M. TECH. ELECTRONICS & COMMUNICATION ENGINEERING (ECE)

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**	
MECE1-101	Advanced Communication Systems	4	0	0	40	60	100	4
MECE1-102	Microcontrollers and Embedded Systems	4	0	0	40	60	100	4
MECE1-103	Electronics System Design	4	0	0	40	60	100	4
MECE1-104	Research Lab 1	0	0	4	60	40	100	2
Departmental Elective – I (Select any one)		4	0	0	40	60	100	4
MECE1-156	Advance Semiconductor Physics							
MECE1-157	Biomedical Electronics							
MECE1-158	Information Theory and Coding							
MECE1-159	Hardware Description Languages and VLSI Design							
Departmental Elective – II (Select any one)		4	0	0	40	60	100	4
MECE1-160	Micro and Nano Sciences							
MECE1-161	Sensors and Transducers							
MECE1-162	Speech and Audio Processing							
MECE1-163	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**	
MECE1-205	Optical Communication System	4	0	0	40	60	100	4
MECE1-206	Advanced Digital Signal Processing	4	0	0	40	60	100	4
MECE1-207	Research Lab 2	0	0	4	60	40	100	2
Departmental Elective – III (Select any one)		4	0	0	50	100	150	4
MECE1-264	Digital Image Processing							
MECE1-265	Satellite Communication							
MECE1-266	Information Security							
MECE1-267	Parallel Processing							
Departmental Elective – IV (Select any one)		4	0	0	50	100	150	4
MECE1-268	Nano electronics							
MECE1-269	Multimedia Communication System							
MECE1-270	Advanced Network Synthesis and Analysis							
MECE1-271	Micro & Nano Electromechanical Systems MEMS and NEMS							
Open Elective – I (Select any One)		4	0	0	50	100	150	4
Total	Theory = 5 Lab = 1	**20**	**0**	**4**	**260**	**340**	**600**	**22**

Total Contact Hours = 26 **Total Marks = 500** **Total Credits = 22**

SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MREM1-101	Research Methodology	4	0	0	40	60	100	4
MECE1- 308	Project	0	0	10	100	0	100	8
MECE1- 309	Seminar	0	0	4	100	0	100	2
Departmental Elective – V (Select any one)		4	0	0	40	60	100	4
MECE1- 372	Antenna System Design							
MECE1- 373	Error Control and Coding							
MECE1- 374	Wireless and Adhoc Networks							
MECE1- 375	Speech And Audio Processing							
Total		**12**	**0**	**14**	**320**	**180**	**500**	**22**

Total Credits = 24

SEMESTER 4th		Contact Hrs			Evaluation Criteria	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Satisfactory/ Unsatisfactory**	
MECE1 – 410	Thesis	0	0	20		24

Overall

Semester	Marks	Credits
1st	600	22
2nd	600	22
3rd	500	22
4th	--	24
Total	**1700**	**90**

ADVANCED COMMUNICATION SYSTEMS

Subject Code: MECE1-101 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Introduction: Digital Communication System (Description of different modules of the block diagram), Complex baseband representation of signals, Gram-Schmidt Orthogonalization procedure. M-ary orthogonal signals, bi-orthogonal signals, Simplex signal waveforms.

UNIT-II (10 Hrs.)

Band-limited channels: Pulse shape design for channels with ISI: Nyquist pulse, Partial response signaling (Duobinary and modified Duobinary pulses), demodulation, Maximum likelihood estimation technique.

UNIT-III (12 Hrs.)

Communication over fading channels: Characteristics of fading channels, Rayleigh and Rician channels, Receiver performance-average SNR, outage probability, Amount of Fading and Average Bit/Symbol Error Rate. Statistical channel modeling of Rayleigh and Rician fading channels.

UNIT-IV (11 Hrs.)

4G Technology /OFDM: Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, BER performance over AWGN and Rayleigh fading, OFDM Issues like PAPR, Frequency and Timing Offset.

Recommended Books:

1. G. Proakis and M. Salehi, 'Fundamentals of Communication Systems', Pearson Education, **2005**.
2. S. Haykins, 'Communication Systems', 5th Edn., John Wiley, **2008**.
3. M.K. Simon, S.M. Hinedi and W.C. Lindsey, 'Digital Communication Techniques: Signaling and detection', PHI, **1995**.
4. W. Tomasi, 'Advanced Electronic Communication Systems'. 4th Edn., Pearson Education, **1998**.
5. M.K. Simon and M.S. Alouini, 'Digital Communication over Fading Channels', **2000**.

MICROCONTROLLERS AND EMBEDDED SYSTEMS

Subject Code: MECE1-102 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Typical Embedded System: Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware, Other System Components. Characteristics and Quality Attributes of Embedded Systems: Hardware Software Co-Design and Program Modelling: Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modelling Language, Hardware Software Trade-offs.

UNIT-II (10 Hrs.)

Embedded Hardware Design and Development: EDA Tools, how to Use EDA Tool, Schematic Design – Place wire, Bus, port, junction, creating part numbers, Design Rules check, Bill of materials, Netlist creation, PCB Layout Design – Building blocks, Component placement, PCB track routing.

UNIT-III (11 Hrs.)

ARM Architecture: ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families. ARM Programming Model – I: Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions. ARM Programming Model – II: Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions

UNIT-IV (12 Hrs.)

ARM Programming: 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 –V: Memory Management: Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation, Access Permissions, Context Switch.

RECOMMENDED BOOKS:

1. Andrew N. Sloss, Dominic Symes, Chris Wright, 'ARM Systems Developer's Guides-Designing & Optimizing System Software', 1st Edn., Elsevier, **2008**.
2. K.V. Shibu, 'Introduction to Embedded Systems', 1st Edn., Tata McGraw Hill Education Private Limited, **2009**.

REFERENCE BOOKS:

1. Jonathan W. Valvano – Brookes / Cole, 'Embedded Microcomputer Systems, Real Time Interfacing', 1st Edn., Thomas Course, **1999**.
2. James K. Peckol, 'Embedded Systems – A contemporary Design Tool', 2nd Edn., John Weily, **2008**.

ELECTRONICS SYSTEM DESIGN

Subject Code: MECE1-103 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

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 fibre cable, co-axial cable etc.

Books Recommended:

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

RESEARCH LAB.-1

Subject Code: MECE1-104 **L T P C**
4 0 0 4

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.

ADVANCE SEMICONDUCTOR PHYSICS

Subject Code: MECE1-156 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

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.)

Application 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**.

BIOMEDICAL ELECTRONICS

Subject Code: MECE1-157 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (12 Hrs.)

Physiology & Human Nervous System: Cell, Bioelectricity, Sodium Potassium pump, Action and Resting potentials, Bioelectric Signals, Nervous System, Peripheral Nervous System, Autonomic Nervous System, SNS, PNS.

UNIT-II (12 Hrs.)

Electro-Physiological Measurements Basic components of biomedical electronics system, Electrodes: Micro, Needle and Surface electrodes, Electrical activity of heart, Generation and Recording of ECG signals, ECG Waves and Time Intervals, Heart Rhythms, Heart beat morphologies, Noise and artefacts, Respiratory system, EEG, EEG Rhythms and waveforms, Recording.

UNIT-III (11 Hrs.)

Non-Electrical Parameter Measurement: Blood pressure measurement, Cardiac output, Heart Sounds, Respiratory rate, Gas volume, Flow rate, pH value, ESR, GSR, Plethysmography.

UNIT-IV (10 Hrs.)

Assistive Restorative and Medical Imaging Equipment: Phonocardiography, Vectrocardiography, Defibrillators, Pacemakers, X-Ray, Ultrasonography, Computer Tomography, MRI.

RECOMMENDED BOOKS:

1. Joseph J. Carr and John M. Brown, 'Introduction to Biomedical Equipment Technology', 4th Edn., Pearson Education India, **2001.**
2. 'Biomedical Instrumentation and Measurements', Leslie Cromwell, J. Fred, Weibell and Erich A. Pfeiffer, Prentice Hall of India Pvt. Ltd, New Delhi, **1980.**
3. John G. Webster, 'Medical Instrumentation Application & Design', 3rd Edn., Wiley India.
4. R.S. Khandpur, 'Handbook on Biomedical Instrumentation', TMH.
5. Barbara Christe, 'Introduction to Biomedical Instrumentation: The Technology of Patient Care', Cambridge University Press, **2009.**

INFORMATION THEORY AND CODING

Subject Code: MECE1-158 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1 (11 Hrs.)

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

UNIT-2 (11 Hrs.)

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

UNIT-3 (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- 4 (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', McGraw Hill, **1992**.

HARDWARE DESCRIPTION LANGUAGES AND VLSI DESIGN

Subject Code: MECE1-159 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (11 Hrs.)

MOS TRANSISTOR THEORY: Introduction, Ideal I-V Characteristics, Second Order Effects, CMOS Logic, CMOS Fabrication and Layout, VLSI Design Flow.

CIRCUIT CHARACTRIZATION 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 BEHAVIORAL 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 AND NANO SCIENCES

Subject Code: MECE1-160 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1 (10 Hrs.)

Introduction to semiconductor devices Introduction- material conductivity - Quantum mechanics - energy bands - crystalline structures - Density of states - band structures - Fermi - Dirac function - material classification - Band structure - electrons and holes - doping - Scattering - mobility - Diffusion transport - Einstein relation - Carrier generation and recombination- continuity equation.

UNIT-2 (13 Hrs.)

Crystal Growth, Wafer Preparation, Epitaxy and Oxidation Review of Semiconductor theory - Electronic Grade Silicon - Czochralski Crystal Growing - Silicon Shaping Processing consideration - Vapour Phase Epitaxy - Molecular Beam Epitaxy - Silicon on Insulators – Epitaxial Evaluation – Growth Mechanism and Kinetics – Thin Oxides – Oxidation Techniques and Systems – Oxide Properties. Lithography and Relative Plasma Etching Optical Lithography – Electron Lithography – X-Ray Lithography - Ion Lithography Plasma -Properties – Feature Size - Control and Anisotropic Etch Mechanism – Relative Plasma Etching Techniques and Equipment.

UNIT-3 (11 Hrs.)

Deposition, Diffusion, Lon Implementation and Metallization Deposition Processes – Polysilicon – Plasma Assisted Deposition – Models of Diffusion in Solids – Fick's One Dimensional Diffusion Equation – Atomic Diffusion Mechanism – Measurement Techniques – Range Theory – Implantation Equipment. Annealing Shallow Junction – High Energy Implantation – Physical Vapour Deposition – Patterning.

UNIT-4 (11 Hrs.)

VLSI Process Integration, Analytical, Assembly Techniques and Packaging Of VLSI Devices NMOS IC Technology – CMOS IC Technology – MOS Memory IC Technology – Bipolar IC Technology – IC Fabrication. Analytical Beams – Beams Specimen interaction – Chemical Methods – Package Types Baking Design Considerations – VLSI Assembly Technology – Package Fabrication Technology.

Recommended Books:

1. S.M. Sze, 'VLSI Technology', McGraw-Hill, 2nd Edn., **1988.**
2. Duoglas A. Pucknell and Kamaran Eshragian,'Basic VLSI Design', 3rd Edn., PHI, **1994**.
3. Wayne Wolf, 'Modern VLSI design', 2nd Edn., Prentice Hall Ptr, **1998**.
4. D.S. Grewal, 'Nanotechnology', Orient Longman's, **2008.**

SENSORS AND TRANSDUCERS

Subject Code: MECE1-161 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-I (10 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 (12 Hrs.)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photosensistors/Photo Detectors, X-ray and Nuclear Radiation Sensors and Fibre 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 (10 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.**

SPEECH AND AUDIO PROCESSING

Subject Code: MECE1-162 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

UNIT-1 (11 Hrs.)

Digital models for the speech signal - mechanism of speech production - acoustic theory - lossless tube models – digital models - linear prediction of speech - auto correlation - formulation of LPC equation - solution of LPC equations -Levinson Durbin algorithm - Levinson recursion - Schur algorithm - lattice formulations and solutions - PARCORcoefficients - Spectral analysis of speech - Short Time Fourier analysis - filter bank design. Auditory Perception: Psychoacoustics- Frequency Analysis and Critical Bands - Masking properties of human ear.

UNIT-2 (12 Hrs.)

Speech coding -sub band coding of speech - transform coding - channel vocoder - formant vocoder - cepstral vocoder -vector quantizer coder- Linear Predictive Coder. Speech synthesis - pitch extraction algorithms - gold rabiner pitch trackers - autocorrelation pitch trackers - voice/unvoiced detection - homomorphic speech processing – homomorphic systems for convolution - complex cepstrums - pitch extraction using homomorphic speech processing. Sound Mixtures and Separation - CASA, ICA & Model based separation.

UNIT-3 (11 Hrs.)

Speech Transformations - Time Scale Modification - Voice Morphing. Automatic speech recognition systems – isolated word recognition - connected word recognition -large vocabulary word recognition systems - pattern classification -DTW, HMM - speaker recognition systems - speaker verification systems - speaker identification Systems.

UNIT-4 (11 Hrs.)

Audio Processing : Non speech and Music Signals - Modelling -Differential, transform and sub-band coding of audio
signals & standards - High Quality Audio coding using Psychoacoustic models - MPEG Audio coding standard. Music
Production - sequence of steps in a bowed string instrument - Frequency response measurement of the bridge of a violin. Audio Data bases and applications - Content based retrieval.

Recommended Books

1. L.R. Rabiner & R.W. Schafer, 'Digital Processing of Speech Signals', Prentice Hall Inc.
2. D. O'Shaughnessy, 'Speech Communication, Human and Machine'. Addison-Wesley.
3. Thomas F. Quatieri , 'Discrete-Time Speech Signal Processing: Principles and Practice', Prentice Hall, Signal Processing Series.
4. J. Deller, J. Proakis and J. Hansen, 'Discrete-Time Processing of Speech Signals', Macmillan.
5. Ben Gold & Nelson Morgan, 'Speech and Audio Signal Processing', John Wiley & Sons, Inc.
6. F.J. Owens, 'Signal Processing of Speech', Macmillan New Electronics.
7. S. Saito & K. Nakata, 'Fundamentals of Speech Signal Processing', Academic Press, Inc.
8. P.E. Papamichalis, 'Practical Approaches to Speech Coding', Texas Instruments, Prentice Hall.
9. L.R. Rabiner & Gold, 'Theory and Applications of Digital Signal Processing', Prentice Hall of India.
10. N.S. Jayant and P. Noll, 'Digital Coding of Waveforms: Principles and Applications to Speech and Video. Signal Processing Series', Englewood Cliffs: Prentice-Hall.
11. Thomas Parsons, 'Voice and Speech Processing', McGraw Hill Series.

SOFT COMPUTING

Subject Code: MECE1-163 **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. Course rules and equations: Perceptron, Hebb's, Delta, winner take all and out-star Course rules. Supervised Course Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network, Associative memory networks, Unsupervised Course 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, **2011.**
2. S.N. Sivanandam & S.N. Deepa, 'Principles of Soft Computing', Wiley Publications, **2007.**

Reference Books

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

OPTICAL COMMUNICATION SYSTEM

Subject Code: MECE1-205 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Course Objectives

This Course provides knowledge about various types of optical sources and detectors available at receivers. It also imparts knowledge about communication system based on optical fibre and various techniques of multiplexing. Apart from this, various networking models for optical communication taught to complete all aspects of this subject.

Course Outcomes

Students will attain various skills to develop different optical networks for single user and multiusers and can also attain the maximum benefit of this domain w.t.t. maximum data rate and available bandwidth.

UNIT I (11 Hrs.)

Nature of light and basic fibre optic communication system, principle of light transmission through a fibre, Classification of optical fibres: Single Mode and Multi-Mode Fibres, Step Index and Graded Index Fibres, Losses in Optical Fibres; Absorption, Scattering and Dispersion, Optical Windows for Fibre Optic Transmission system.

Fibre Materials: Glass Fibres and Plastic Glass Fibres, Fibre Fabrication Methods: Outside Vapour Phase Oxidation & Vapour Phase Axial Deposition and Double Crucible Method, Optical Fibre Cables.

UNIT II (13 Hrs.)

Optical Sources: PN junction Diode Theory, Light Emitting Diode& Laser Diode: Structure, Materials, Quantum Efficiency and Modulation. Optical Detectors: Semiconductor Photodiodes &Avalanche Photodiodes and their characteristics, responsivity and quantum efficiency.

UNIT III (12 Hrs.)

Optical Fibre Splices: Fusion and Mechanical Splicing Technique and Fibre Connectors, Working Principle of OTDR and Applications of OTDR, Optical Fibre Measurements: Attenuation, Absorption, Dispersion and Scattering, Fibre Cut-Off Wavelength and Numerical Aperture Measurement.

UNIT IV (12 Hrs)

Optical Amplifiers: Semiconductor and Erbium Doped Fibre Amplifiers, Optical communication Techniques and Network Topologies: Wavelength division Multiplexing and SONET/SDH.

Recommended Books

1. Gerd Keiser, 'Optical Fibre Communications', 3rd Edn., McGraw-Hill International.
2. John M. Senior, 'Optical Fibre Communications, Principles & Practice', 3rd Edn., Pearson Publishers.

ADVANCED DIGITAL SIGNAL PROCESSING

Subject Code: MECE1-206 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

Course Objectives

The Digital Signal Processing is a fundamental and immensely important signal processing course keeping in view the modern day technological advancements. The objective of this course is to provide fundamental background for digital signal processing which later on becomes basic building block of new upcoming technologies.

Course Outcomes:

The students will have knowledge to work in Time as well as frequency domain systems. They also can design high speed systems with the help of FFT/IFFT.

UNIT I (12 Hrs.)

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

UNIT II (12 Hrs.)

Adaptive Filters: Adaptive signal processing-FIR adaptive filters – steepest descent adaptive filter – LMS algorithm – convergence of LMS algorithms – Application: noise cancellation – channel equalization – adaptive recursive filters – recursive least squares.

UNIT III (12 Hrs.)

Multirate Signal Processing: Multirate signal processing- Decimation by a factor D – Interpolation by a factor I – Filter Design and implementation for sampling rate conversion: Direct form FIR filter structures – Polyphase filter structure.

UNIT IV (12 Hrs.)

Wavelet Transforms and their Application: Wavelet Transform- Fourier Transform: Its power and Limitations – Short Time Fourier Transform – The Gabor Transform - Discrete

Time Fourier Transform and filter banks – Continuous Wavelet Transform – Wavelet Transform Ideal Case – Perfect Reconstruction Filter Banks and wavelets – Recursive multi-resolution decomposition–Haar Wavelet – Daubechies Wavelet

Recommended Books:

1. John G. Proakis, Dimitris G. Manobakis, 'Digital Signal Processing, Principles, Algorithms and Applications', 3rd Edn., PHI, **2000**.
2. Monson H. Hayes, 'Statistical Digital Signal Processing and Modelling', Wiley, **2002**.
3. Emmanuel C. Ifeachor and Barrie W. Jervis, 'Digital Signal Processing: A Practical Approach', Pearson Education, **2008.**
4. Robert J. Schilling and Sandra L. Harris, 'Fundamentals of Digital Signal Processing', Cengage Course, **2005**.

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RESEARCH LAB.-2

Subject Code: MECE1-207 **L T P C**
4 0 0 2

Students will be make familiar with maximum available softwares like optisystem, optsim, Matlab, Virtual instrumentation, Network simulator, FHSS 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.

DIGITAL IMAGE PROCESSING

Subject Code: MECE1-264 **L T P C** **Duration: 40 Hrs.**
4 0 0 4

Course Objectives

This course will provide students fundamentals of Digital Image Processing and its applications. This course incorporates the concepts of image enhancement, image restoration, segmentation and image compression. Students will be able to perform image manipulations and analysis in many different fields like object recognition, medical image processing, representation of images etc.

Course Outcomes

The student will have skills to deal with different operations on image processing. Different applications will be open for the students to work with.

UNIT I (12 Hrs.)

D**igital Image Fundamentals:** Digital Image Processing: Definition, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of visual perception – Image sampling and Quantization, Basic relationship between pixels – Basic geometric transformations - Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform – FFT – Separable Image Transforms -Walsh – Hadamard – Discrete Cosine Transform, Haar.

UNIT II (09 Hrs.)

Image Enhancement Techniques: Spatial Domain methods: Basic grey level transformation, Histogram Equalization, Image Subtraction, Image averaging, Spatial filtering: Smoothing, sharpening filters – Laplacian filters, Frequency domain filters: Smoothing – Sharpening filters, Homomorphic filtering.

UNIT III (08 Hrs.)

Image Restoration: Model of Image Degradation/restoration process, Noise models, Inverse filtering, least mean square filtering, Blind image restoration, Singular value decomposition.

UNIT IV (11 Hrs.)

Image Compression and Segmentation: Lossless compression: Variable length coding, LZW coding, bit plane coding, Predictive coding-DPCM, Lossy Compression: Transform coding, Wavelet coding, Basics of Image compression standards: JPEG, MPEG, Edge detection, Thresholding, Region Based segmentation.

Recommended Books

1. R.C. Gonzalez and R.E. Woods, 'Digital Image Processing', Pearson Education, **2002**.
2. G.A. Baxes, 'Digital Image Processing', Indian Edn., John Wiley, **1994.**
3. R.J. Schalkoff, 'Digital Image Processing and Computer Vision', John Wiley, **1989**.
4. Sid Ahmed, 'Image Processing', McGraw Hill, **1994**.
5. William K. Pratt, 'Digital Image Processing', John Willey, **2001**.
6. Millman Sonka, Vaclav Hlavac, Roger Boyle, 'Image Processing Analysis and Machine Vision', Broos/colic, Thompson Course, **1999**.
7. A.K. Jain, 'Fundamentals of Digital Image Processing', PHI, **2002**.
8. Chanda Dutta Magundar, 'Digital Image Processing and Applications', Prentice Hall of India, **2000**.

SATELLITE COMMUNICATION

Subject Code: MECE1-265 **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.

Course 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**.

INFORMATION SECURITY

Subject Code: MECE1-266 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

UNIT-I

INTRODUCTION (12 Hrs.)

Introduction to various multimedia communication, Techniques, Applications, Networks, Protocols and Standards, Bandwidth and Compression issues. Source Encoding, Channel Encoding, Different types of multimedia information, Information representation. Encoding and decoding techniques

UNIT-II

COMPRESSION TECHNIQUES (12 Hrs.)

Text compression techniques, Image compression techniques, Audio and Video Compression, Standards for Multimedia Compression, Huffman, Run length, Variable length, Lossy/ Lossless compression.

Various files formats for multimedia and their applications, BMP, TIFF, JPEG, DFX, AVI, MPEG.

UNIT-III

NETWORK SECURITY (12 Hrs.)

Network and computer security issues. Security attacks, Security Services and Security Mechanisms. Network security models.

Cryptology: Introduction, Terminology, Cryptography and its objectives, Cryptanalysis, Classifications of cryptography; Basic concept of symmetric and asymmetric cryptography. Stream Ciphers versus Block Ciphers.

UNIT-IV

SYMMETRIC & ASYMMETRIC KEY CRYPTOGRAPHY (12 Hrs.)

Substitution and Transposition techniques. Block cipher principles. Study of DES Algorithm, its internal structure, f-function and its key schedule. Security of DES. Triple DES, IDEA, AES Algorithm.

Principles of public key cryptosystems. RSA algorithm. Distribution of public keys. Diffie-Hellman key exchange**.**

Recommended Books

1. Fred Halsall, 'Multimedia Communication', Prentice Hall.
2. Proakis, 'Digital Communication', Prentice Hall.
3. William Stallings, 'Cryptography and Network Security', Prentice Hall.
4. Bruce Schneier, 'Applied Cryptography', John Wiley & Sons.
5. W. Zeng, H. Yu and C. Lin, 'Multimedia Security Technologies for Digital Rights Management', Elsevier.
6. B. Furht and D. Kirovski (Eds.), 'Multimedia Security Handbook', CRC Press.

PARALLEL PROCESSING

Subject Code: MECE1-267 **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.

Course Outcomes

Students will have skills in RISC as well as CISC architectures 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-III (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.

NANO ELECTRONICS

Subject Code: MECE1-268 **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.

Course 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 Vapour 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: MECE1-269 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

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.

ADVANCED NETWORK SYNTHESIS AND ANALYSIS

Subject Code: MECE1-270 **L T P C** **Duration: 48 Hrs.**
4 0 0 4

UNIT 1 (12 Hrs.)

Data Transmission
Overview of Data Communication and networking, Analog and Digital Data Transmission, Transmission Impairments, Various Transmission Media, Data Encoding.

UNIT II (12 Hrs.)

Switching and Computer Networks
Communication Networks, Circuit Switching, Message Switching, Packet Switching, X.25, Virtual circuits and Data gram's, LAN/MAN Technologies, Medium Access control protocols (CSMA/CD, Token ring, FDDI, DQDB)

UNIT III (12 Hrs.)

Network Security
Security issues, concept of firewalls, intrusion detection Systems

UNIT IV (12 Hrs.)

Advanced Network Analysis: Application analysis using the Application form (AAF) Binary-Hex-Decimal conversion, building test packets, Calculating the cost of network problems (Analysis ROI), Key network calculations: Throughput, Latency and Bandwidth, Unattended captures: Triggered starts/stops, Analysis ROI worksheet/calculation

Recommended Books:
1. Scott Empson, 'CCNA Portable Command Guide', 2nd Edn.,
2. Laura Chappell, 'Network Analysis'.

MICRO & NANO ELECTRO MECHANICAL SYSTEM (MEMS & NEMS)

Subject Code: MECE1-271 **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.

Course 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 1 (12 Hrs.)

Introduction:

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.

RESEARCH METHODOLOGY

Subject Code – MREM0-101 **L T P C** **Duration – 45 Hrs.**
4 0 0 4

UNIT–I (11 Hrs.)

Introduction to Research: Meaning, Definition, Objective and Process

Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental

Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature

Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.

Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (10 Hrs.)

Sources of Data: Primary and Secondary, Validation of Data

Data Collection Methods: Questionnaire Designing, Construction

Sampling Design & Techniques – Probability Sampling and Non Probability Sampling

Scaling Techniques: Meaning & Types

Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability

Validity: Content Validity, Criterion Related Validity and Construct Validity

UNIT–III (13 Hrs.)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation

Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number

Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT – IV (11 Hrs.)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling

Report Writing: Essentials of Report Writing, Report Format

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

Recommended Books

1. R.I. Levin and D.S. Rubin, 'Statistics for Management', 7th Edn., Pearson Education New Delhi.
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', 4th Edn., Pearson Education, New Delhi,
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill, New Delhi.
4. Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers.
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education, New Delhi.
6. C.R. Kothari, 'Research Methodology Methods & Techniques', 2nd Edn., New Age International Publishers.

PROJECT

Subject Code: MECE1-309 **L T P C**

Course Objectives

1. To propose engineering based project in a clear and concise manner.
2. Allow students to develop problem solving, analysis, synthesis and evaluation skills.

Course Outcomes

1. Synthesis of knowledge.
2. To demonstrate the aptitude of applying the own knowledge to solve a specific problem.
3. To mature the knowledge.
4. Able to organize, compile and record all work details in an efficient manner

Each student will be required to complete a Project and submit a Project Report on a topic on any of the areas of modern technology related to Electronics & Communication Engineering including interdisciplinary fields.

SEMINAR

Subject Code: MECE1-310 **L T P C**
0 0 4 2

Course Objectives

1. To identify, understand and discuss current advanced research topic.
2. To gain experience in the critical assessment of the available scientific literature
3. To practice the use of various resources to locate and extract information using offline & online tools, journals

Course Outcomes

1. An ability to utilize technical resources
2. An ability to write technical documents and give oral presentations related to the work completed.
3. To learn preparation and presentation of scientific papers in an exhaustive manner

Each student will be required to prepare a Seminar Report and present a Seminar on a topic in any of the areas of modern technology related to Electronics & Communication Engineering including interdisciplinary fields.

ANTENNA SYSTEM DESIGN

Course Code: MECE1- 372 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives

1. To study various types of antennas, antenna arrays and antenna parameters
2. Study of propagation of waves through different media.
3. Familiarize the students with different parameters to be considered while designing antennas.

Course Outcomes

1. Gain understanding of different parameters used to characterize antennas.
2. Know how to analyze wire and aperture radiating elements.
3. Be able to design various antennas and arrays for many communication systems.
4. Implementation of radio wave propagation mechanisms while designing an antenna.
5. An ability to understand basic terminology associated with antennas and calculation of power radiated from an antenna and array.

UNIT-I (10 Hrs.)

Review of electromagnetic fields, Displacement current, Maxwell's equations in free space, plane wave & uniform plane wave in free space. Electromagnetic radiations, Physical concept of radiation, Retarded potential, Radiation from a Hertizian dipole, monopole and a half wave dipole, Fields in the vicinity of an antenna and far field approximation.

UNIT-II (10 Hrs.)

Antenna Parameters: Radiation pattern, Gain, Directive gain, Directivity, Reciprocity theorem & its applications, effective aperture, radiation resistance, terminal impedance, noise temperature, elementary ideas about self & mutual impedance, front-to-back ratio, antenna beam width, antenna bandwidth, antenna beam efficiency, antenna beam area or beam solid angle, polarization, antenna temperature.

UNIT-III (13 Hrs.)

Antenna Arrays: Various forms of antenna arrays, arrays of point sources, non-isotropic but similar point sources, multiplication of patterns, arrays of n-isotropic sources of equal amplitude and spacing, Dolph-Tchebysceff arrays, continuous arrays, rectangular arrays.

UNIT-IV (12 Hrs.)

Broadband Antennas: Travelling wave antennas helical antennas, Biconical antennas Sleeve antennas, and Principles of frequency independent antennas, Spiral antennas, and Log - periodic antennas.

Aperture antennas, scanning antennas, smart antennas. Long Wire antenna, folded dipole antenna, Yagi-Uda antenna, Slot antenna, Micro Strip or Patch antennas, Antenna measurements.

Recommended Books

1. J.D. Krauss, 'Antennas', McGraw Hill Inc., New York, **1991.**
2. Balanis A. Constantine, 'Antenna Theory, Analysis and Design', Wiley, New York.
3. K.D. Prasad, 'Antenna and Wave Propagation', 3rd Edn., Satya Prakashan, New Delhi.
4. W.L. Stutzman, G.A. Thieele, 'Antenna Theory and Design', Wiley, New York.

ERROR CONTROL AND CODING

Subject Code: MECE1-373 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives: Students will be able to understand block codes, maximum likelihood decoding, generator matrix, parity-check matrix, error-correcting capability of a linear code and the importance of probability theory in error control & coding

Course Outcomes

1. Describe the model and calculate the capacity of typical digital communication channels
2. Demonstrate the encoding and decoding procedures of various error control codes
3. Compare the error correction capability of different error control codes and their performances
4. Apply error control coding to achieve error detection and correction in digital transmission systems
5. Design an error detecting and correcting system for semiconductor memory system to meet given system specification.

UNIT-I (11 Hrs.)

Review of Random Process: Review of Probability Theory, Basic concepts of random processes, random variables, basicconcepts from systems theory and stochastic processes, Stationary and non stationary process, correlation function, Ergodicity and power spectral density, transformation random process by linear system, Special random process: white Gaussian noise, Wiener levy, Shot noise, Markov Process

UNIT-II (11 Hrs.)

Hypothesis Testing: Simple binary hypothesis test, Decesion Criteria, Neyman Pearson tests, Bayes Criteria Multiple hypothesis testing, Composite hypothesis testing

UNIT-III (11 Hrs.)

Detection Theory: Sequential detection Walds test Detection of known signals in white noise, Detection of known signal in colored noise, Maximum SNR Criteria, Detection of signals with unknown parameters

UNIT-IV (12 Hrs.)

Coding: Error Control coding for wireless fading channels, Channel Estimation and Adaptive channel coding, Joint Source and Channel coding. Non binary Linear Block Codes, Hard and

soft decision decoding, Coding and Decoding of BCH, Reed Solomon Codes, Convolution codes: Coding and Decoding, Distance bounds, Performance bounds Turbo codes: Coding, Decoding Algorithms, Performance comparison, Interleaver design Trellis coded Modulation, TCM Decoders, TCM for AWGN and Fading Wireless Channels, Performance comparison

Recommended Books

1. C.W. Helstrom, 'Elements of Signal Detection and Estimation', Prentice Hall, NJ, **1995.**
2. H.L. Van Trees, 'Detection, Estimation, and Modulation Theory', Wiley, **1971.**
3. H. V. Poor, 'An Introduction to Signal Detection and Estimation', 2nd Edn., Springer-Verlag, New York.
4. Stephen G. Wilson, 'Digital Modulation & Coding'. Prentice Hall Inc.
5. Ranjan Bose, 'Information Theory Coding and Cryptography', TMH.
6. J.G. Proakis, 'Digital Communication', Pearson Education.

WIRELESS AND ADHOC NETWORKS

Subject Code: MECE1-374 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives: The objective of this course is to provide the concepts of sensor networks and to understand the MAC and transport protocols for adhoc networks.

Course Outcomes:

1. To understand the adhoc networks.
2. To learn the data transmission flow in adhoc networks
3. To understand the security of sensor networks
4. To understand the applications of adhoc and sensor networks

UNIT-I (11 Hrs.)

Introduction to Ad Hoc Wireless Networks: Characteristics of MANETs, Applications of MANETs, Challenges.

Routing in MANETs: Topology-based versus Position-based approaches, Topology based routing protocols, Position based routing, Other Routing Protocols.

UNIT-II (10 Hrs.)

Data Transmission in MANETs: The Broadcast Storm, Multicasting, Geocasting, TCP over Ad Hoc Networks: TCP Protocol overview, TOP and MANETs, Solutions for TOP over Ad Hoc

UNIT-III (12 Hrs.)

Basics of Wireless Sensors and Applications: The Mica Mote, Sensing and Communication Range, Design issues, Energy consumption, Clustering of Sensors, Applications.

Data Retrieval In Sensor Networks: Classification of WSNs, MAC layer, Routing layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT-IV (12 Hrs.)

Security: Security in Ad hoc Wireless Networks, Key Management, Secure Routing, Cooperation in MANETs, Intrusion Detection Systems. Sensor Network Platforms and Tools: Sensor Network Hardware, Sensor Network Programming Challenges, Node-Level Software Platforms

Recommended Books

1. Car/os Corderlo Dharma R. Aggarwal, 'Ad Hoc and Sensor Networks — Theory and Applications', World Scientific Publications /Cambridge University Press, March **2006**
2. Feng Zhao, Leonidas Guibas, 'Wireless Sensor Networks: An Information Processing Approach', Elsevier Science imprint, Morgan Kauffman Publishers, **2005**, rp **2009.**

3. C. Siva Ram Murthy, B.S. Murthy, 'Adhoc Wireless Networks — Architectures and Protocols', Pearson Education, **2004.**
4. Fei Hu, Xiaojun Cao, 'Wireless Sensor Networks — Principles and Practice', CRC Press, Taylor & Francis Group, **2010.**
5. Subir Kumar Sarkar, et al., 'Wireless Ad hoc Mobile Wireless Networks — Principles, Protocols and Applications', Auerbach Publications, Taylor & Francis Group, **2008.**

SPEECH AND AUDIO PROCESSING

Subject Code: MECE1-375 **L T P C** **Duration: 45 Hrs.**
4 0 0 4

Course Objectives

To introduce the fundamentals of speech & image processing and provide students the description of adaptive filters and filters in image and audio processing. Also study the filters in image& audio processing and wavelets along with its application in various fields

Course Outcomes:

1. Qualitatively describe the mechanisms of speech production.
2. Apply programming tools (such as Matlab) to analyze speech and audio signals in time and frequency domains.
3. Analyze, compare and implement methods and systems for filtering and coding of speech and audio signals.
4. Analyze the methods and systems for enhancement of speech and audio signals in environmental noisy conditions.

UNIT-I (10 Hrs.)

Introduction: Review of basic digital signal processing fundamentals, Parametric methods for power spectrum estimation-Relationship between the auto correlation and the model parameters – The Yule – Walker method for the AR Model Parameters – The Burg Method for the AR Model parameters – unconstrained least-squares method for the AR Model parameters – sequential estimation methods for the AR Model parameters – selection of AR Model order.

UNIT-II (13 Hrs.)

Adaptive Filters: Adaptive signal processing-FIR adaptive filters – steepest descent adaptive filter – LMS algorithm – convergence of LMS algorithms – Application: noise cancellation – channel equalization – adaptive recursive filters – recursive least squares.

Multirate Signal Processing: Multirate signal processing- Decimation by a factor D – Interpolation by a factor I – Filter Design and implementation for sampling rate conversion: Direct form FIR filter structures – Polyphase filter structure.

UNIT-III (11 Hrs.)

Speech Signal Processing: Speech signal processing-Digital models for speech signal: Mechanism of speech production – model for vocal tract, radiation and excitation – complete model – time domain processing of speech signal: Pitch period estimation – using autocorrelation function – Linear predictive Coding: Basic Principles – autocorrelation method – Durbin recursive solution.

UNIT-IV (11 Hrs.)

Wavelet Transforms and their Application: Wavelet Transform- Fourier Transform: Its power and Limitations – Short Time Fourier Transform – The Gabor Transform - Discrete Time Fourier Transform and filter banks – Continuous Wavelet Transform – Wavelet Transform Ideal Case – Perfect Reconstruction Filter Banks and wavelets – Recursive multi-resolution decomposition–Haar Wavelet – Daubechies Wavelet.

Recommended Books

1. John G. Proakis, Dimitris G. Manobakis, 'Digital Signal Processing, Principles, Algorithms and Applications' 3rd Edn., PHI, **2000.**
2. Monson H. Hayes, 'Statistical Digital Signal Processing and Modelling', Wiley, **2002**.
3. Emmanuel C. Ifeachor and Barrie W. Jervis, 'Digital Signal Processing: A Practical Approach', Pearson Education, **2008.**
4. Robert J. Schilling and Sandra L. Harris, 'Fundamentals of Digital Signal Processing', Cengage Course, **2005.**

DISSERTATION

Subject Code: MECE1-410 L T P C

Course Objectives: To learn, practice, and critique effective scientific writing and to formulate the research objectives clearly, state claims and evidence clearly, assess validity of claims, evidence, outcomes, and results.

Course Outcomes:

1. Design and execute a meaningful research project that demonstrates spatial thinking and uses the knowledge and skills.
2. Define and analyze a problem in latest research areas.
3. Formulate and write a research proposal.
4. Able to learn effectively record data and experiments so that others can understand them.
5. Communicate the findings by means of a thesis, written in the format specified by the department/institute.

Each student will be required to complete a Dissertation and submit a written Report on the topic on any of the areas of modern technology related to Electronics & Communication Engineering including interdisciplinary fields in the Final semester of M.Tech. Course.

Papers accepted in UGC approved journals will be given 10 marks as special incentive. It will be mandatory to publish one paper in conference/journal.