materials.*
2. *Classify different types of composite materials.*
3. *Describe the Fabrication and processing of composite materials.*
4. *Illustrate the Methods of preparation of Metal matrix Composites and polymer matrix composites*
5. *Discuss about the Mechanical behavior of composite materials.*
6. *Explain the application of composite materials.*

UNIT- I
Introduction To Composites: Fundamentals of composites – need– enhancement of properties – classifications —Introduction to Reinforcement composites–types. Applications.Fiber production techniques for glass, carbon and ceramic fibers –Resin materials-Types.

UNIT- II
Polymer Matrix Composites: Fabrication of PMC's ,Fabrication of Fibers, Plastic Fiber Forms, Pre-pregs, Molding Compounds-Processes, Lay-Ups, Filament Winding, Pultrusion, and Recycling. Matrix – Reinforcement Interface, Wettability.

UNIT-III
MMC & CMC: Fabrication of MMC'S, Liquid Infiltration- Casting, Solid State Processes-Diffusion Bonding &In Situ Technique. Fabrication of CMC's, Hot-Pressing, Infiltration, In Situ Chemical reaction Techniques.CVD& CVI, Sol-gel.

UNIT-IV
Mechanics of Composites: Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria, Von -Mises Yield criterion for

isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai-Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates

UNIT-V

Applications Of Composites: Applications of advanced composite materials. Environmental effects in Composites, Green composites, Synthesis and Properties of Nano composites. Surface Composites & Surface metal matrix composites: Need, Synthesis, Properties and applications.

TEXT BOOKS

1. Mathews F. L. and Rawlings R. D., *Composite Materials: Engineering and Science*, 1st Edition, Chapman and Hall, London, England, 1994.
2. Chawla K. K., *Composite materials*, Second Edition, Springer – Verlag, 1998.

REFERENCES

1. Clyne, T. W. and Withers, P. J., *Introduction to Metal Matrix Composites*, Cambridge University Press, 1993.
2. Strong, A.B., *Fundamentals of Composite Manufacturing*, SME, 1989.
3. Sharma, S.C., *Composite mat*