M. TECH. ELECTRONICS & COMMUNICATION ENGINEERING (MICRO ELECTRONICS)

Total Contact Hours = 24 Total Marks = 600 Total Credits = 22

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MECE5-101	Hardware Description Languages and VLSI Design	4	0	0	40	60	100	4
MECE5-102	Microelectronics	4	0	0	40	60	100	4
MECE5-103	Advanced Semiconductor Physics	4	0	0	40	60	100	4
MECE5-104	Research Lab-I	0	0	4	60	40	100	2
Departmental Elective – I (Select any one)		4	0	0	40	60	100	4
MECE5-156	Nanoscale Devices and Systems							
MECE5-157	Electronic System Design							
MECE5-158	Information Theory and Coding							
MECE5-159	Digital Signal Processing							
Departmental Elective – II (Select any one)		4	0	0	40	60	100	4
MECE5-160	Sensors & Transducers							
MECE5-161	Optoelectronics							
MECE5-162	Materials Science & Engineering							
MECE5-163	Soft Computing							
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 24 Total Marks = 600 Total Credits = 22

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MECE5-205	MEMS and NEMS	4	0	0	40	60	100	4
MECE5-206	CPLD and FPGA Architectures and Applications	4	0	0	40	60	100	4
MECE5-207	Research Lab -II	0	0	4	60	40	100	2
Departmental Elective – III (Select any one)		4	0	0	40	60	100	4
MECE5-264	Satellite Communication							
MECE5-265	Electronic System Design							
MECE5-266	MOS Integrated Circuit Modelling							
MECE5-267	Parallel Processing							
Departmental Elective – IV (Select any one)		4	0	0	40	60	100	4
MECE5-268	CAD Tools for VLSI Design							
MECE5-269	Nano Electronics							
MECE5-270	Multimedia Communication System							
MECE5-271	Low Power VLSI Design							
Open Elective – I (Select any One)		4	0	0	40	60	100	4
Total	**Theory = 5 Lab = 1**	**20**	**0**	**4**	**260**	**340**	**600**	**22**

Overall

Semester	Marks	Credits
1st	600	22
2nd	600	22
Total	**1200**	**44**

HARDWARE DESCRIPTION LANGUAGES AND VLSI DESIGN

Subject Code: MECE5-101 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs)

MOS Transistor Theory: **I**ntroduction, Ideal I-V Characteristics, Second Order Effects, CMOS Logic, CMOS Fabrication and Layout, VLSI Design Flow.

Circuit Characterization and Performance Estimation: CMOS Inverter, DC Transfer Characteristics, Delay Estimation, Logical Effort, Power Dissipation, Scaling and Latch-up

UNIT-II (11 Hrs)

Combinational and Sequential Circuit Design: Static CMOS, Ratioed Circuits, Differential Cascode Voltage Switch Logic, Dynamic Circuits, Domino Logic-Pass Transistor Circuits, CMOS D Latch and Edge Triggered Flip-flop and Schmitt trigger.

UNIT-III (12 Hrs)

HDL Programming Using Behavioural and Data Flow Models: Verilog, Introduction, Typical Design Flow, Modules and Ports, Instances, Components, Lexical Conventions, Number Specification, Strings, Identifiers and Keywords, Data Types, System Tasks and Compiler Directives, Behavioural Modelling, Dataflow Modelling, RTL, Gate Level Modelling, Programs For Combinational and Sequential.

UNIT-IV (11 Hrs)

HDL Programming With Structural and Switch Level Models: Tasks and Functions, Difference between Tasks and Functions, Switch Level, MOS Switches, CMOS Switches, Examples: CMOS NAND and NOR, MUX using Transmission Gate, CMOS Flip-Flop.

Recommended Books

1. Neil H.E. Weste, David Harris and Ayan Banenjee, 'CMOS VLSI Design', 3rd Edn., Pearson, **2004.**
2. Sung Mu Kang and Yusuf Leblebici, 'CMOS Digital Integrated Circuits', 3rd Edn., Tata Mc-Graw Hill, **2002.**
3. Samir Palnitkar, 'Verilog HDL', 2nd Edn., Pearson, **2004.**

MICRO ELECTRONICS

Subject Code: MECE5-102 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs)

Crystal Growth and Wafer Preparation: Clean room concept, safety requirements, crystal growth techniques: czochralski and gradient freeze techniques, physics involved in CZ growth, Energy flow balance, pull rate- considerations, problems and solutions, defects involved in CZ method, effects due to carbon and oxygen impurities, modelling of dopant incorporation, float zone growth for high purity silicon, liquid encapsulated growth for GaAs, material characterization- wafer shaping, crystal characterization, wafer cleaning.

Current Element Characteristics: Growth mechanism and kinetic oxidation, thin oxides, oxidation techniques and systems, oxide properties, characterization of oxide films, growth and properties of dry and wet oxidation, charge distribution during oxidation, oxide characterization, anomalies with thin oxide regime.

UNIT-II (10 Hrs)

Diffusion: The nature of diffusion, diffusion mechanisms – interstitial, substitution, interstitial-substitution combined, interstitially and grain boundary, Fick's law of diffusion, limited and constant source diffusion, models of diffusion in solid, diffusion equation, atomic diffusion mechanisms, diffusion system for silicon and gallium arsenide. Measurement techniques, experimental analysis of diffused profiles.

Ion Implantation: Introduction, physics of implantation, range theory, projected range, ion stopping mechanisms- channelling, nuclear stopping, electronic stopping, implantation damage, implantation equipment, annealing, shallow junction, application to silicon and gallium arsenide, RTA mechanism.

UNIT-III (12 Hrs)

Lithography: Pattern generation and mask making, exposure sources, photolithography, photoresists, optical lithography, electron lithography, X-ray lithography, ion lithography, mask defects, atomic force microscopy based lithography system, dip pen lithography system.

Deposition: Need for film deposition, film deposition methods- physical and chemical, deposition processes, CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films, sputter deposition, sputter unit, Epitaxy –types, techniques, advantages, vapour phase epitaxy, molecular beam epitaxy.

UNIT-IV (12 Hrs)

Etching: Directionality and selectivity issues, wet chemical etching, wet etchants, dry physical etching, dry etchants, plasma etching, advantages and disadvantages, issues involved, dry etching systems, dry chemical etching, reactive ion etching, etching induced damage, cleaning.

Metallization: Introduction, metallization applications, metallization choices, physical vapour deposition, patterning, metallization problems.

Recommended Books

1. S.M. Sze, 'VLSI Technology', TMH.
2. S.K. Gandhi, 'VLSI Fabrication Principles'.
3. S.M. Sze, 'Semiconductor Devices Physics and Technology'.
4. K.R. Botkar, 'Integrated Circuits'.

ADVANCED SEMICONDUCTOR PHYSICS

Subject Code: MECE5-103	L T P C 4 0 0 4	Duration: 45 Hrs

UNIT-I (12 Hrs)

Preparation and Characterization of Semiconductors: Types of semiconductors, charge carrier statistics, crystal growth, preparation and doping techniques of elemental and compound semiconductors, Metallization, Lithography and Etching, Bipolar and MOS device fabrication characterization (electrical, thermoelectric, magnetic and optical properties) of semiconductor materials

UNIT-II (10 Hrs)

Optical Properties of Semiconductors: Dipolar elements in direct gap semiconductors, optical susceptibility of a semiconductor, absorption and spontaneous emission, bimolecular recombination coefficient, condition for optical amplification in semiconductors.

UNIT-III (12 Hrs)

Electronic and Electric Properties of Semiconductors: Boltzmann equation, scattering mechanisms, hot electrons, recombination, transport equation in a semiconductor, Electronic and ionic conductivity, solid oxide fuel cells, ceramic semiconductors, linear dielectrics, dielectric properties, Ferroelectric materials, piezoelectrics, ferro-piezoceramics, actuators and electrostrictions, pyroelectrics, electro-optics photorefractives, thin film capacitors. Ferroic crystals, primary and secondary ferroics, proper ferroics, magnetoferroelectricity.

UNIT-IV (11 Hrs)

Applications in Semiconductor Devices: Ge, Si, GaAs, Semiconductor device: metal-semiconductor and semiconductor heterojunctions, physics of bipolar devices, fundamentals of MOS and field effect devices, basics of solar cell, photodiodes, photodetectors.

Recommended Books

1. S.M. Sze and Kwok. K. Ng, 'Physics of Semiconductor Devices', 3rd Edn., Wiley, **2008.**
2. J. Wilson and J.F.B. Hawkes, 'Optoelectronics: An Introduction'. Prentice-Hall, **1989.**
3. R.A. Smith, 'Semiconductors', Academic Press, **1963.**
4. M. Shur, 'Physics of Semiconductor Devices', Prentice Hall, **1990.**
5. A. Paul, 'Chemistry of Glasses', Chapman and Hall, **1982.**
6. Bishnu P. Pal, 'Fundamentals of Fibre Optics in Telecommunication and Sensor Systems', New Age International Publishers, **2005**.
7. Kwan Chi Kao, 'Dielectric Phenomena in Solids', Elsevier Academic Press, **2004.**
8. Vinod K. Vadhawan, 'Introduction to Ferroic Materials', Gordon and Breach Science Publications, **2000.**

RESEARCH LAB-I

Subject Code: MECE5-104 **L T P C**
0 0 4 2

Every Subject In-charge will define atleast one project to each student of his/her (preferably different) concerned subject to be performed in Research- Lab.

NANOSCALE DEVICES AND SYSTEMS

Subject Code: MECE5-156 **L T P C** **Duration: 45 Hrs**
4 0 0 4

UNIT-I (10 Hrs)

CMOS scaling challenges in nanoscale regimes: Moor and Koomey's law, Leakage current mechanisms in nanoscale CMOS, leakage control and reduction techniques, process variations in devices and interconnects.

UNIT-II (13 Hrs)

Device and technologies for sub 100nm CMOS: Silicidation and Cu-low k interconnects, strain silicon – biaxial stain and process induced strain; Metal-high k gate; Emerging CMOS technologies at 32nm scale and beyond – FINFETs, surround gate nanowire MOSFETs, heterostructure (III-V) and Si-Ge MOSFETs.

UNIT-III (11 Hrs)

Device scaling and ballistic MOSFET: Two dimensional scaling theory of single and multigate MOSFETs, generalized scale length, quantum confinement and tunnelling in

MOSFTEs, velocity saturation, carrier back scattering and injection velocity effects, scattering theory of MOSFETs.

UNIT-IV (11 Hrs)

Emerging nanoscale devices: Si and hetero-structure nanowire MOSFETs, carbon nanotube MOSFETs, Tunnel FET, quantum wells, quantum wires and quantum dots; Single electron transistors, resonant tunnelling devices.

Recommended Books

1. M. Lundstrom,, 'Nanoscale Transport: Device Physics, Modeling, and Simulation', Springer, **2005.**
2. Sandip Kundu, Aswin Sreedhar, 'Nanoscale CMOS VLSI Circuits: Design for Manufacturability', McGraw Hill, **2010.**
3. C.K. Maiti, S. Chattopadhyay and L.K. Bera, 'Strained-Si and Hetrostructure Field Effect Devices', Taylor and Francis, **2007.**
4. G.W. Hanson, 'Fundamentals of Nanoelectronics', Pearson India, **2008.**

ELECTRONIC SYSTEM DESIGN

Subject Code: MECE5-157 | **L T P C 4 0 0 4** | **Duration: 45 Hrs**

UNIT-I (10 Hrs)

MSI and LSI Circuits and Their Applications: Review of Digital electronics concept, Arithmetic Circuits, Comparators, Multiplexers, Code Converters, XOR and AND OR INVERTER Gates, Wired Logic, Bus Oriented Structures, Tri-State Bus System, Propagation Delay.

UNIT-II (12 Hrs)

Sequential Machines: The Concept Of Memory, The Binary Cell, The Cell And The Bouncing Switch, Set/Reset, D, Clocked T, Clocked JK Flip Flop, Design Of Clock F/F, Conversion, Clocking Aspects, Clock Skew, State Diagram Synchronous Analysis Process, Design Steps For Traditional Synchronous Sequential Circuits, State Reduction, Design Steps For Next State Decoders, Design Of Out Put Decoders, Counters, Shift Registers and Memory.

UNIT-III (11 Hrs)

Multi Input System Controller Design: System Controllers, Design Phases And System Documentation, Defining The System, Timing And Frequency Considerations, Functional, Position And Detailed Flow Diagram Development, MDS Diagram, Generation, Synchronizing Two System And Choosing Controller, Architecture, State Assignment, Next State Decoders And Its Maps, Output Decoders, Clock And Power Supply Requirements, MSI Decoders, Multiplexers In System Controllers, Indirect Addressed Multiplexers Configurations, Programmable System Controllers, ROM, PLA And PAL Based Design.

UNIT-IV (12 Hrs)

Asynchronous Finite State Machines: Scope, Asynchronous Analysis, Design Of Asynchronous Machines, Cycle And Races, Plotting And Reading The Excitation Map, Hazards, Essential Hazards Map Entered Variable, MEV Approaches To Asynchronous Design, Hazards In Circuit Developed By MEV Method, Electromagnetic Interference And Electromagnetic Compatibility Grounding And Shielding of Digital Circuits. Interfacing digital system with different media like fiber cable, co-axial cable etc.

Recommended Books

1. Fletcher, 'An Engineering Approach to Digital Design', PHI, **1990.**
2. 'Designing with TTL Circuits', Texas Instruments.
3. Related IEEE/IEE Publications.

INFORMATION THEORY AND CODING

Subject Code: MECE5-158 **L T P C** **Duration: 45 Hrs**
4 0 0 4

UNIT-I (11 Hrs)

Elements of information theory Source coding theorem, Huffman coding, Channel coding theorem, channel capacity theorem, Shenonfano theorem, entropy

UNIT-II (11 Hrs)

Sampling Process Base band and band pass sampling theorems reconstruction from samples, Practical aspects of sampling and signal recovery TDM

UNIT-III (11 Hrs)

Waveform Coding Techniques PCM Channel noise and error probability DPCM and DM Coding speech at low bit rates Prediction and adaptive filters. Base band shaping for data transmission, PAM signals and their power spectra Nyquist criterion ISI and eye pattern Equalization.

UNIT-IV (12 Hrs)

Digital Modulation Techniques Binary and M-ary modulation techniques, Coherent and non-coherent detection, Bit Vs symbol error probability and bandwidth efficiency. Bit error analysis, using orthogonal Signalling. Error Control Coding Rationale for coding Linbear block codes, cyclic codes and convolution codes Viterbi decoding algorithm and trellis codes.

Recommended Books

1. J. Dass, S.K. Malik & P.K. Chatterjee, 'Principles of digitals communication', Wiley-Blackwel, **1991**.
2. Vera Pless,'Introduction to the Theory of Error Correcting Codes', 3rd Edn., **1998.**
3. Robert G. Gallanger, 'Information Theory and Reliable Communication', Mc Graw Hill, **1992.**

DIGITAL SIGNAL PROCESSING

Subject Code: MECE5-159 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs)

DISCRETE TIME SIGNALS AND SYSTEMS

Signals, Classification of signals, Signal processing, Basic elements of a digital signal processing system, Advantages of digital signal processing over analog signal processing, Sampling, Aliasing, Discrete-time systems, Analysis of discrete-time linear shift-invariant systems, Linearity, Causality and stability criterion, Discrete-time systems described by difference equations, Convolution.

UNIT-II (13 Hrs)

Discrete Transforms: The Fourier transform of discrete-time signals (DTFT), Properties of the DTFT, The frequency response of an LTI discrete-time system, Frequency domain sampling and DFT: Properties of DFT, Linear filtering using DFT, Frequency analysis of signals using DFT, radix 2, Goertzel algorithm, Efficient computation of the DFT: Decimation-in-time and decimation-in frequency, Linear convolution using DFT, Fast Fourier transform algorithms, Applications of FFT algorithm, Introduction to the Z-transform & the inverse Z-transform, Properties of the Z-transform, Relationship between the Fourier transform and the Z-transform, System function, Analysis of linear time-invariant systems in the Z-domain.

UNIT-III (9 Hrs)

Implementation of Discrete Time Systems: Direct form, Cascade form, Frequency sampling and lattice structures for FIR systems. Direct forms, Transposed form, Cascade form, Parallel form. Lattice and lattice ladder structures for IIR systems.

UNIT-IV (11 Hrs)

Design of Fir Iir Filters: General considerations of digital filter design, Characteristics of practical frequency selective filters. Filters design specifications, Design of FIR filters using windows, Gibbs phenomenon, Design of FIR filters by frequency sampling method, Design of optimum equiripple FIR filters. Comparison of design methods for FIR filters. Design of IIR filters from analog filters, Design by approximation of derivatives, Impulse invariance method, Bilinear transformation method, Characteristics of Butterworth, Chebyshev and Elliptical analog filters, Frequency transformation, Least square methods.

Recommended Books

1. John G. Proakis & Dimitris G. Manolakis, 'Digital Signal Processing: Principles, Algorithms and Applications', 2nd Edn., Pearson Education.
2. A.V. Openheim & R.W. Schafer, 'Discrete Time Signal Processing', 2nd Edn., PHI, **1998**.
3. Alan V. Oppenheim & Ronald W. Schafer; 'Digital Signal Processing', 1st Edn., PHI Publications, **2007**.

SENSORS & TRANSDUCERS

Subject Code: MECE5-160	**L T P C** **4 0 0 4**	**Duration: 45 Hrs**

UNIT-I (9 Hrs)

Sensors/Transducers: Principles, Classification, Parameters, Characteristics (Static and Dynamic), Environmental Parameters (EP), Characterization.

Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge (Resistance and Semiconductor), Inductive Sensors: Sensitivity and Linearity of the Sensor, Types-Capacitive Sensors, Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

UNIT –II (13 Hrs)

Thermal Sensors: Introduction, Gas Thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermosensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermoemf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal

Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry and Heat Flux Sensors.

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magnetoresistive Sensors (Anisotropic and Semiconductor), Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers (Synchros and Synchro-resolvers), Eddy Current Sensors, Electromagnetic Flowmeter, Switching Magnetic Sensors and SQUID Sensors.

UNIT-III (11 Hrs)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photosensistors/Photo Detectors, X-ray and Nuclear Radiation Sensors and Fiber Optic Sensors.

Electroanalytical Sensors: Introduction, The Electrochemical Cell, The Cell Potential, Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization (Concentration, Reactive, Adsorption and Charge Transfer), Reference Electrodes, Sensor Electrodes and Electroceramics in Gas Media.

UNIT-IV (12 Hrs)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication (Standards for Smart Sensor Interface) and The Automation

Sensor's Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing and Sensors for Environmental Monitoring.

Recommended Books

1. D. Patranabis, 'Sensors and Transducers', 2nd Edn., PHI, **2003.**
2. W. Bolton, 'Mechatronics', 4th Edn., Pearson, **2011.**

OPTOELECTRONICS

Subject Code: MECE5-161 | **L T P C 4 0 0 4** | **Duration: 45 Hrs**

UNIT-I (11 Hrs)

Nature of light, light sources, black body, colour temperature, units of light, radio metric and photometric units, basic semiconductors, PN junction, carrier recombination and diffusion, injection efficiency, heterojunction, internal quantum efficiency, external quantum efficiency, double hetero junction, fabrication of heterojunction, quantum wells and super lattices.

UNIT-II (11 Hrs)

Optoelectronic devices, Optical modulators, modulation methods and modulators, transmitters, optical transmitter circuits, LED and laser drive circuits, LED-Power and efficiency, double hereostructure LED, LED structures, LED characteristics, laser modes, strip geometry, gain guided lasers, index guided lasers.

UNIT-III (11 Hrs)

Modulation of light, birefringence, electro-optic effect, Electro-Optic materials and applications, Kerr modulators, scanning and switching, self-electro-optic devices, Magneto-Optical devices, Acousto-Optic devices, Acousto-Optic modulators.

UNIT-IV (12 Hrs)

Display devices, Photoluminescence, cathodoluminescence, EL display, LED display, drive circuitry, plasma panel display, liquid crystals, properties, LCD displays, numeric displays.

Photo detectors, thermal detectors, photoconductors, detectors, photon devices, PMT, photodiodes, photo transistors, noise characteristics of photo-detectors, PIN diode, APD characteristics, Design of detector arrays, CCD, Solar cells.

Recommended Books

1. John Wilson and J.F.B. Hawkes, 'Optoelectronics: An Introduction', Prentice-Hall India, **1996.**
2. J.M. Senior, 'Optical Fibre Communication', Prentice Hall India, **1985.**
3. J. Gowar, 'Optical Fibre Communication Systems', Prentice Hall, **1995.**
4. J. Palais, 'Introduction to Optical Electronics', Prentice Hall, **1988.**
5. Jasprit Singh, 'Semiconductor Optoelectronics', McGraw-Hill, **1995.**
6. P. Bhattacharya, 'Semiconductor Optoelectronic Devices', PHI, **1995.**
7. R.P. Khare, 'Fibre Optics and Optoelectronics', Oxford University Press, **2004.**

MATERIAL SCIENCE & ENGINEERING

Subject Code: MECE5-162 **L T P C** **Duration: 45 Hrs**
4 0 0 4

UNIT-I (12 Hrs)

Atomic Structure, Bonding Classifications, Seven Systems and Fourteen Lattices, Metal, Ceramic, Polymeric and Semiconductor Structures, X-ray Diffraction, and Defects (Point, Linear and Planar), Diffusion, Mechanical Behavior: Stress versus Strain, Elastic and Plastic Deformation, Hardness, Creep and Stress Relaxation, Viscoelastic Deformation. Thermal Behavior: Heat capacity, Thermal expansion, conductivity and shock, Failure Analysis & Prevention.

UNIT-II (13 Hrs)

Phase Diagrams-Equilibrium Microstructural Development: Phase Rule and Diagram, Lever Rule, Heat Treatment, Metals, Ceramics and Glasses, Polymerization, Structural Features of Polymers, Thermoplastic and Thermosetting Polymers, Composites (Fiber Reinforced and Aggregate), Mechanical Properties and Processing of Composites, Electrical Behavior, Optical Behavior, Corrosion & Oxidation Semiconductor Materials, Magnetic Materials, Environmental Degradation.

UNIT-III (14 Hrs)

Superconductivity, Band Structure, Carrier Concentration, Electrical, Mechanical and Optical properties of Gallium Nitride (GaN), Aluminum Nitride (AlN), Indium Nitride (InN), Boron Nitride (BN), Silicon Carbide (SiC), Silicon-Germanium(Si1-xGex).

UNIT-IV (6 Hrs)

Materials of Special Applications viz. Cryogenic, High Temperature, High Frequency Application

Recommended Books

1. Michael E. Levinshtein, Sergey L. Rumyantsev and Michael S. Shur, 'Properties of Advanced Semiconductor Materials: GaN, AlN, InN, BN, SiC and SiGe', John Wiley & Sons, **2001**.
2. James F. Shackelford, 'Introduction to Materials Science for Engineers', 6th Edn., Prentice Hall, **2001**.
3. 'Fundaments of Semiconductors: Physics and Materials Properties by Yu and M Cardona', Springer, **1996.**
4. K.M. Gupta, 'Materials Science & Engineering', 5th Edn., Umesh Publications, **2012**.

SOFT COMPUTING

Subject Code: MECE5-163 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs)

Soft Computing: Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing.
Fuzzy Logic: Fuzzy set versus crisp set, basic concepts of fuzzy sets, membership functions, basic operations on fuzzy sets and its properties. Fuzzy relations versus Crisp relation,
Fuzzy rule base system: Fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, Fuzzy Inference Systems (FIS) – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models, Fuzzification and Defuzzification, fuzzy decision making & Applications of fuzzy logic.

UNIT-II (13 Hrs)

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN and its applications. Neural Network architecture: Single layer and multilayer feed forward networks and recurrent networks. Learning rules and equations: Perceptron, Hebb's, Delta, winner take all and out-star learning rules. Supervised Learning Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised Learning Networks: Competitive networks, Adaptive Resonance Theory, Kohnen Self Organizing Map

UNIT-III (12 Hrs)

Genetic Algorithm: Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modelling: selection operator, cross over, mutation operator, Stopping Condition and GA flow, Constraints in GA, Applications of GA, Classification of GA.

UNIT-IV (8 Hrs)

Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems

Recommended Books

1. S. Rajasekaran & G.A. Vijayalakshmi Pai, 'Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & Applications', PHI Publication.
2. S.N. Sivanandam & S.N. Deepa, 'Principles of Soft Computing', Wiley Publications.

Reference Books

1. Michael Negnevitsky, 'Artificial Intelligence', Pearson Education, New Delhi, **2008**.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Wiley, **2010**.

MICRO & NANO ELECTRO MECHANICAL SYSTEM (MEMS & NEMS)

Subject Code: MECE5-205 **L T P C** **Duration: 48 Hrs**
4 0 0 4

Course Objectives

The course aims to give the students a basic knowledge about state-of-the-art MEMS including technology, device architecture, design and modelling, scalability, figures of merit and RF IC novel functionality and performance.

Learning Outcomes

Students will attain analytical and design oriented feature knowledge about NEMS and MEMS. Reliability and packaging are also considered as key issues for industrial applications.

UNIT-I (12 Hrs)

Micro Electro Mechanical System (MEMS) Origins, MEMS Impetus / Motivation, Material for MEMS, The toolbox: Processes for Micro machining.

UNIT-II (12 hrs)

MEMS Fabrication Technologies, Fundamental MEMS Device Physics: Actuation.

UNIT-III (12 Hrs)

Fundamental MEMS Devices: The Cantilever Beam. Microwave MEMS Applications: MEM Switch

UNIT-IV (12 Hrs)

Design Considerations. The Micromachined Transmission Line. MEMS-Based Microwave Circuit and System

Recommended Books

1. Hector J. De Los Santos, 'Micro-Electromechanical (MEM) Microwave Systems', Artechhouse.
2. Nadim Maluf, 'An Introduction to Micro-Electromechanical System', Artechhouse.

CPLD AND FPGA ARCHITECTURE AND APPLICATIONS

Subject Code: MECE5-206 | **L T P C 4 0 0 4** | **Duration: 48 Hrs**

Learning Objectives

1. To learn fundamentals of Programmable Logic Devices.
2. To enrich the ideas of field programmable gate arrays.
3. To explore the ideas of SRAM programmable FPGAs
4. To facilitate the knowledge of anti-fuse programmed FPGAs.

Learning Outcomes

1. Understanding of Programmable logic devices and its architecture.
2. Knowledge of FPGAs and its applications.
3. Fundamental understanding of SRAM and anti-fuse programmed FPGAs

UNIT-I (12 Hrs)

Introduction to Programmable Logic Devices: Introduction, Simple Programmable Logic Devices – Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Programmable Logic Devices/Generic Array Logic; Complex Programmable Logic Devices – Architecture of Xilinx Cool Runner XCR3064XL CPLD, CPLD Implementation of a Parallel Adder with Accumulation.

UNIT-II (12 Hrs)

Field Programmable Gate Arrays: Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, and Programmable I/O blocks in FPGAs, Dedicated Specialized Components of FPGAs, Applications of FPGAs.

UNIT –III (12 Hrs)

SRAM Programmable FPGAs: Introduction, Programming Technology, Device Architecture, The Xilinx XC2000, XC3000 and XC4000 Architectures.

UNIT –IV (12 Hrs)

Anti-Fuse Programmed FPGAs: Introduction, Programming Technology, Device Architecture, The Actel ACT1, ACT2 and ACT3 Architectures.

Recommended Books

1. Stephen M. Trimberger, 'Field Programmable Gate Array Technology', International Edition Springer.
2. Charles H. Roth Jr, Lizy Kurian John, 'Digital Systems Design', Cengage Learning.
3. John V. Oldfield, Richard C. Dorf, 'Field Programmable Gate Arrays', Wiley India.
4. Pak K. Chan/Samiha Mourad, 'Digital Design Using Field Programmable Gate Arrays', Pearson Low, Price Edition.
5. Ian Grout, 'Digital Systems Design with FPGAs and CPLDs', Elsevier, Newnes.
6. Wayne Wolf, 'FPGA based System Design', Prentice Hall Modern Semiconductor Design Series.

RESEARCH LAB - II

Subject Code: MECE5-207 **L T P C**
0 0 4 2

Students will be made familiar with maximum available software like optisystem, optsim, Matlab, Virtual instrumentation, Network simulator, HFSS etc.so that student can opt any one as per his/her interest for thesis work. Students will be advised to go through maximum research papers and conclude a particular domain to work further.

SATELLITE COMMUNICATION

Subject Code: MECE5-264 **L T P C** **Duration: 48 Hrs**
4 0 0 4

Course Objectives

This course provides an introduction to the fundamentals of orbital mechanics and launchers, link budgets, modulation, coding, multiple access techniques, propagation effects, and earth terminals. This course provides an understanding how analog and digital technologies are used for satellite communications networks.

Learning Outcomes

The students will gain teaching skills in this area. They will gain skills for performance improvement for different available satellites by calculating power Budgets

UNIT-I (12 hrs)

Introduction: Origin of Satellite Communication, Current state of Satellite Communication, Advantages of Satellite Communication, Active & Passive satellite, Orbital aspects of Satellite Communication, System Performance. Communication Satellite Link Design - Introduction, general link design equation, system noise temperature, C/N & G/T ratio, atmospheric & econospheric effects on linkdesign, complete link design, interference effects on complete link design, earth station
parameters.

UNIT- II (12 hrs)

Satellite Analog & Digital Communication Baseband analog (voice) signal, FDMA techniques, S/N ration, SCPC & CSSB systems, digital baseband signals & modulation techniques.

Multiple Access Techniques TDMA frame structure, burst structure, frame efficiency, superframe, frame acquisition & synchronization, TDMA vs FDMA, burst time plan, beam hopping, satellite switched, Erlang call congestion formula, demand assignment ctrl, DA-FDMA system, DATDMA.

UNIT-III (12 hrs)

Laser & Satellite Communication Link analysis, optical satellite link Tx & Rx, Satellite, beam acquisition, tracking & pointing, cable channel frequency, head end equation, distribution of signal, n/w specifications and architecture, optical fibre CATV system.

UNIT-IV (12 hrs)

Satellite Applications Satellite TV, telephone services via satellite, data Communication services, satellites for earth observation, weather forecast, military appliances, scientific studies.

Recommended Books

1. Timothy Pratt, 'Satellite Communication', Addison Wesley, **2010**.
2. D.C Aggarwal 'Satellite Communication', Willey Sons, **2010**.

ELECTRONIC SYSTEM DESIGN

Subject Code: MECE5-265 **L T P C** **Duration: 48 Hrs**
4 0 0 4

UNIT-I (12 Hrs)

MSI and LSI Circuits and Their Applications: Review of Digital electronics concept, Arithmetic Circuits, Comparators, Multiplexers, Code Converters, XOR and AND OR INVERTER Gates, Wired Logic, Bus Oriented Structures, Tri-State Bus System, Propagation Delay.

UNIT-II (12 Hrs)

Sequential Machines: The Concept of Memory, The Binary Cell, The Cell and The Bouncing Switch, Set/Reset, D, Clocked T, Clocked JK Flip Flop, Design Of Clock F/F, Conversion, Clocking Aspects, Clock Skew, State Diagram Synchronous Analysis Process, Design Steps For Traditional Synchronous Sequential Circuits, State Reduction, Design Steps For Next State Decoders, Design of Out Put Decoders, Counters, Shift Registers and Memory.

UNIT-III (12 Hrs)

Multi Input System Controller Design: System Controllers, Design Phases And System Documentation, Defining The System, Timing And Frequency Considerations, Functional, Position And Detailed Flow Diagram Development, MDS Diagram, Generation, Synchronizing Two System And Choosing Controller, Architecture, State Assignment, Next State Decoders And Its Maps, Output Decoders, Clock And Power Supply Requirements, MSI Decoders, Multiplexers In System Controllers, Indirect Addressed Multiplexers Configurations, Programmable System Controllers, ROM, PLA And PAL Based Design.

UNIT-IV (12 Hrs)

Asynchronous Finite State Machines: Scope, Asynchronous Analysis, Design Of Asynchronous Machines, Cycle And Races, Plotting And Reading The Excitation Map, Hazards, Essential Hazards Map Entered Variable, MEV Approaches To Asynchronous Design, Hazards In Circuit Developed By MEV Method, Electromagnetic Interference And Electromagnetic Compatibility Grounding And Shielding of Digital Circuits. Interfacing digital system with different media like fiber cable, co-axial cable etc.

Recommended Books

4. Fletcher, 'An Engineering Approach to Digital Design', PHI, **1990.**
5. 'Designing with TTL Circuits', Texas Instruments.
6. Related IEEE/IEE Publications.

MOS INTEGRATED CIRCUIT MODELLING

Subject Code: MECE5-266 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Learning Objectives

1. To provide students with a comprehensive understanding on design of MOSFET devices.
2. To enable students to understand modelling and design of bipolar devices.
3. To understand the concept of CMOS and its characteristics.

Learning Outcomes

After successful completion of this course the students will be able to:

1. Demonstrate understanding of basic characteristics such as scaling, threshold voltage, drain current etc. of MOSFET.
2. Compute and evaluate CMOS performance factor.
3. Understand design of bipolar devices.

UNIT-I (12 Hrs)

Basic Device Physics: Energy bands in solids, p-n Junctions, MOS Capacitors, Metal-Silicon Effects, MOSFET Devices Design: Long Channel MOSFET, Short-Channel MOSFETS, MOSFET Scaling, Threshold Voltage. MOSFET DC Model: Drain Current Calculations, Pao-Sah Model, Charge Sheet Model, Piece-Wise Drain Current Model for Enhancement Devices

UNIT-II (12 Hrs)

CMOS Performance Factors: Basic CMOS Circuit Elements, Parasitic Elements, Sensitivity of CMOS delay to device parameters, Performance Factors of Advanced CMOS Devices.

UNIT-III (12 Hrs)

Bipolar Devices Design: npn & pnp Transistors, Ideal Current-Voltage Characteristics, Bipolar Device Models for Circuit and Time-Dependent Analyses, Modern Bipolar Transistor Structures, Figures of Merit of a Bipolar Transistors, Digital Bipolar Circuits.

UNIT-IV (12 Hrs)

MOSFET DC Model: Drain Current Calculations, Pao-Sah Model, Charge Sheet Model, Piece-Wise Drain Current Model for Enhancement Devices.

Recommended Books

1. M.S. Tyagi, 'Introduction to Semiconductor Materials and Devices', Wiley.
2. Ben G. Streetman, 'Solid State Electronic Devices', Pearson Prentice-Hall.
3. Yuan Taur and T.H. Ning, 'Fundamentals of Modern VLSI Devices', Cambridge.

PARALLEL PROCESSING

Subject Code: MECE5-267 **L T P C** **Duration: 48 Hrs**
4 0 0 4

Course Objectives

This course will help students to achieve the following objectives:

1. Describe the principles of computer design and classify instruction set architectures.
2. Describe the operation of performance enhancements such as pipelines, dynamic scheduling, branch prediction, caches, and vector processors.
3. Describe the operation of virtual memory, modern architectures such as RISC, Super Scalar, VLIW (very large instruction word), and multi-core and multi-CPU systems.

Learning Outcomes

Students will have skills in RISC as well as CISC architures and can design or analyses different problems associated with this domain

UNIT-I (12 hrs)

Parallel computer models: The state of computing, Classification of parallel computers, Multiprocessors and multicomputer, Multivector and SIMD computers. Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms.

UNIT-II (12 hrs)

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network. Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors.

UNIT-III (12 hrs)

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines.

UNIT-IV (12 hrs)

Multiprocessor Architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

Recommended Books

1. Kai Hwang, 'Advanced Computer Architecture', 18th Reprint, TMH, **2003**.
2. D.A. Patterson and J.L. Hennessey, 'Computer Organization and Design', 4th Edn., Morgan Kaufmann.
3. J.P. Hayes, 'Computer Architecture and Organization', 2nd Edn., MGH, **1988**.
4. Harvey G. Cragon, 'Memory System and Pipelined Processors', Narosa Publication, **1996**.

5. V. Rajaranam & C.S.R. Murthy, 'Parallel Computer', PHI.
6. R.K. Ghose, Rajan Moona & Phalguni Gupta, 'Foundation of Parallel Processing', Narosa Publications

CAD TOOLS FOR VLSI DESIGN

Subject Code: MECE5-268 **L T P C** **Duration: 48 Hrs**
4 0 0 4

UNIT-I (12 Hrs)

An overview of OS commands. System settings and configuration. Introduction to Unix commands. Writing Shell scripts. VLSI design automation tools., Leonardo spectrum, ISE 8.1i, Quartus II, VLSI backend tools.

UNIT-II (12 Hrs)

Introduction to VLSI design methodologies and supporting CAD tool environment. Overview of C and Data structures, Graphics and CIF, concepts and structure and algorithm for some of the CAD tools, schematic editor, layout editor, Module generator, silicon compilers, placement and routing tools, Behavioural, functional, logic and circuit simulators, Aids for test vector generator and testing.

UNIT-III (12 Hrs)

Synthesis and simulation using HDLs-Logic synthesis using verilog and VHDL. Memory and FSM synthesis. Performance driven synthesis, Simulation- Types of simulation. Static timing analysis. Formal verification. Switch level and transistor level simulation.

UNIT-IV (12 Hrs)

Circuit simulation using Spice - circuit description. AC, DC and transient analysis. Advanced spice commands and analysis. Models for diodes, transistors and opamp. Digital building blocks. A/D, D/A and sample and hold circuits. Design and analysis of mixed signal circuits.

Recommended Books

1. M.J.S. Smith, 'Application Specific Integrated Circuits', Pearson, **2002.**
2. M.H. Rashid, 'Spice for Circuits and Electronics using Pspice', 2nd Edn., PHI.
3. T. Grdtkeretal, 'System Design with System C', Kluwer, **2004**.
4. P.J. Ashendenetal, 'The System Designer's Guide to VHDL-AMS', Elsevier, **2005.**

NANO ELECTRONICS

Subject Code: MECE5-269 **L T P C** **Duration: 48 Hrs**
4 0 0 4

Course Objectives: The main aim of this course is to introduce the students about Nano sciences. Actual chemistry involved in semiconductor physics will be discussed. How this will be helpful for Designing of different circuits.
Learning Outcomes: Students learn skills for handling basic concepts of Nano sciences for different applications for various fields.

UNIT-I (12 Hrs)

Basics and Scale of Nanotechnology: Introduction – Scientific revolutions – Time and length scale in structures, Definition of a nano-system, Top down and bottom up approaches – Evolution of band structures and Fermi surface – introduction to semi conducting Nanoparticles, introduction to quantum Dots, wells, wires, Dimensionality and size dependent phenomena – Fraction of surface atoms – Surface energy and surface stress, Misconceptions of Nanotechnology.

UNIT-II (12 hrs)

The Carbon Age and Nanotubes: New forms of carbon, Types of nanotubes, Formation of nanotubes, methods and reactants- Arcing in the presence of cobalt, Laser method, Chemical vapor deposition method, ball milling, properties of Nanotubes Electrical properties, vibrational properties, Mechanical properties, applications of Nanotubes in electronics, hydrogen storage, materials, space elevators.

UNIT-III (12 hrs)

Characterization Techniques in Nano-electronics: Principle, construction and working: Electron microscopy (SEM and TEM), Infrared and Raman Spectroscopy, Photoemission and X-RD spectroscopy, AFMs, Magnetic force microscope.

UNIT-IV (12 hrs)

Nano-scale Devices: Introduction: Quantum Electron Devices; High Electron Mobility Transistor, Quantum Interference Transistor, Single Electron Transistor and Carbon Nanotube Transistor, DNA Computing; Structure of DNA, Basic Operation on DNA and DNA Computer.

Recommended Books

1. C.P. Polle and F.J. Owens, 'Introduction to Nanotechnology', Willey India Pvt. Ltd,, **2011**.
2. Daniel Minoli 'Nanotechnology Applications to Telecommunications and Networking', Willey India Pvt. Ltd, **2011**.

MULTIMEDIA COMMUNICATION SYSTEM

Subject Code: MECE5-270	L T P C 4 0 0 4	Duration: 48 Hrs

Course Objectives: The objective of this course is to get aware the students about various multimedia systems, components associated and possibilities available for this particular domain.

Course Outcomes: Student will acquire teaching as well as analytical knowledge to design different Multimedia oriented systems.

UNIT-I (12 Hrs)

Introduction: Concept of Multimedia, Multimedia Applications, Hardware Software requirements, Multimedia products & its evaluation.

UNIT-II (12 Hrs)

Components of Multimedia: Text, Graphics, Audio, Video. Design & Authoring Tools, Categories of Authority Tools, Types of products

UNIT-III (12 Hrs)

Animation: Introduction, Basic Terminology techniques, Motion Graphics 2D & 3D animation.

UNIT-IV (12 Hrs)

Introduction to MAYA (Animating Tool): Fundamentals, Modelling: NURBS, Polygon, Organic, animation, paths & boxes, deformers. Working with MEL: Basics & Programming Rendering & Special Effects: Shading & Texturing Surfaces, Lighting, Special effects.

Recommended Books

1. David Hillman, 'Multimedia Technology & Applications', Galgotia Publications.
2. Rajneesh Agrawal, 'Multimedia Systems', Excel Books.
3. Nigel Chapman & Jenny Chapman, 'Digital Multimedia', Wiley Publications.
4. D.P. Mukherjee, 'Fundamentals of Computer Graphics and Multimedia', PHI.

LOW POWER VLSI DESIGN

Subject Code: MECE5-271 **L T P C** **Duration: 48 Hrs**
4 0 0 4

UNIT-I (12 Hrs)

Introduction: Hierarchy of limits of power, Sources of power consumption, power estimation

UNIT-II (12 Hrs)

Analysis and Synthesis Approach: Synthesis for low power, Voltage scaling approaches, Design and test of low power circuits

UNIT-III (12 Hrs)

Switching Techniques: Adiabatic switching, Minimizing switched. Capacitance, low power static RAM architecture, Low energy computing using energy recovery techniques,

UNIT-IV (12 Hrs)

Power Computation: Low power programmable computation, Software design for low power.

Recommended Books

1. Kaushik Roy and Sharat Parsad, 'Low Power CMOS VLSI Circuit Design', John Wiley & Sons, **1998**.
2. A.P. Chandrakasan and R.W. Broadersen, 'Low power Digital CMOS Design', Kluwer Academic Publishers, **1995**.
3. J.M. Rabaey and M. Pedram, 'Low Power Design Methodologies', Kluwer Academic Publishers, **2001**.
4. Dimitrios Soudris, Christian Piguet and Costas Goutis, 'Designing CMOS Circuits for Low Power', Kluwer Academic Publishers, **2000**.

COMPUTER NETWORKS

Subject Code: MECE0-F91 **L T P C** **Duration: 48 Hrs**
4 0 0 4

Course Objectives

This course provides an In-depth knowledge on computer networks and provides a good background for advanced studies in communication networks.

Learning Outcomes

The students will be able to design different networks based on different Internet protocols and also able to work for different OSI layers.

UNIT –I (12 Hrs)

Introduction and Overview: The need of Internet, TCP/IP Internet, Internet services, History & scope, Protocol standardization.

Review of Underlying Technologies: LAN, WAN, MAN, Ethernet Topology, Token Ring, ARPANET, PRO net technology, FDDI. Internetworking concepts and architectural model, application level Internet connection, Interconnection through IP gateway, users view.

UNIT- II (12 Hrs)

Internet Addresses: Universal Identifiers, Three Primary Classes of IP Addresses, Structure of IP packets, network and broadcast addresses, class less addressing, supernet/ subnet addressing, Addressing Conventions, Mapping Internet Addresses to Physical Addresses (ARP/RARP), Determining Internet Addresses at Startup (DHCP, Bootp).

UNIT-III (12 Hrs)

Internetworking: Internet as a virtual network, Internetworking devices (routers, bridges, gateways), Protocol layering, routing algorithms, congestion control techniques, ICMP, IP Fragmentation, difference between X.25 and Internet layering, Gateway to Gateway Protocol (GGP), OSPF, Exterior Gateway Protocol (EGP), Managing Internet.

UNIT-IV (12 Hrs)

Security Issues: Reliable Transactions and Security on Internet, Data encryption, IPsec, SSL, Concept of Firewalls, Intrusion Detection Systems, Denial of Service Attacks.

Recommended Books

1. Comer, 'Internetworking with TCP/IP', Vol-1, PHI.
2. Stevan, 'TCP/IP Illustrated', Pearson.
3. Forouzan, 'TCP/IP Suite', TMH.
4. Related IEEE/IEE Publications.

DIGITAL SIGNAL PROCESSING

Subject Code: MECE0-F92	L T P C 4 0 0 4	Duration: 48 Hrs

UNIT-I (12 Hrs)

Introduction to DSP, Time and Frequency domain description of different type of signals & systems, Discrete time sequences systems, Linearity unit sample response, Convolution, Time invariant system, Stability criteria for discrete time systems.

UNIT-II (12 Hrs)

Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, Sampling of continuous time signal, Reconstruction of continuous time signal from sequences, Z-Transform and its properties, complex Z-plane, ROC. Relationship between Fourier Transform and Z-Transform, Inverse Z-Transform.

UNIT-III (12 Hrs)

Discrete Time Fourier Transform and its properties, Linear convolution, Circular convolution, convolution from DFT, FFT, Inverse Fast Fourier Transform, Decimation in time and frequency algorithm.

UNIT-IV (12 Hrs)

Filter categories, Finite impulse response filters, various design techniques of FIR filters, FIR filter design by Windowing method, Rectangular, Triangular and Blackman window, Kaiser window. Design of IIR by Approximation of derivatives, Impulse invariant method and Bilinear Transformation method. Steps in Filter Design of Butter worth, Elliptic filter, Chebyshev filters, Frequency Transformation, Applications of DSP. Introduction to DSP Processor

Recommended Books

1. Oppenhavm & Scheffer, 'Discrete Time Processing', PHI.
2. Proakis & D.G. Monolakis, 'Digital Signal Processing' PHI.
3. S.K. Mitra, 'Digital Signal Processing', PHI.
4. Roman Kuc, MC, 'Digital Signal Processing', MGH Pub.
5. E.C. Ifeacher, B.W. Jervis, 'Digital Signal Processing', Addison Wesely.

SENSORS AND TRANSDUCERS

Subject Code: MECE1-F93	L T P C 4 0 0 4	Duration: 48 Hrs

Course Objectives: The main aim of this course is to understand the role of sensors and transducers for different communication systems. In this different transducers for Temperature, pressure, Liquid level measurement will be discussed in detail.

Learning Outcomes: For different process control industries sensors and transducers play a vital role. For DCS, SCADA or PLC operation basic idea about measurement will be boosted in the students.

UNIT-I (12 Hrs)

Sensors/Transducers: Principles, Classification, Parameters, Characteristics (Static and Dynamic), Environmental Parameters (EP), Characterization.

Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge (Resistance and Semiconductor), Inductive Sensors: Sensitivity and Linearity of the Sensor, Types-Capacitive Sensors, Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

UNIT –II (12 Hrs)

Thermal Sensors: Introduction, Gas Thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermosensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermoemf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry and Heat Flux Sensors.

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magnetoresistive Sensors (Anisotropic and Semiconductor), Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers (Synchros and Synchro-resolvers), Eddy Current Sensors, Electromagnetic Flowmeter, Switching Magnetic Sensors and SQUID Sensors.

UNIT-III (12 Hrs)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photosensistors/Photo Detectors, X-ray and Nuclear Radiation Sensors and Fiber Optic Sensors.

Electroanalytical Sensors: Introduction, The Electrochemical Cell, The Cell Potential, Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization (Concentration, Reactive, Adsorption and Charge Transfer), Reference Electrodes, Sensor Electrodes and Electroceramics in Gas Media.

UNIT-IV (12 Hrs)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication (Standards for Smart Sensor Interface) and The Automation

Sensor's Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing and Sensors for Environmental Monitoring.

Recommended Books

1. D. Patranabis, 'Sensors and Transducers', 2nd Edn., PHI, **2003.**
2. W. Bolton, 'Mechatronics' 4th Edn., Pearson, **2011.**

ELECTRONIC SYSTEM DESIGN

Subject Code: MECE0-F94 **L T P C** **Duration: 48 Hrs**
4 0 0 4

UNIT-I (12 Hrs)

MSI and LSI Circuits and Their Applications: Review of Digital electronics concept, Arithmetic Circuits, Comparators, Multiplexers, Code Converters, XOR and AND OR INVERTER Gates, Wired Logic, Bus Oriented Structures, Tri-State Bus System, Propagation Delay.

UNIT-II (12 Hrs)

Sequential Machines: The Concept of Memory, The Binary Cell, The Cell and The Bouncing Switch, Set/Reset, D, Clocked T, Clocked JK Flip Flop, Design of Clock F/F, Conversion, Clocking Aspects, Clock Skew, State Diagram Synchronous Analysis Process, Design Steps For Traditional Synchronous Sequential Circuits, State Reduction, Design Steps For Next State Decoders, Design Of Out Put Decoders, Counters, Shift Registers and Memory.

UNIT-III (12 Hrs)

Multi Input System Controller Design: System Controllers, Design Phases And System Documentation, Defining The System, Timing And Frequency Considerations, Functional, Position And Detailed Flow Diagram Development, MDS Diagram, Generation, Synchronizing Two System And Choosing Controller, Architecture, State Assignment, Next State Decoders And Its Maps, Output Decoders, Clock And Power Supply Requirements, MSI Decoders, Multiplexers In System Controllers, Indirect Addressed Multiplexers Configurations, Programmable System Controllers, ROM, PLA And PAL Based Design.

UNIT-IV (12 Hrs)

Asynchronous Finite State Machines: Scope, Asynchronous Analysis, Design of Asynchronous Machines, Cycle and Races, Plotting And Reading The Excitation Map, Hazards, Essential Hazards Map Entered Variable, MEV Approaches To Asynchronous Design, Hazards In Circuit Developed By MEV Method, Electromagnetic Interference And Electromagnetic Compatibility Grounding And Shielding of Digital Circuits. Interfacing digital system with different media like fiber cable, co-axial cable etc.

Recommended Books:

1. Fletcher, 'An Engineering Approach to Digital Design', PHI, **1990.**
2. 'Designing with TTL Circuits', Texas Instruments.
3. Related IEEE/IEE Publications.

DIGITAL CIRCUITS AND LOGIC DESIGN

Subject Code: MECE0-F95 **L T P C** **Duration: 48 Hrs**
4 0 0 4

Course Objectives: The use of digital circuitry is present in virtually all aspects of our lives and its use is increasing rapidly. Thus, this course aims to introduce postulates of Boolean algebra; methods for simplifying Boolean expressions and also outline the formal procedures for the analysis and design of combinational and sequential circuits. Next focus is to get student familiarize with concepts of digital logic families, D/A & A/D converters, memories and programmable logic devices.

Learning Outcomes: After going through this subject in detail student will be able to understand Digital devices and in turn can learn and operate Microprocessor/Microcontroller more easily.

UNIT- I (12 Hrs)

Fundamentals of Digital Techniques: Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra. Review of Number systems. Binary codes: BCD, Excess-3, Gray, EBCDIC, ASCII, Error detection and correction codes.

UNIT - II (12 Hrs)

Combinational Design Using Gates: Design using gates, Karnaugh map and Quine Mcluskey methods of simplification. Combinational Design Using MSI Devices: Multiplexers and Demultiplexers and their use as logic elements, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Decoders / Drivers for display devices.

UNIT - III (12 Hrs)

Sequential Circuits: Flip Flops: S-R, J-K, T, D, master-slave, edge triggered, shift registers, sequence generators, Counters, Asynchronous and Synchronous Ring counters and Johnson Counter, Design of Synchronous and Asynchronous sequential circuits.

Digital Logic Families: Switching mode operation of p-n junction, bipolar and MOS. devices. Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, Interfacing of CMOS and TTL families.

UNIT - IV (12 Hrs)

A/D and D/A converters: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel - comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs. Programmable Logic Devices: ROM, PLA, PAL, FPGA and CPLDs. Finite State Machines: Finite state model, Memory elements and their excitation functions, Synthesis of Synchronous sequential circuits, Capabilities and limitations of FSM, Design, Modelling and Simulation of Moore and Mealy machines.

Recommended Books

1. R.P. Jain, 'Modern Digital Electronics', 4th Edn., TMH, **2011**.
2. Malvino & Leach, 'Digital Principles & Applications', TMH, 4th Edn., **1991**.
3. Fletcher, 'An Engg. Approach to Digital Design', PHI, Indian Edn., **2011**.
4. Sanjay Sharma, 'Digital Electronics', 1st Edn., Kataria Sons, **2011**.