

ETC/ECE 7.1 MICROWAVE ENGINEERING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.1	Microwave Engineering	4	--	2	3	100	25	--	--	--	125

Course Objectives:

The subject aims to provide the student with:

1. An understanding of microwave waveguides, passive & active devices, tubes and network analysis.
2. An ability to design microwave matching networks.
3. An ability to perform microwave measurements.
4. An understanding of RADARs and its applications.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain different types of waveguides and their respective modes of propagation.
2. Analyze typical microwave networks using impedance, admittance, transmission and scattering matrix representations.
3. Design microwave matching networks using L section, single and double stub and quarter wave transformer.
4. Explain working of microwave passive circuits such as isolator, circulator, Directional couplers, attenuators etc.
5. Describe and explain working of microwave tubes and solid state devices.
6. Perform measurements on microwave devices and networks using power meter and VNA.
7. Explain the operation of RADAR systems and recite their applications.

UNIT - 1

(16 hours)

Review of Transmission lines: Distributed elements concept, Telegrapher's equations, lossless and lossy lines, line impedance and junction, Smith Chart. General solutions for TEM, TE and TM waves.

Waveguides: Rectangular, circular, coaxial cable and modes of propagation. Introduction to stripline and microstripline.

Microwave networks: N-port microwave networks, impedance, admittance, transmission and scattering matrix representations, reciprocal and lossless networks, network matrices transformations.

UNIT - 2

(16 hours)

Impedance matching and tuning: L-section impedance matching, single and double stub matching, Quarter wave transformer.

Microwave passive circuits: Waveguide cavity resonators. Principles of E-plane Tee, H-plane Tee, hybrid Tee, isolator, circulator, directional couplers, attenuators and phase shifters. Microstrip: Design of Wilkinson power divider.

UNIT - 3

(16 hours)

Microwave tubes: Limitations of conventional tubes in the microwave frequency ranges. Working principles of Klystron amplifier, Reflex klystron oscillator, Magnetrons, Traveling wave tubes.

Microwave solid-state devices: Characteristics of microwave bipolar transistors and FET, GUNN Diode, IMPATT Diode, PIN Diode.

Microwave measurements: fundamentals of power meter, transmission measurements and reflection measurements. Vector network analyzer: Basic vector measurements, architecture, calibration, material property measurements using VNA.

UNIT - 4

(16 hours)

Radar: Principle of operation of radar, maximum unambiguous range, radar range equation, Radar block diagram, radar frequencies, and applications of radar. Probability of Detection & False Alarm. Radar Cross Section of Targets. Continuous wave Radar, FM-CW Radar.

MTI Radar: Principle of operation, block diagram. Blind speeds, staggered PRF's.

Tracking Radar: Different methods of tracking, Sequential lobing, Conical Scanning, amplitude & phase comparison Monopulse Radar.

Recommended Readings:

1. D. M. Pozar; Microwave Engineering, 3rd Ed.; John Wiley & Sons Inc
2. H.J.Reich, J.G.Skolnik, P.F.Ordung, H.L.Krauss; Microwave Principles; Affiliated East West Press Ltd.
3. R. E. Collin; Foundations for Microwave Engineering, 2nd Ed; Wiley-IEEE Press
4. Merrill Skolnik; Introduction to Radar Systems, 3rd Edition; Tata McGraw Hill
5. S. M. Liao; Microwave devices and Circuits, 3rd Ed.; Prentice Hall of India
6. Ananjan Basu; An Introduction to Microwave Measurements; CRC Press

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Characterization of E-Plane, H-Plane and Magic(Hybrid) Tee
2. Characterization of microwave Isolator and Circulator
3. Characterization of Microwave directional couplers
4. Characterization of Microwave attenuators
5. Characterization of Microwave phase shifters
6. Design of Wilkinson power divider
7. VI Characteristics of GUNN Diode
8. Study of PIN diode as a microwave switch
9. Operating modes of Klystron microwave source
10. Microwave measurements using a Vector Network Analyzer
 - a. Return loss
 - b. Insertion Loss
 - c. Bandwidth
 - d. Smith Chart
11. Study of a FM-CW radar
12. Impedance matching using Smith Chart
13. Operation of Vector Signal Generator and Analyzer

ETC/ECE 7.2 INTRODUCTION TO SOFT COMPUTING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.2	Introduction To Soft Computing	3	1	2	3	100	25	--	--	25	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of soft computing techniques and their applications in real life problems.
2. An introduction to artificial neural networks and their training methodologies.
3. An introduction to Fuzzy systems and Fuzzy operators.
4. An introduction to Evolutionary Algorithms and optimization techniques.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain different soft computing approaches and their applications.
2. Explain the architectures of different types of artificial neural networks.
3. Design systems using Fuzzy logic and controllers.
4. Evaluate and Apply appropriate optimization algorithm for a given problem.

UNIT - 1

(12 hours)

Soft Computing: Soft Computing versus Hard Computing, Soft-Computing Systems. Artificial Intelligence: Problem Solving in AI, Logic in Artificial Intelligence. Soft-Computing Techniques: Artificial Neural Networks, Fuzzy Systems, Evolutionary Algorithm, Hybrid Systems. Expert Systems: Expert System Design, High-End Planning and Autonomous Systems. Types of Problems: Classification, Functional Approximation, Optimizations. Machine Learning: Historical Database, Data Acquisition, Pattern Matching.

Introduction to Neural Networks: Introduction to neural networks, structure of biological neuron, Mc-Culloch Pitts neuron model, Neuron modeling for artificial neuron systems, Neural learning. Single layer network: Concept of linear separability and non-linear separability.

Training: Training algorithms- Hebbian learning rule, perceptron learning rule, Delta learning rule, Widrow-Hoff learning rule related problems.

UNIT - 2

(12 hours)

Setting of parameter values and design considerations: Initialization of weights, Frequency of weight updates, Choice of learning rate, Momentum, Generalizability, Network size, Sample size, Non-numeric inputs.

Prediction network, radial basis function and its applications, Winner-Take-All network, Clustering, simple competitive learning algorithm, LVQ algorithm, Adaptive resonance theory, Self-Organizing Maps.

Hopfield network, Brain-state-in-a-box network, Bi-directional associative memory and problems, Applications of neural network.

UNIT - 3

(12 hours)

Fuzzy Inference Systems: Fuzzy Systems, Fuzzy Logic, Membership Functions: Gaussian Membership Functions, Triangular Membership Function, Sigmoidal Membership Function, Other Membership Functions.

Fuzzy Logical Operators: AND Operator, Realization of Min and Product, OR Operator, Realization of Max, NOT Operator, Implication.

More Operations: Aggregation, Realization of Sum and Max, Defuzzification, Fuzzy Inference Systems: Fuzzy Inference System Design, The Fuzzy Process, Type-2 Fuzzy Systems, Other Sets, Sugeno Fuzzy Systems, Fuzzy Controller.

UNIT - 4

(12 hours)

Evolutionary Algorithms, Genetic Algorithms: Concept, Solution, Initial Population, Genetic Operators, Fitness Function, Stopping Condition.

Fitness Scaling, Selection, Mutation, Crossover, Other Genetic Operators, Algorithm Working, Diversity, Grammatical Evolution, Other Optimization Techniques: Particle Swarm Optimization, Ant Colony Optimizations, Metaheuristic Search, Traveling Salesman Problem.

Recommended Readings:

1. Anupam Shukla, Ritu Tiwari, Rahul Kala; Real Life Applications of Soft Computing; CRC Press
2. Kishan Mehrotra, Chilukuri Mohan, Sanjay Ranka; Elements of artificial neural network; Penram Publications.
3. J. Zurada; Introduction to Artificial neural network; Jaico Publications.
4. Timothy J. Ross; Fuzzy Logic with Engineering Applications, 3rd Ed.; Wiley-India Edition
5. Satish Kumar; Neural Networks, A Classroom Approach; Mc Graw Hill Education
6. D. Patterson; Artificial neural networks; Prentice Hall
7. J.Harris; An Introduction to Fuzzy Logic Applications; Springer
8. Rajasekaran, G. A. Vijayalakshmi Pai; Neural Networks, Fuzzy Logic and Generic Algorithm, PHI Learning Pvt.Ltd.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Hebbian learning rule
2. perceptron learning rule
3. Delta learning rule
4. Widrow-Hoff learning rule
5. Radial basis function network
6. Learning vector quantization
7. Self-Organizing maps
8. Recurrent neural networks
9. Fuzzy inference system
10. Genetic algorithm
11. Particle Swarm Optimization
12. Ant Colony Optimizations
13. Traveling Salesman Problem.

ETC/ECE 7.3 MOBILE COMMUNICATION

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.3	Mobile Communication	3	1	--	3	100	25	--	--	--	125

Course Objectives:

The subject aims to provide the student with:

1. An understanding of the cell theory and the different types of handoffs.
2. An ability to calculate the Co-channel Interference reduction factor, received power at the mobile using the different types of propagation models, parameters of the mobile multipath channels and classify the different types of fading channels.
3. An understanding of the different types of equalization and diversity techniques.
4. An understanding of the GSM and CDMA standards for mobile communication.

Course Outcomes:

The student after undergoing this course will be able to:

1. Model a cellular system to study its performance.
2. Determine the Co-channel Interference reduction factor in a cellular system.
3. Calculate the received power using the different types of propagation models.
4. Evaluate the parameters of the mobile multipath channels and classify the different types of fading channels.
5. Differentiate between types of equalizers.
6. Explain the different types of diversity techniques.
7. Explain GSM and CDMA technology.
8. Evaluate processing gain, Jamming to Signal ratio for Spread Spectrum System.

UNIT - 1

(12 hours)

The Cellular Concept: Introduction, Block diagram of Cellular System, Concept of Frequency Reuse, Hexagonal shaped cells.

Handoff Strategies: Handoffs, Types of handoff, handoff initiation, delaying handoff, forced handoff, Power Difference Handoffs, Mobile assisted Handoff (MAHO) and Soft Handoff, Cellsite Handoff, Intersystem Handoff.

Co-channel Interference Reduction Factor, Desired C/I for a normal case in an Omnidirectional Antenna System. Reduction of Co-Channel interference by means of a notch in the tilted antenna pattern.

Mobile Radio Propagation, Large -Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, The Three Basic Propagation Mechanisms, Reflection, Ground Reflection (Two Ray) Model, Diffraction, Scattering: Radar cross section model.

UNIT - 2

(12 hours)

Mobile Radio Propagation: Small -Scale Fading and Multipath:

Small- Scale Multipath Propagation, Impulse Response Model of a Multipath Channel: Relationship between bandwidth and received power, Small-scale multipath measurements. Parameters of Mobile Multipath Channels, Types of Small -Scale Fading, Rayleigh and Ricean Distribution. Statistical models for multipath fading channels: Clarke's model for flat fading, Level crossing and fading statistics, Two Ray-Rayleigh fading model.

UNIT - 3

(12 hours)

Equalization: Introduction, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communications Receiver, Linear Equalizers, Nonlinear Equalization ,Algorithms for adaptive equalization: Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm.

Diversity Techniques: Practical Space Diversity Considerations, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

MIMO Systems: Multiple Input Multiple Output Antenna Systems, Alamouti Space Time Codes for MIMO Wireless Communications.

UNIT - 4

(12 hours)

Global System for Mobile Communication (GSM): GSM Services and Features, GSM System Architecture, GSM Radio Subsystem, GSM Channel Types, Example of a GSM Call, Frame Structure for GSM.

Spread Spectrum techniques & CDMA: Advantages, Process Gain, Jam Margin, J/S ratio, Multipath Fading and its avoidance, PN Sequences, Techniques: Direct Sequence (DSSS) & Frequency Hopping (FHSS), The Near Far Problem ,DS-CDMA & FH-SS CDMA .

CDMA Digital Cellular Standard (IS-95): Frequency and Channel Specifications, Forward CDMA Channel, Reverse CDMA Channel.

Recommended Readings:

1. William Lee; Mobile Cellular Telecommunications; Tata McGraw Hill,
2. Theodore Rappaport; Wireless Communication : Principles and Practice, 2nd Ed.; Pearson Education
3. Mohinder Janakiraman; Time Codes and MIMO Systems;, Artech House
4. Taub, Schilling, Saha; Principles of communication systems, 3rd edition; Tata McGraw hill publishing company
5. David Tse and Pramod Vishwanathan; Fundamentals of Wireless Communications; Cambridge University Press
6. Jochen Schiller; Mobile Communications, 2nd Edition; Addison Wesley

ETC/ECE 7.6 PROJECT

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Instruction						
		L	T	P	Th. Duration (Hrs)	Marks					
						TH	S	TW	P	O	Total
ETC/ECE 7.6	Project	--	--	4	--	--	--	--	--	25	25

Guidelines for Project Work:

1. The project can be undertaken in-house or in an industry or in a research /service organization.
2. Project batch will consist of a maximum of four students.
 - a. If the scale of the project is large or if it is the requirement of a large project in the Industry, then the maximum size of project group may be extended up to six students subject to, only one or two such groups being allowed per year.
3. The Project Title / Synopsis should be prepared at the beginning of the term and approved by a designated departmental committee.
4. The topic of the project may be in the area related to Electronics/Electrical/Communication/Software engineering. It may involve investigation/ analytical study / experimental work / fabrication / Statistical study / simulation etc. The project should preferably be taken in the latest trends in Engineering and Technology.

Project Report:

The Project (Interim) report shall consist of the following:

- a. Problem identification.
- b. Statement of problem.
- c. Formulation of the objective and Scope of the study.
- d. Literature review.
- e. Methodology to be adopted.
- f. Preliminary Work

Review:

Monthly review to assess the progress of the project work will be conducted by the Guide. Students shall submit project reports to the department and make a presentation before the departmental committee at the end of Semester.

ETC 8.1 INFORMATION THEORY AND CODING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC 8.1	Information Theory And Coding	3	1	2	3	100	25	--	--	25	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of information theoretic behavior of a communication system.
2. A perspective of problems associated with channel capacity of the different types of the communication channels.
3. An ability to calculate the efficiency of the source using the various source coding techniques.
4. An understanding of various channel coding techniques.

Course Outcomes:

The student after undergoing this course will be able to:

1. Determine the marginal, joint and conditional entropy of a communication system.
2. Calculate the mutual information of the communication channel.
3. Calculate the entropy of second order Markov source.
4. Evaluate the channel capacity of the different types of the communication channels.
5. Encode the data using various source coding techniques and determine their efficiencies.
6. Code and decode the data using the various channel coding techniques.
7. Compare error rates in coded and un-coded transmission.

UNIT - 1

(12 hours)

Information Theory: Information content, unit of information, Entropy, Entropy of binary source, rate of information, Joint entropy and conditional entropy. Mutual Information and channel capacity: Noise free channel, Channel with independent input and output, Symmetric channel, Binary symmetric channel (BSC), Binary erasure channel (BEC), cascaded channels, repetition of signals, extension of the Zero Memory Sources. Sources with finite memory: Markov sources. Extension of Binary Channels.

UNIT - 2

(12 hours)

Shannon's Theorem, Capacity of Gaussian channel: Shannon-Hartley Theorem, Bandwidth –S/N Tradeoff, Shannon Limit.

Source Coding: Coding efficiency, Shannon's first fundamental theorem, Lossless coding algorithm, Kraft's inequality, Variable length source coding: Shannon –Fano coding, Huffman coding, (D-ary compact codes), Lempel-Ziv (LZ) coding, Lossy data compression: Rate distortion theory.

UNIT - 3

(12 hours)

Error Control Coding: Types of codes, Error Probability with Repetition in the Binary Symmetric Channel, Parity Check bit for error detection, Hamming distance.

Linear Block Codes, Syndrome and error detection, standard array and syndrome decoding for error correction, Probability of undetected error for linear block codes.

Single Parity Check Bit Code, Repeated Codes, Hadamard Code, Hamming Codes, Reed Muller codes, dual codes.

Cyclic Codes: Algebraic Structure of cyclic codes, Binary cyclic code properties, Encoding in systematic form, Circuit for dividing polynomials, Systematic encoding with an (n-k) stage shift register, error detection with an (n-k) stage shift register, Golay Code, BCH Codes.

UNIT - 4

(12 hours)

Burst Error Correction: Block Interleaving, Convolutional Interleaving, Reed Solomon (RS) Code, Concatenated Codes.

Convolutional Coding: Code Generation, Generator Matrix, code tree, State and Trellis Diagrams for Convolutional codes, types of Convolutional codes, their realizations, catastrophic encoders. Decoding Convolutional Code: using code tree, decoding in the presence of noise, Sequential decoding, The Viterbi algorithm.

Comparison of Error rates in coded and uncoded transmission, Introduction to Turbo Codes, Turbo Decoding, Automatic Repeat request, Performance of ARQ systems.

Recommended Readings:

1. Herbert Taub, Donald Schilling, Goutam Saha; Principles of Communication Systems; Tata McGraw Hill
2. R. P. Singh, S. Sapre; Communication systems: Analog and Digital, 3rd Ed.; Tata McGraw Hill
3. J.Das, S. K. Mullick, P. K. Chatterjee; Principles of Digital Communication; John Wiley
4. Bernard Sklar; Digital Communications : Fundamental & Applications, 2nd Edition; Pearson Education
5. Ranjan Bose; Information Theory, Coding & Cryptography, 2nd Edition; Tata McGraw Hill Publishing Company Limited.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. MATLAB program that takes in channel transition probability matrix and computes the Mutual Information
2. MATLAB program to compute the channel capacity of the BSC channel
3. MATLAB program to compute the channel capacity of the BEC channel
4. MATLAB program to compute the channel capacity of the cascaded BSC channel
5. MATLAB program to compute the channel capacity of the BSC channel with the two repetition of inputs
6. Simulate binary Huffman code in MATLAB. Find average length, entropy and coding efficiency of the code.
7. Simulate binary Shannon-Fano code in MATLAB. Find average length, entropy and coding efficiency of the code.
8. Simulate binary Lempel-Ziv code in MATLAB. Find average length, entropy and coding efficiency of the code.
9. MATLAB program to encode messages for a forward error correction system with a given Linear block code.
10. MATLAB program to perform Linear Block encoding and decoding.
11. MATLAB program to encode and decode messages for a system with Cyclic Redundancy code.
12. MATLAB program to Reed-Solomon encoding and decoding.
13. MATLAB program to perform Convolutional encoding.
14. MATLAB program to perform Convolutional decoding using Viterbi algorithm.
15. MATLAB Study of Turbo codes.

ETC/ECE 8.2 ADVANCED COMMUNICATION

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					Total
						Th	S	TW	O	P	
ETC/ECE 8.2	Advanced Communication	3	1	2	3	100	25	--	--	--	125

Course Objectives:

The subject aims to provide the student with:

1. In depth understanding about the science behind the orbiting satellites, satellite orbital mechanics and their parameters, satellite subsystems and earth station equipment.
2. Conceptual knowledge of factors affecting the satellite link design, multiple access schemes, Global Positioning systems and VSAT systems.
3. Coverage of the basic concepts of ray and mode theory of light propagation through optical fibers, fiber impairments, fiber joints and connectors.
4. Knowledge of construction and working of Optical Sources and Photo-detectors, WDM concepts and Optical Networks.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the orbits of satellites, satellite launch mechanism, satellite hardware and Earth station design.
2. Describe the concepts of signal propagation effects, frequency and noise considerations which affect satellite link design.
3. Investigate various multiple access techniques used for satellite communication.
4. Describe the fundamentals underlying the operation of VSAT systems and GPS.
5. Recognize and classify the structures of Optical fiber and types and discuss the channel impairments like absorption losses, attenuation, scattering and dispersion.
6. Examine various optical sources and photo-detectors and discuss their principle and performance parameters.
7. Explain principle of working and components of WDM optical systems.

UNIT - 1

(12 hours)

Satellite Orbits: Advantages and disadvantages of Satellite communications, Satellite Communication System, Kepler's Laws of planetary motion, Types of orbits-based on altitude, eccentricity, orbital plane, description of satellite orbit, location of satellite with respect to earth, orbital elements, Look angles, earth coverage and slant range, eclipse effects, orbital perturbations, placing of satellite in geostationary orbit, Station keeping and Satellite Stabilization.

Satellite Subsystems: Electric power supply, Altitude and Orbit Control, Propulsion Subsystem, Communication Subsystem (Repeaters/Transponders), Antenna Subsystems, Telemetry-Tracking-Command and Monitoring, Thermal Control Subsystem, Structure Subsystem.

Earth Station: Types of Earth Station, Design Considerations and Earth system sub-systems.

Applications of satellite communications: Satellite Television, Satellite Telephony, Earth observation (Remote Sensing), weather forecast, scientific studies.

UNIT - 2

(12 hours)

Satellite Link Design: Link design equations, system noise temperature, C/N and G/T Ratio, Uplink design, complete Link design, Frequency considerations, Propagation considerations, interference related problems, earth station parameters.

Multiple Access: Frequency Division Multiple access, Time Division Multiple access, TDMA Frame, Burst and Superframe structure, FDMA v/s TDMA, Satellite switched TDMA, Beam Hopping TDMA, Space division Multiple Access.

VSAT satellite systems: VSAT concept, VSAT/ Wireless local loop networks. VSAT network architectures, multiple access methods, Applications of VSAT networks.

Global positioning Satellite systems: GPS segments, Working principle, GPS signal structure, GPS Positioning services and positioning modes, Trilateration method.

UNIT - 3

(12 hours)

Overview of optical fiber communication: Optical spectral bands, key elements of optical fiber systems, advantages, disadvantages and applications of optical fiber communication.

Optical fiber waveguides: Ray theory transmission: Total internal reflection, acceptance angle, numerical aperture, skew rays. Optical fiber modes and configurations, single mode fibers, graded index fiber structures, cut-off wavelength, mode-field diameter.

Transmission characteristics of optical fibers: Attenuation, material absorption, linear scattering, bending loss, chromatic dispersion, intermodal dispersion.

Optical fiber joints and connectors: Fiber to fiber joints, fiber misalignments, Fiber splices: fusion and mechanical, fiber connectors: cylindrical ferrule and expanded beam.

UNIT - 4

(12 hours)

Optical Sources: Energy bands, direct and indirect bandgap.

LED structures: edge emitter LEDs and surface emitter LEDs, Quantum efficiency and LED power, modulation of LED.

Laser diodes: absorption, emission of radiation, population inversion, laser diode modes and threshold conditions, Fabry-Perot Laser diode, distributed feedback Laser diode. (4 Hours)

Photo-detectors: PN photodiode, PIN photodiode, Avalanche Photodiode, Quantum efficiency, responsivity, cut-off wavelength.

WDM concepts and components: Operational principles and standards of WDM. Passive optical couplers: 2x2 fiber coupler, Star Coupler, Mach-Zehnder Interferometer Multiplexers. Optical Isolator and circulator. Basics of Grating, Fiber Bragg grating & applications.

Optical Networks: SONET/SDH transmission formats and speeds, SONET/SDH Rings, SONET/SDH Networks.

Recommended Readings:

1. D. C. Agarwal; Satellite Communications, 6th Edition, Khanna Publishers
2. Timothy Pratt, Charles Bostian, Jeremy Allnut; Satellite Communications, 2nd Edition, Wiley Publications
3. Anil K Maini, Varsha Agarwal; Satellite Communications; Wiley Publications.
4. Gerd Keiser; Optical Fiber Communication, 4th Edition, McGraw Hill Publications.
5. John M Senior; Optical Fiber Communications, 5th Edition, Pearson Education.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

(SATELLITE COMMUNICATION)

1. Setting up communication link and study of change in uplink and downlink frequency.
2. Establishing audio-video satellite link between Transmitter and Receiver
3. Study of Frequency Hopping (FHSS) Modulation and Demodulation
4. Study of Direct Sequence (DSSS) Modulation and Demodulation
5. Study of PN sequence generation
6. Tele-commands transmission and reception via Satellite
7. Calculation of C/N ratio and S/N ratio of satellite link
8. Study of GPS data like longitude, latitude using GPS receiver
9. Simulation of different aspects of satellite communication systems on MATLAB
10. Study of Satellite Tool kit (STK) from Analytics Graphics (evaluation version) and its application in Satellite Communication systems

(OPTICAL FIBER COMMUNICATION)

1. Establishing 650nm fiber optic analog and digital link
2. Study of intensity modulation technique using analog input signal and digital input signal.
3. Measurement of Numerical Aperture of different fiber cables
4. Measurement of power emitted by LED
5. Attenuation and coupling losses in optical fiber
6. Transmission characteristics of LED and LASER diode.
7. Operational characteristics of Photodiode as a photo-detector.
8. Simulation of different aspects of optical fiber communication systems on MATLAB or any open source simulator.

ETC/ECE 8.5 PROJECT

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Instruction						
		L	T	P	Th. Duration (Hrs)	Marks					
						TH	S	TW	P	O	Total
ETC/ECE 8.5	Project	--	--	8	--	--	--	75	--	75	150

Guidelines for Project Work:

1. Students shall carry out the required experimental/field/ numerical / analysis/ design / any other work related to the project during the semester.
2. Students shall perform the project work using institute/industry facilities.
3. Students shall maintain a project book including observations, readings, calculations and all other relevant data related to the project.
4. The student shall continuously update the project book and submit the same to the guide.

TERM WORK:

Project Report: It is expected to show clarity of thought and expression, critical appreciation of the existing literature, and analytical, computational, experimental aptitudes of the student through project report.

The Project report shall be submitted in a standard format (prepared using LaTeX) and shall consist of the following:

- a. Statement of problem
- b. Objective and Scope of the study
- c. Literature review
- d. Methodology
- e. Results and Discussions
- f. Conclusions
- g. References

Review:

Monthly review to assess the progress of the project work will be conducted by the Guide. Students shall submit a final project report to the department in the form of hard and soft copy after answering the final examination.

Syllabus Electives

ETC/ECE 7.4.1 DIGITAL VLSI

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					Total
						Th	S	TW	O	P	
ETC/ECE 7.4.1	Digital VLSI	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An in-depth knowledge of the MOS Transistors, Transmission Gates and MOS inverters.
2. An ability to estimate the resistances, capacitances and inductances associated with MOS circuits and their impact on device performance.
3. The capability to apply Graph theory to MOS circuits, and understanding of CMOS logic gate design.
4. An understanding of design strategies, CMOS testing and ability to program using Verilog HDL.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the operation of MOS Transistor as a switch and compare its working to a transmission gate.
2. Analyze the CMOS Inverter and compute the VIL, VIH, VOH and VOL equations.
3. Estimate the Resistance, capacitance and Inductance associated with MOS circuit.
4. Derive expressions for the different types of power dissipations involved in CMOS Gate.
5. Apply Graph Theory to MOS circuits and represent graphs using Matrices.
6. Implement any given Boolean Function in CMOS Logic Gate.
7. Write the Verilog program for Digital Circuits.
8. Explain design strategies, verification and CMOS testing.

UNIT - 1

(12 hours)

Introduction To MOS Circuits: MOS transistors, MOS transistor switches, CMOS logic, circuit and system representations, MOS transistor theory – Introduction, MOS device design equations, The Complementary MOS Inverter - DC Characteristics, Static Load MOS Inverters, the Differential Inverter, the Transmission Gate, the Tri State Inverter, Bipolar Devices.

UNIT - 2

(12 hours)

Circuit Characterization and Performance Estimation: Introduction, resistance estimation, capacitance estimation, inductance, switching characteristics CMOS-gate transistor sizing, power dissipation, sizing routing conductors, charge sharing, design margining, and reliability.

UNIT - 3

(12 hours)

Graphs: Representation of graphs using matrices; Paths, connectedness; circuits, cutsets, trees; Fundamental circuit and cutset matrices; Voltage and current spaces of a directed graph and their complementary orthogonality. Stick Diagrams & Layouts.

CMOS Circuit and Logic Design: CMOS logic gate design, basic physical design of simple gate, CMOS logic structures, clocking strategies, I/O structures.

UNIT - 4

(12 hours)

Systems Design and Design Method: Design strategies, CMOS chip design options, design methods, design capture tools, design verification tools, CMOS testing – Manufacturing test principles, design strategies for test, chip level test techniques, system level test techniques.

Syntax and Semantics of Verilog: Variable types, arrays and tables. Operators, expressions and signal assignments. Modules, nets and registers, concurrent and sequential constructs. Tasks and functions. Examples of design using Verilog.

Recommended Readings:

1. N. Weste , K. Eshraghian; Principles of CMOS VLSI Design; Addison Wesley
2. Jacob Backer, Harry W. Li, David E. Boyce; CMOS Circuit Design, Layout and Simulation; Prentice Hall of India
3. L. Glaser, D. Dobberpuhl; The Design and Analysis of VLSI, Circuits; Addison Wesley
4. C. Mead, L. Conway; Introduction to VLSI Systems; Addison Wesley
5. Randel & Geiger; VLSI Analog and Digital Circuit Design Techniques; McGraw-Hill
6. Sabih H. Gerez; Algorithms for VLSI design automation; John Wiley & Sons
7. William M. Penny, Lillian Lau; MOS Integrated Circuits- Theory, Fabrication, Design and System Applications of MOS LSI; Van Nostrand Reihold Company.
8. Sung Ms Kang, Yusuf Lablebici; CMOS Digital Integrated Circuits Analysis & Design; Tata Mc-Graw Hill.
9. S. Palnitkar; Verilog HDL: A Guide to Digital Design and Synthesis; Prentice Hall
10. J. Bhaskar; Verilog HDL Synthesis - A Practical Primer; Star Galaxy Publishing

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. SPICE program to Plot the VI Characteristics of NMOS and PMOS.
2. SPICE program to plot the VTC of Static Load and CMOS Inverter.
3. SPICE program to examine effect of Transistor Sizing on the Switching Characteristics.
4. SPICE program to estimate Resistance and Capacitance in MOS circuit.
5. Layout for Transmission gate and CMOS Inverter.
6. Layout of Complex Boolean Function.
7. Layout of NAND and NOR Gates.
8. Verilog code for MUX and Demux.
9. Verilog program for Counter
10. Verilog Program for RAM
11. Verilog Program for ALU.
12. Verilog program for Hardware Multiplier.
13. Verilog Program for Finite State Machine.
14. Verilog code for GENERIC Ripple carry Adder.
15. Verilog Code for parallel to Serial Converter.

ETC/ECE 7.4.2 IMAGE PROCESSING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.4.2	Image Processing	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of basics of visual perception, effects of image sampling and quantization.
2. An ability to apply relevant filters for enhancing images.
3. An understanding of image degradation and restoration process.
4. An ability to apply the various edge detection algorithms to segment image into different regions.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the effects of variation in sampling and quantization parameters on image quality.
2. Perform different transformations on images and observe the subjective changes in image quality.
3. Perform smoothing and sharpening operations on image using spatial-domain filters.
4. Analyze the image in frequency domain by taking various transforms and perform smoothing and sharpening in frequency domain.
5. Explain the various noise models and different types of degradations which affect an image during the acquisition process.
6. Apply various filtering techniques on degraded images to restore it.
7. Apply edge detection techniques to separate regions in images.
8. Explain the process of reconstruction of an image from projections.

UNIT - 1

(12 hours)

Elements of visual perception: Light and electromagnetic spectrum, image sensing and acquisition, image sampling and quantization, basic relationship between pixels: neighbors, connectivity, distance measures, and arithmetic & logic operations.

Image enhancement: Translation, Rotation, Concatenation.

Basic transformations: Image negatives, Log Power-law, Contrast-stretching, Intensity-level slicing, Bit-plane slicing.

Histogram processing: Histogram equalization, Histogram equalization and Perspective Transformation.

UNIT - 2

(12 hours)

Spatial filtering: Smoothing, sharpening filters: Laplacian filters, Unsharp masking and highboost filtering.

Introduction to Fourier Transform and DFT: Properties of 2D Fourier Transform, FFT, Separable Image Transforms, Walsh, Hadamard, Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms.

Frequency domain filters: (High pass and low pass) Ideal, Butterworth, Gaussian; Homomorphic filtering.

UNIT - 3

(12 hours)

Image Restoration: Image degradation/restoration process, noise models, restoration in the presence of noise only- spatial filtering, periodic noise reduction by frequency domain filtering. Linear position invariant degradations, estimating the degradation function, Inverse filter, Wiener filter.

Image Compression: Lossless and Lossy Coding, Block Transform Coding, predictive coding, JPEG, MPEG.

UNIT - 4

(12 hours)

Edge detection: Detection of point, line, discontinuities. Gradient Operators, Laplacian, LoG Filters, Global Processing via Hough Transform.

Mathematical morphology: Binary Morphology, Dilation, Erosion, Opening and Closing, Duality Relations, Gray Scale Morphology, Hit-and-Miss Transform, Thinning and Shape Decomposition.

Computer Tomography: Radon transform, Back-Projection Operator, Fourier-slice theorem, CBP and FBP methods.

Recommended Readings:

1. Rafael C. Gonzalez and Richard E. Woods; Digital Image Processing; Pearson
2. Anil K. Jain; Fundamentals of Digital Image Processing; Prentice Hall of India
3. W. K. Pratt; Digital image processing, Prentice Hall.
4. Sonka, Hlavac, Boyle; Image Processing: Analysis and Machine Vision; Thomson

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. To observe the effects on sampling and quantization on image.
2. To perform image transformation (negative, Power-law, Log, anti-log) on images.
3. To perform contrast stretching on images
4. To perform histogram equalization on images
5. To smoothen an image by using spatial filtering
6. To sharpen an image by using spatial filtering
7. To observe the effects of convolution of filter on images due to aliasing
8. To filter images through ideal frequency domain filters
9. To filter images by using Butterworth, Gaussian filters
10. To observe the effect of degradation function and various noise on images
11. To restore a degraded image by using inverse and wiener filter

ETC/ECE 7.4.3 TECHNICAL WRITING AND PROFESSIONAL ETHICS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.4.3	Technical Writing and Professional Ethics	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An ability to write technical documents.
2. An ability to communicate information through verbal and visual methods.
3. An understanding of importance of ethics, safety and risks.
4. An understanding of corporate structure and ethics.

Course Outcomes:

The student after undergoing this course will be able to:

1. Plan, Draft and write technical documents.
2. Design verbal and visual documents for effective communication.
3. Write correspondence letters and reports.
4. Explain the importance of ethics in work and work place.
5. Assess safety and risks involved in decisions.
6. Explain issues related to loyalty, rights and corporate ethics.

UNIT - 1

(12 hours)

Understanding the Technical Communication Environment: Introduction to Technical Communication. Understanding ethical and legal considerations.

Writing Technical Documents: Planning, Drafting, Revising, Editing, Proof reading.

Writing Collaboratively: Advantages and Disadvantages of Collaboration, Managing Projects, Conducting Meetings, Using Social Media and Other Electronic Tools in Collaboration Gender and Collaboration, Culture and Collaboration.

Planning the Document: Analyzing Your Audience and Purpose. Researching Your Subject. Organizing Your Information.

UNIT - 2

(12 hours)

Developing and Testing the Verbal and Visual Information: Communicating Persuasively, Emphasizing Important Information, Writing Correct and Effective Sentences, Designing Print and Online Documents, Creating Graphics, Reviewing, Evaluating, and Testing Documents and Websites.

Learning Important Applications: Writing Correspondence, Writing Job-Application Materials, Writing Proposals, Writing Informational Reports, Writing Recommendation

Reports, Writing Lab Reports, Writing Definitions, Descriptions, and Instructions, Making Oral Presentations.

Skimming Your Sources and Taking Notes, Documenting Your Sources, Editing and Proofreading Your Documents, Guidelines for Multilingual Writers (ESL).

UNIT - 3

(12 hours)

Senses of 'Engineering Ethics': Variety of moral issues, Types of inquiry, Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory, Consensus and Controversy, Professions and Professionalism, Professional Ideals and Virtues, Uses of Ethical Theories, Engineering as Experimentation, Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards, A Balanced Outlook on Law, The Challenger Case Study.

Safety and Risk: Assessment of Safety and Risk, Risk Benefit Analysis, Reducing Risk, The Government Regulator's Approach to Risk, Chernobyl Case Studies and Bhopal.

UNIT - 4

(12 hours)

Collegiality and Loyalty: Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crime, Professional Rights, Employee Rights, Intellectual Property Rights (IPR), Discrimination.

Multinational Corporations: Business Ethics, Environmental Ethics, Computer Ethics, Role in Technological Development, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Honesty, Moral Leadership, Sample Code of Conduct.

Recommended Reading:

1. Mike Markel; Technical Communication, 11th Edition; Bedford/St. Martin's
2. Meenakshi Raman , Sangeeta Sharma; Technical Communication: English Skills for Engineers; Oxford University Press
3. Mike Martin , Roland Schinzinger; Ethics in Engineering; McGraw Hill, New York
4. Charles E Harris, Michael S Pritchard, Michael J Rabins; Engineering Ethics Concepts and Cases; Thompson Learning
5. Caroline Whitbeck; Ethics in Engineering Practice and Research; Cambridge University Press

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Writing Lab Reports
 2. Presentation on interpretation of a technical paper
 3. Writing a technical paper
 4. Writing a technical papers through peer collaboration
 5. Designing presentations on technical content
 6. Designing website/blog on technical content
-

7. Writing Informational Reports
8. Writing Recommendation Report
9. Writing Definitions, Descriptions, and Instructions
10. Safety and risk assessment case studies
11. Writing a Patent application

ETC/ECE 7.4.4 INTRODUCTION TO ROBOTICS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					Total
						Th	S	TW	O	P	
ETC/ECE 7.4.4	Introduction to Robotics	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of all the subsystems and components of a robot.
2. An ability to solve problems related to kinematics of a robot.
3. An ability to design and program simple robotic platforms.
4. An ability to perform image processing techniques for robotic applications.

Course Outcomes:

The student after undergoing this course will be able to:

1. Describe the subsystems of robot system and explain the anatomy and working of basic robot configurations.
2. Evaluate different robot actuator drive systems and end effectors for given application.
3. Evaluate different sensors used and integrate them in robotic systems.
4. Analyze anatomy of simple robots and compute kinematic solutions.
5. Explain control strategies used in robotic systems.
6. Evaluate motion planning strategies for a given application.
7. Explain image acquisition and processing techniques used in robotics.
8. Design simple image processing and servoing system for robotic application.

UNIT - 1

(12 hours)

Basic Concepts in (Fundamentals of) robotics: Automation and robotics, Robot applications.

Different classifications of robot: By application, by coordinate system, by actuation system, by control method and by programming method.

Robot anatomy: links and joints, Joint notation scheme. Degree of Freedom. Robot resolution, accuracy and repeatability. Concept of workspace.

Actuator and Drive systems: Pneumatic and hydraulic systems. Electric: Relation between torque and voltage. AC and DC Servo motors, Stepper motors, BLDC motors. Electronic control of motors.

Robot End Effectors: Grippers and Tools.

UNIT - 2

(12 hours)

Sensors in Robotics: Sensor classification, Touch sensors, Force and Torque sensors, Accelerometers and Gyroscopes, LIDAR, Acoustic sensors, Slip sensors, Proximity & Range sensors: Light and Ultrasonic. Optical encoders: absolute and relative, Resolvers and DC tachometers.

Transformations: Pose of rigid body, Coordinate transforms, Homogeneous Transform, DH parameters.

Kinematics: Forward and Inverse kinematics. The Jacobean matrix. Concept of Statics and Dynamics.

UNIT - 3

(12 hours)

Robot Control: Control techniques. Transfer function and state space representation. Analysis of a Robot joint. Feedback control, Stability and performance. Joint Controller.

Motion Planning: Joint space and Cartesian space planning, Position and orientation trajectories.

UNIT - 4

(12 hours)

Computer Vision: image acquisition, The Imaging Transformation, Camera transformation and calibrations, Image processing (spatial and frequency domain analysis), Image enhancements, histogram Equalization, Image Segmentation, Image Feature Extraction.

Visual Servoing: Vision-Based Control, Position-Based Visual Servoing, Image-Based Visual Servoing.

Recommended Reading:

1. John J. Craig; Introduction to Robotics, Mechanics & Control; Pearson Education Inc.
2. S. K. Saha; Introduction to Robotics, 2nd Ed.; McGrawHill
3. Peter Corke; Robotics, Vision and Control; Springer.
4. M. P. Groover, M. Weiss, R. N. Nagel, N. G. Odrey; Industrial Robotics Technology: programming and Applications; McGrawHill
5. K. S. Fu, R. C. Gonzalez, C. S. G. Lee; Robotics Control Sensing, Vision and Intelligence; McGraw Hill Book co.
6. Mittal & Nagrath; Robotics and Control; McGrawHill

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Electronic Control of a DC Servo motor
2. Electronic Control of a Stepper motor
3. Electronic control of BLDC motor
4. Interfacing of proximity and range sensors to Arduino/R-Pi
5. Interfacing of Accelerometers and Gyroscopes sensors to Arduino/R-Pi
6. Interfacing of force sensors to Arduino/R-Pi
7. Forward kinematics of a Robot arm (Hardware/Matlab or Simulation Software)
8. Inverse kinematics of a Robot Arm (Hardware/Matlab or Simulation Software)

9. Programming a robot arm for straight line, circular and curved paths (Hardware or Simulation Software)
10. Programming a robot arm for pick and place operation. (Hardware or Simulation Software)
11. Programming a robot arm: Loops, branches and subroutines (Hardware or Simulation Software)
12. Programming a robot arm: external events (Hardware or Simulation Software)
13. Image Processing
14. Image Feature Extraction
15. Image-Based Visual Servoing

ETC/ECE 7.4.5 INTRODUCTION TO GPU COMPUTING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.4.5	Introduction to GPU Computing	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. Ability to write a GPU kernel function.
2. An understanding of using different memories of GPU in a CUDA program.
3. Ability to synchronize multiple threads of a program.
4. Applying the GPU resources for computationally intensive algorithms.

Course Outcomes:

The student after undergoing this course will be able to:

1. Analyze and compare the performance of CPU and GPU for a sample computationally intensive program.
2. Write a GPU kernel function.
3. Compare the performance improvements by using different GPU memories
4. Apply Synchronization techniques for different threads of a GPU program.
5. Analyze the thread warping in CUDA program.
6. Write CPU program for different computationally intensive applications.
7. Compare the effect of using I/O strategies to boost performance.

UNIT - 1

(12 hours)

Introduction to CPU and GPU computing: Basics of C, matrix multiplication using CPU.

Introduction: GPUs as Parallel Computers, Architecture of a Modern GPU, Why More Speed or Parallelism, Parallel Programming Languages and Models Overarching Goals, Evolution of Graphics Pipelines; the Era of Fixed-Function.

Introduction to CUDA: Data Parallelism CUDA Program Structure, A Matrix-Matrix Multiplication Example, Device Memories and Data Transfer, Kernel Functions and Threading; Function declarations, Kernel launch, Predefined variables, Runtime API.CUDA Thread Organization, Using blockIdx and threadIdx

UNIT - 2

(12 hours)

CUDA Memories: Importance of Memory Access Efficiency, CUDA Device Memory Types, A Strategy for Reducing Global Memory Traffic Memory as a Limiting Factor to Parallelism,

Global Memory Bandwidth, Dynamic Partitioning of SM Resources, Data Prefetching, Instruction Mix, Thread Granularity, Measured Performance, Synchronization, Shared memory, Matrix Transpose.

UNIT - 3

(12 hours)

Synchronization and Transparent Scalability, Thread Assignment, Thread Scheduling and Latency Tolerance, Atomic instructions, warping, Advanced GPU-accelerated algorithms, CUDA libraries and tools, Reduction, Prefix sum, Stream compaction.

UNIT - 4

(12 hours)

Advanced GPU accelerable algorithms: sorting (quicksort), GPU-accelerated Fast Fourier Transform, cuFFT (FFT library) IO strategy, CUDA streams, CUDA events, how it all works: virtual memory, command buffers, Pinned host memory, Managed memory.

Recommended Readings:

1. David B Kirk; Wen Mei W Hwu; Programming Massively Parallel Processors: A Hands-On Approach; Elsevier India Private Limited
2. Shane Cook; CUDA Programming: A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing); Morgan Kaufmann
3. Jason Sanders, Edward Kandrot; CUDA by Example: An Introduction to General-Purpose GPU Programming ; Addison-Wesley Professional
4. Duane Storti, Mete Yurtoglu; CUDA for Engineers: An Introduction to High-Performance Parallel Computing; Addison Wesley
5. Nicholas Wilt; The CUDA handbook ; Pearson Education

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Write a C program to perform matrix multiplication.
2. Write a helloworld GPU kernel function
3. Write a cuda program to print the block ID and thread ID
4. Write a cuda program to use register memory
5. Write a cuda program to perform matrix transpose
6. Write a cuda program to perform matrix multiplication
7. Write a cuda program to perform matrix multiplication using tiles
8. Write a cuda program to perform prefix sum
9. Write a cuda program to perform quicksort
10. Write a cuda program to perform FFT

ETC/ECE 7.4.6 COMPUTER NETWORKS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.4.6	Computer Networks	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the students with:

1. An introduction to key components of any data network.
2. An understanding of the hierarchical addressing of devices and how this allows communication between networks.
3. An understanding IP addressing and Variable Length Subnet Mask (VLSM).
4. An ability to configure devices, apply address and VLANs in a network topology.
5. An introduction of Wireless LAN technology.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the hierarchical model of computer data network.
2. Explain the role and operation of different networking devices.
3. Explain IPv4, IPv6 and TCP/IP protocols.
4. Configure IP networks with help of subnets.
5. Implement VLSM networks.
6. Configure Routers while selecting appropriate routing protocol.
7. Configure inter-VLAN routing on a router to enable communication between end-user devices on separate VLANs.
8. Configure and verify basic wireless LAN access.

UNIT - 1

(12 hours)

Internetworking basics: Types of networks, Line configuration, Modes of transmission, Topology; OSI reference model; Ethernet networks; Ethernet Cabling.

Three layer Hierarchical model: Core layer, Distribution layer, Access layer.

Networking devices: Hubs, Switches, Routers, Repeaters, Bridges.

UNIT - 2

(12 hours)

TCP/IP model: 4 layers protocols; IP addressing: class A, B, C, D, E, Private IP Addresses; IPV4 Address types: Unicast, broadcast, multicast; IP Subnetting: Subnet masks, Classless Inter-Domain Routing (CIDR), Subnetting Class C Addresses, Subnetting Class B Addresses, Subnetting Class A Addresses.

Variable Length Subnet Masks (VLSM): VLSM Design, Implementing VLSM Networks.

IPv6: Benefits and Uses; Addressing; Working; IPv6 Routing Protocols: RIPng, EIGRPv6, OSPFv3; Migrating to IPv6.

UNIT - 3

(12 hours)

Router Fundamentals: Internal Components, Ports, Router Boot Sequence; Command-Line Interface (CLI): Overview of Router Modes; Router Administrative Configurations: Hostnames, Banners, Setting passwords, recovering passwords; Router Interfaces: Configuring an IP Address on an interface, Bringing up an interface, Serial Interface Commands; Viewing, Saving Erasing and Changing Configurations.

IP Routing: Routing Basics; IP Routing Process; Configuring IP Routing: Static Routing: Manual, Default Routing; Dynamic Routing: Routing Protocols Basics, Distance-Vector Routing Protocols, Routing Information Protocol (RIP), Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path First (OSPF); Introduction to Access Control Lists (ACLs): Standard, Extended; Network Address Translation (NAT).

UNIT - 4

(12 hours)

Layer 2 Switching; Switching services; Types of switches; Spanning Tree Protocols (STP); Configuring Catalyst Switches: Basic Commands, Port security; Virtual LANs (VLANs): VLAN Basics, Routing between VLANs, Configuring VLANs; VLAN Trunking Protocol (VTP): Modes of operation, Configuring VTP.

Wireless LAN: Basic Wireless Devices; Wireless Topologies: Independent Basic Service Set (Ad Hoc), Basic Service Set (BSS), Infrastructure Basic Service Set; Wireless Standards. Wireless Security.

Recommended Reading:

1. Behrouz A. Forouzan; Data Communication & Networking, 2nd edition; Tata Mc-Graw Hill
2. Cisco CCNA Routing And Switching ICND2 200-101 : Official Cert Guide; Cisco Press
3. Jim Geier; Wireless LANs, 2nd Edition; Sams Publishing
4. Todd Lammle ; CCNA Routing and Switching Study Guide: Exams 100-101, 200-101, and 200-120; Wiley
5. James Macfarlane; Network Routing Basics: Understanding IP Routing in Cisco Systems; Wiley
6. Thomas Albert Maufer; IP Fundamentals: What Everyone Needs to Know About Addressing and Routing ; Prentice Hall
7. Pejman Roshan , Jonathan Leary; 802.11 Wireless LAN Fundamentals; Cisco Press

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Creating a network topology and assigning IP addresses.
2. Exploring User, Privileged and Configuration Modes of Router.
3. Setting the Hostname, Descriptions, IP Address and Clock Rate to Router.
4. Configuring Router using Telnet and console ports.
5. Configure Router using Static and default routing.
6. Configure Router using RIP, OSPF and EIGRP.
7. Configure ACLs on a router for blocking a host or a network.
8. Configure Port Security on a Switch.
9. Creating and managing VLANs on a switch.
10. Using STP and VTP on a Switch.

ETC/ECE 7.4.7 INTRODUCTION TO DEVICE DRIVERS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.4.7	Introduction to Device Drivers	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An Ability to write, load and debug kernel modules.
2. An understanding of concurrency and race conditions.
3. An understanding of memory allocation for large buffers using kernel function.
4. An understanding of block device drivers.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the relation and differences between kernel and device driver.
2. Configure, compile, and install a Linux kernel/kernel module from sources.
3. Identify the possibilities of race condition and solve it by using different approaches like semaphores, mutexes.
4. Compare the differences in user memory and kernel memory.
5. Navigate and read the Linux kernel sources.
6. Experiment with the Linux kernel internal services needed by devices drivers, including memory mapping, kernel memory allocation, interrupt handling, timekeeping, and scheduling.
7. Design and implement a kernel module.
8. Modify, or design and implement a device driver.

UNIT - 1

(12 hours)

An Introduction to Device Drivers: The Role of the Device Driver, Splitting the Kernel, Classes of Devices and Modules, Security Issues, Version Numbering.

Building and Running Modules: Setting Up Your Test System, the Hello World Module, Kernel Modules versus Applications, Compiling and Loading, the Kernel Symbol Table, Preliminaries, Initialization and Shutdown, Module Parameters, Doing It in User Space.

Char Drivers: The Design of scull, Major and Minor Numbers, Some Important Data Structures, Char Device Registration, open and release, scull's Memory Usage, read and write, playing with the New Devices.

Debugging Techniques: Debugging Support in the Kernel, Debugging by Printing, Debugging by Querying, Debugging by Watching, Debugging System Faults.

UNIT - 2

(12 hours)

Concurrency and Race Conditions: Pitfalls in scull, Concurrency and Its Management, Semaphores and Mutexes, Completions, Spinlocks, Locking Traps, Alternatives to Locking.

Advanced Char Driver Operations: ioctl, Blocking I/O, poll and select, Asynchronous Notification, Seeking a Device, Access Control on a Device File.

Time, Delays, and Deferred Work: Measuring Time Lapses, Knowing the Current Time, Delaying Execution, Kernel Timers, Tasklets, Workqueues.

UNIT - 3

(12 hours)

Allocating Memory: The Real Story of kmalloc, Lookaside Caches, get_free_page and Friends, vmalloc and Friends, Per-CPU Variables, Obtaining Large Buffers.

Communicating with Hardware: I/O Ports and I/O Memory, Using I/O Ports, An I/O Port Example, Using I/O Memory.

Interrupt Handling: Preparing the Parallel Port, Installing an Interrupt Handler, Implementing a Handler, Top and Bottom Halves, Interrupt Sharing, Interrupt-Driven I/O.

UNIT - 4

(12 hours)

Data Types in the Kernel: Use of Standard C Types, Assigning an Explicit Size to Data Items, Interface-Specific Types, Other Portability Issues, Linked Lists.

Memory Mapping and DMA: Memory Management in Linux, The mmap Device Operation, Performing Direct I/O, Direct Memory Access.

Block Drivers: Registration, The Block Device Operations, Request Processing, Some Other Details.

Recommended Readings:

1. Jonathan Corbet, Alessandro Rubini, Greg Kroah-Hartman; Linux Device Drivers, 3rd Edition; O'Reilly Media
2. Daniel P. Bovet; Understanding the Linux Kernel, 3rd Edition; O'Reilly Media

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Write a simple hello world module
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2. Write a scull driver with a majority and minority numbers
3. write a program using illustrating a lock condition and use a semaphore to prevent the race condition
4. Write char driver using ioctl
5. Write a char driver with work queues
6. Write a program using kmalloc to allocate a large buffer.
7. Write a driver program to communicate with a I/O.
8. Write an interrupt handler in a char driver to service the interrupts.
9. Using mmap write a driver program to allocate memory.
10. Write a block driver program and register it.

ETC/ECE 7.4.8 VIRTUAL INSTRUMENTATION

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.4.8	Virtual Instrumentation	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to Virtual Instrumentation.
2. An understanding of the Virtual Instrumentation programming techniques.
3. An understanding of the data acquisition techniques using LABVIEW.
4. An understanding of the Applications of Virtual Instrumentation.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the concepts and principles of Virtual Instrumentation.
2. Design and simulate virtual instruments using the arrays, loops, clusters.
3. Design and simulate virtual instruments for sensors and data acquisition using LABVIEW software.
4. Explain the different applications of virtual Instrumentation.

UNIT - 1

(12 hours)

Virtual Instrumentation: Historical perspective, advantages, block diagram and Architecture of a virtual instrument, data-flow techniques, graphical programming in data flow. Comparison with conventional programming. Development of Virtual Instrument using GUI. Real-time systems, Embedded Controller, OPC, HMI/SCADA software, Active X programming.

UNIT - 2

(12 hours)

VI programming techniques: VIS and sub-VIS, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes.

Local and global variables, string and file I/O, Instrument Drivers, Publishing measurement data in web. Programming examples.

UNIT - 3

(12 hours)

Data acquisition basics: Introduction to data acquisition on PC, Sampling fundamentals, Input/Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.

VI Chassis requirements. Common Instrument Interfaces: current loop, RS232C/RS485, GPIB, Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI. Networking basics for office and Industrial applications, VISA and IVI.

UNIT - 4

(12 hours)

VI toolsets, Distributed I/O modules. Application of Virtual Instrumentation: Instrument Control, Development of process database management system. Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control.

Recommended Readings:

1. Gary Johnson; LabVIEW Graphical Programming, 2nd edition; McGraw Hill
2. Lisa k. Wells, Jeffrey Travis; LabVIEW for everyone; Prentice Hall
3. Kevin James; PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control; Newnes

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Virtual Instruments ,Sub VIS
2. Loops using LABVIEW
3. Structures using LABVIEW
4. Arrays and Clusters using LABVIEW
5. Data Acquisition using LABVIEW
6. Development of Control system using LABVIEW
7. Industrial Communication using LABVIEW
8. Image acquisition and processing using LABVIEW
9. Motion control using LABVIEW

ETC/ECE 7.4.9 WAVELETS AND MULTIRATE DIGITAL SIGNAL PROCESSING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.4.9	Wavelets and Multirate Digital Signal Processing	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. Ability to analyze signal in time and frequency domain.
2. Understanding of orthonormality, sampling rate conversion and short time Fourier transform.
3. Ability to perform multi resolution analysis using filter banks.
4. Understanding of various continuous and discrete wavelet families.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the application of orthonormal basis in signal transformations.
2. Compute short time Fourier transform of signal.
3. Design a filter bank for analyzing signal.
4. Perform multiresolution analysis of a signal using Haar Wavelet.
5. Explain Daubechies' family of wavelets in detail.
6. Identify the importance of vanishing moments in construction of wavelets.
7. Explain the Continuous wavelet transform.
8. Explain the discretization process of wavelets.

UNIT - 1

(12 hours)

Introduction to Transformations: Need for Transformations, Inner Products, Orthogonal Transforms, Orthonormality, Basis: Orthogonal and Biorthogonal, Subspace, Span.

Overview of some basic transforms: Z-Transform, Fourier series, Fourier Transform: Continuous and Discrete, Short Time Fourier Transform, Windowing Methods.

Introduction to Rate Converters: Interpolator, Decimator, Properties, Effect of Interpolation and Decimation in frequency domain.

Disadvantage of: Fourier Transform, STFT and Windowing Methods.

UNIT - 2

(12 hours)

Piecewise constant approximation - the Haar wavelet, Building up the concept of dyadic Multiresolution Analysis (MRA), Relating dyadic MRA to filter banks, Elements of multirate systems and two-band filter bank design for dyadic wavelets.

UNIT - 3

(12 hours)

Families of wavelets: Orthogonal and biorthogonal wavelets, Daubechies' family of wavelets in detail, vanishing moments and regularity. Conjugate Quadrature Filter Banks (CQF) and their design, Dyadic MRA more formally; Data compression - fingerprint compression standards, JPEG-2000 standards.

The Uncertainty Principle, and its implications: the fundamental issue in this subject - the problem and the challenge that Nature imposes. The importance of the Gaussian function: the Gabor Transform and its generalization; time, frequency and scale - their interplay.

UNIT - 4

(12 hours)

The Continuous Wavelet Transform (CWT), Condition of admissibility and its implications, Application of the CWT in wideband correlation processing, Journey from the CWT to the DWT: Discretization in steps, Discretization of scale - generalized filter bank., Discretization of translation - generalized output sampling, Discretization of time/ space (independent variable) - sampled inputs.

Recommended Readings:

1. Howard L. Resnikoff, Raymond O. Wells; Wavelet Analysis: The Scalable Structure of Information; Springer
2. Raghuvver M.Rao , Ajit S. Bapardikar; Wavelet transforms- Introduction to theory and applications; Person Education
3. P. P. Vaidyanathan; Multirate Systems and Filter Banks; Pearson Education
4. L. Prasad, S.S. Iyengar; Wavelet Analysis with Applications to Image Processing.; CRC Press
5. G. Strang, T. Nguyen; Wavelets and filter banks; Wellesley-Cambridge Press
6. K.P. Soman and K.L. Ramchandran; Insight into Wavelets from theory to practice; Prentice Hall

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Signal analysis using DFT
2. Signal analysis using STFT
3. Haar wavelet for signal analysis
4. Two-channel filter bank
5. Perfect reconstruction of signals

6. Conjugate Quadrature filter bank
7. The uncertainty principle
8. Gabor transformations
9. Discretization of wavelets from Continuous time wavelets
10. Discrete wavelet transform

ETC/ECE 7.4.10 ELECTRONIC MATERIAL SCIENCE

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.4.10	Electronic Material Science	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of semiconductor physics.
2. An ability to solve problems on semiconductor device junctions.
3. An ability to analyze and solve problems on optoelectronics devices.
4. An understanding of wafer and IC manufacturing process.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain intrinsic and extrinsic semiconductor.
2. Explain density of states and Fermi energy level of semiconductor.
3. Solve numerical on semiconductor device junctions.
4. Explain I-V characteristics of semiconductor device junctions.
5. Explain working of optoelectronics devices.
6. Solve numerical on optoelectronics devices.
7. Compare Czochralski and float zone method of ingot formation.
8. Explain steps involved in manufacturing of IC devices and semiconductor wafer.

UNIT - 1

(12 hours)

Introduction to chemical bonding and development of band gap: Introduction and types of semiconductors. Explanation of density of states, Fermi energy, and band occupancy. Problem set on bonding, density of states, and Fermi statistics. Intrinsic semiconductors, carrier concentration, mobility, temperature dependence. Problem set on intrinsic semiconductors. Extrinsic semiconductors. Dopant types and materials. Conductivity, Fermi energy position, temperature dependence. Problem set on extrinsic semiconductors.

UNIT - 2

(12 hours)

Metal-semiconductor junctions: Schottky vs. Ohmic junctions. Band gap diagrams. I-V characteristics. Problem set on metal-semiconductor junctions. p-n junctions. Equilibrium and under bias (forward and reverse). Band diagrams. I-V characteristics. Junction breakdown. Heterojunctions. Problem set on p-n junctions. Transistors-BJT, JFET,

MOSFET. Transistor action. Basics of BJT and JFET. Channel formation in MOSFET. I-V behaviour. Depletion and inversion layer calculation. Problem set on transistors.

UNIT - 3

(12 hours)

Optoelectronic materials: Introduction. LEDs, LASERs, photodetectors, solar cells. Problem set on optical properties. Problem set on optoelectronic devices.

Introduction to semiconductor manufacturing: History, overview of process flow, manufacturing goals. Scaling. Wafer manufacturing. Si ingot preparation. Poly to single crystal conversion. Czochralski vs. float zone method.

UNIT - 4

(12 hours)

IC device manufacturing overview: Thermal oxidation. Doping. Lithography. Etching and growth. Metallization and growth. Process and device evaluation. Yield monitoring and control. Devices and IC formation. IC circuit logic and packaging.

Recommended Readings:

1. S.O. Kasap; Principles of Electronic Materials and Devices, 3rd Edition; McGraw-Hill.
2. S.M. Sze; Semiconductor devices: Physics and Technology, 2nd Edition; Wiley
3. S.M. Sze; VLSI technology; 2nd Edition; McGraw-Hill Education
4. B.G. Streetman, S. Banerjee; Solid State Electronic Devices, 6th Edition; PHI
5. C. Kittel; Introduction to solid state physics, 8th Edition; Wiley
6. Peter van Zant; Microchip Fabrication, 5th Edition; McGraw-Hill
7. G.S. May, C.J. Spanos; Fundamentals of semiconductor manufacturing and process control; Wiley-IEEE press

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. V-I characteristics of metal semiconductor junctions.
2. V-I characteristics of p-n junction.
3. V-I characteristics of Heterojunctions.
4. Characteristics of BJT.
5. Characteristics of FET.
6. Characteristics of MOSFET.
7. Characterization of LED
8. Characterization of LASERs
9. Characterization of photodetectors.
10. Characterization of Solar cells.

ETC/ECE 7.4.11 MICROWAVE NETWORKS AND APPLICATIONS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.4.11	Microwave Networks and Applications	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of Microwave networks.
2. An understanding of power division in microwave components.
3. An understanding of the working of microwave integrated circuits.
4. An understanding of working of microwave antennas & microwave systems.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the working of Microwave networks.
2. Analyze the working of 3-port and 4-port microwave devices.
3. Examine the power division in microwave components.
4. Analyze the working of microwave integrated circuits, microwave antennas & microwave systems.

UNIT - 1

(12 hours)

Microwave network analysis: Impedance and equivalent voltage and currents, Impedance and admittance matrices, scattering matrix, transmission (ABCD) matrix
Microwave Resonators: Series and parallel resonant circuits, transmission line resonators.

UNIT - 2

(12 hours)

Power dividers and Directional couplers: Basic Properties, T-junction power divider, Wilkinson Power divider, Quadrature Hybrid, 180 degree hybrid.

Microwave filters: Periodic structures, filter design by image parameter method and insertion loss method, filter transformations.

UNIT - 3

(12 hours)

Ferromagnetic components: Ferrite isolators, Ferrite phase shifters, Ferrite Circulators.
Microwave Integrated Circuits: Planar transmission lines, lumped elements for MIC, substrates for MIC, Hybrid MIC, Monolithic MIC, Methods of Analysis of planar transmission lines: conformal transformation, variational approach.

Microstrip Antennas: Introduction: Basic characteristics, feeding methods, methods of Analysis, Rectangular patch, Circular Patch, Quality factor, bandwidth and efficiency, input impedance, coupling, array and feed networks.

Microwave systems: Wireless communication systems, radiometer systems, microwave heating, power transfer, biological effects and safety.

Recommended Readings:

1. D. M. Pozar; Microwave Engineering, 3rd Ed.; John Wiley & Sons Inc
2. Constantine Balanis; Antenna Theory: Analysis & Design, 2nd Edition; Wiley India.
3. Bharathi Bhat, Shibani Koul; Striplineline transmission lines for microwave integrated circuits; John Wiley and Sons.
4. K. C. Gupta, Rakesh Chadha, Ramesh Garg; Computer aided design of Microwave circuits; Artech House Publishers.
5. Prakash Bhartiya, K. C. Gupta, Ramesh Garg, Inder Bahl; Microstrip lines and slot lines; Artech House Publishers
6. K. C. Gupta, Amarjit Singh; Microwave integrated circuits; Wiley

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Study of Microwave Components
2. Characteristics of Reflex Klystron
3. Study of E-plane waveguide
4. Study of H-plane waveguide
5. Study of Magic Tee waveguide
6. Study of Isolator and circulator
7. Design of Wilkinson power divider using IE3D
8. Design of 90° Hybrid coupler using IE3D
9. Design of 180° Hybrid coupler using IE3D
10. Design of step impedance Low Pass filter

ETC/ECE 7.4.12 DISTRIBUTED OPERATING SYSTEMS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.4.12	Distributed Operating Systems	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to distributed operating systems fundamentals.
2. An understanding of synchronization and process/processors in distributed operating systems.
3. An understanding file systems used in distributed operating systems.
4. An introduction to practical distributed operating systems through case studies.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the features and fundamental concepts of distributed operating systems.
2. Explain inter distributed OS communication protocols and models.
3. Explain synchronization approaches and its issues in distributed OS.
4. Explain threads and scheduling in distributed OS.
5. Design and implement distributed file systems.
6. Implement distributed operating systems on physical machines.

UNIT - 1

(12 hours)

Introduction to distributed operating systems: What is a distributed operating system? Goals, Hardware Concepts, Software Concepts, Design Issues, Communication in distributed systems.

Layered Protocols, Asynchronous Transfer Mode Networks, the Client-Server Model, Remote Procedure Call, Group Communication.

UNIT - 2

(12 hours)

Synchronization in Distributed Systems: Clock Synchronization, Mutual Exclusion, Election Algorithms, Atomic Transactions, Deadlocks in Distributed Systems.

Processes and Processors in Distributed Systems: Threads, System Models.

UNIT - 3

(12 hours)

Processes and Processors in Distributed Systems (contd.): Processor Allocation, Scheduling in Distributed Systems.

Distributed File Systems: Distributed File System Design, Distributed File System Implementation, Trends in Distributed File Systems.

UNIT - 4

(12 hours)

Case Study of Distributed Systems:

Case study 1: AMOEBA

Introduction, Objects and capabilities, Process management, Memory management, Communication, Amoeba Servers.

Case study 2: Distributed Computing Environment

Introduction, Threads, RPC, Time Service, Directory Service, Security Service.

Recommended Readings:

1. A.S. Tanenbaum; Distributed Operating Systems; Pearson Education
2. G. Coulouris, J. Dollimore, T. King Berg; Distributed Systems: Concepts and Design; Addison Wesley
3. M. Singhal, N. G. Shivaratri; Advanced Concepts in Operating Systems ; TMH

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Installation and commissioning of a distributed operation system
2. Study of inter DOS communication strategies
3. Study of synchronization algorithms
4. Implementation of simple program utilizing threads on DOS
5. Study of Scheduling schemes in DOS
6. Implementation of distributed file system in DOS
7. Implementation of Distributed Computing Environment
8. Study of remote procedure calls in DOS
9. Study of Time Service ,Directory Service and Security Service

ETC 7.4.13 INTRODUCTION TO JAVA

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					Total
						Th	S	TW	O	P	
ETC 7.4.13	Introduction to Java	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of the basic features of Java language like Data Types, Operators, Control Statements and Classes.
2. The ability to implement the object oriented programming features e.g., different types of inheritance, using Java.
3. An ability to apply Java programming paradigms like exception handling and multi-threaded programming.
4. A basic understanding of String Object and ways to handle strings using methods of String Class.
5. An introduction to Java's Event Handling Mechanism.

Course Outcomes:

The student after undergoing this course will be able to:

1. Write programs using basic features of Java like operators, control statements and arrays.
2. Demonstrate the use of Classes, Object, packages and Interfaces using Java
3. Illustrate the use of exception handling for run-time error management using Java.
4. Employ multithreading in a java program for maximum utilization of the CPU by minimizing idle time.
5. Instantiate a String Object and perform different String operations.
6. Exhibit the use of the Collections framework for management of groups of objects.
7. Discuss the concept of event handling and apply concept of Inner Classes to streamline the event handling code.

UNIT - 1

(12 hours)

Introduction to JAVA: Java and Java applications; Java Development Kit (JDK) Byte Code, JVM; Object-oriented programming; Simple Java programs. Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers. Operators and Expressions: Arithmetic

Operators, Bitwise operators, Relational operators, The Assignment Operator, The ? Operator; Operator Precedence; Logical expression; Typecasting; Strings.

Control Statements: Selection statements, iteration statements, Jump Statements.

Classes, Inheritance, Exceptions, Applets:

Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes.

Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading. Exception handling: Exception handling in Java.

The Applet Class: Two types of Applets; Applet basics; Applet Architecture; An Applet skeleton; Simple Applet display methods; Requesting repainting; Using the Status Window; The HTML APPLET tag; Passing parameters to Applets; getDocumentbase() and getCodebase(); ApletContext and showDocument(); The AudioClip Interface; The AppletStub Interface; Output to the Console.

UNIT - 2

(12 hours)

Multi-Threaded Programming, Event Handling: Multi-Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read-write problem, producer-consumer problems.

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.

Swings: Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; JLabel and ImageIcon; JTextField;The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable.

UNIT - 3

(12 hours)

JAVA 2 Enterprise Edition Overview, Database Access: Overview of J2EE and J2SE. The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.

Servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The javax.servlet Package; Reading Servlet Parameter; The javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking.

UNIT - 4

(12 hours)

JSP, RMI: Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects.

Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side.

Enterprise Java Beans: Enterprise java Beans; Deployment Descriptors; Session Java Bean, Entity Java Bean; Message-Driven Bean; The JAR File.

Recommended Readings:

1. Herbert Schildt; Java - The Complete Reference, 7th Edition; Tata McGraw Hill
2. Jim Keogh; J2EE - The Complete Reference; Tata McGraw Hill
3. Y. Daniel Liang; Introduction to JAVA Programming, 6th Edition; Pearson Education
4. Stephanie Bodoff et al; The J2EE Tutorial, 2nd Edition; Pearson Education

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Introduction to Eclipse
2. Programming Flow Control using Java
3. Classes and methods
4. Inheritance
5. Packages and Interfaces
6. Exception Handling
7. Multithreading
8. Interthread Communication
9. String Handling
10. Event Handling

ETC/ECE 7.5.1 ANALOG VLSI

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.1	Analog VLSI	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An ability to analyze MOSFET based Single Stage Amplifiers and Differential Amplifiers.
2. An understanding of Frequency Response of Amplifiers and Noise Considerations.
3. An understanding of Feedback in Analog Circuits.
4. An understanding of MOSFET based Current Mirrors, OPAMPS, Oscillator and PLL.

Course Outcomes:

The student after undergoing this course will be able to:

1. Obtain the Small Signal Equivalent circuit of Single Stage Amplifiers and Determine the Gain, input impedance and output impedance.
2. Analyze the Differential Amplifiers and derive the differential gain.
3. Explain the Frequency response of Amplifiers.
4. Represent Noise in circuit, obtain Noise Figure and explain its effect on performance.
5. Explain Feedback in circuits and the Various Topologies.
6. Analyze the Current Mirror circuit and obtain its small signal equivalent.
7. Design of Single Stage OPAMP circuit.
8. Explain the working of Oscillators and PLL.

UNIT - 1

(12 hours)

Single-Stage amplifiers: Basic concepts, Common-Source Stage, Source Follower, Common- Gate Stage, Cascode Stage, Choice of device models.

Differential amplifiers: Single –ended & differential operations, basic differential pair, Common mode response, Differential pair with MOS loads, Gilbert cell.

UNIT - 2

(12 hours)

Passive & Active Current Mirrors: Basic current mirrors, Cascode Current mirrors, Active current mirrors.

Frequency Response of Amplifiers: General Considerations, Common Source Stage, Source Followers, Common-gate Stage, Cascode Stage, Differential Pair.

Noise: Statistical Characteristics of noise, Types of noise, Representation of noise in circuits, Noise in single stage amplifiers, Noise in differential pairs, Noise Bandwidth.

UNIT - 3

(12 hours)

Feedback: General Considerations, Feedback topologies, Effect of loading, Effect of feedback on Noise.

Operational amplifiers: General considerations, One stage op amps, Two stage op-amps, Gain boosting, comparison, Common mode feedback, Input range limitations, slew rate, Power supply rejection, Noise in op-amps.

UNIT - 4

(12 hours)

Oscillators: General considerations, Ring oscillators, LC oscillators, Voltage controlled oscillators.

Phase locked loops: Simple PLL, Charge-pump PLL's, Nonlinear effects in PLL, Delay locked loops, Applications.

Recommended Readings:

1. Behzad Razavi; Design of Analog CMOS Integrated Circuits; Tata Mc-Graw Hill.
2. R. Jacob Baker, Harry W. Li, David E. Boyce; CMOS Circuit Design, Layout, and Simulation, 3rd Ed.; Wiley-Blackwell
3. Paul R. Gray and Robert G.Meyer; Analysis and Design of Analog Integrated Circuits; John Wiley & Sons.
4. Mohammed Ismail, Terri Fiez; Analog VLSI signal and Information Processing; McGraw-Hill International

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Design of Common Source Amplifier using SPICE.
2. SPICE program for Differential Amplifier.
3. SPICE program for Cascode Amplifier.
4. SPICE program for Gilbert Cell.
5. SPICE program to plot the Frequency response of Amplifier.
6. SPICE program for Cascode Current Mirror.
7. Design of single stage OPAMP using SPICE.
8. SPICE program for dual Stage OPAMP.
9. SPICE program for LC Oscillator.
10. SPICE program for Ring Oscillator.
11. SPICE program for VCO.
12. SPICE program to illustrate the working of PLL.

ETC/ECE 7.5.2 ADAPTIVE SIGNAL PROCESSING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.2	Adaptive Signal Processing	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of statistical characterization of random variables and processes.
2. An introduction to the modeling of random processes.
3. The ability to derive Wiener-Hopf Equations for application in Wiener filtering problems.
4. The knowledge of different nonparametric models of spectral estimation.
5. An understanding of FIR adaptive filters based on the method of steepest descent and their applications.

Course Outcomes:

The student after undergoing this course will be able to:

1. Characterize random variables and processes using their ensemble averages and/or joint moments.
2. Describe different methods of modeling random processes.
3. Derive the Wiener-Hopf equations for application in filtering problems.
4. Compare different methods for estimating the power spectrum of wide sense stationary random processes.
5. Develop FIR adaptive filters based on the method of steepest descent and compare their performance.

UNIT - 1

(12 hours)

Random Variables: Definitions, Ensemble Averages, Jointly Distributed Random Variables, Joint Moments, Independent, Uncorrelated and Orthogonal Random Variables, Linear Mean Square Estimation, Parameter Estimation: Bias and Consistency

Random Processes: Definitions, Ensemble Averages, Stationary Processes, the Autocovariance and Autocorrelation Matrices, Ergodicity, White Noise, The Power Spectrum.

UNIT - 2

(12 hours)

Filtering Random Processes, Spectral factorization, Special Types of Random Processes: ARMA processes, AR processes, MA processes.

Stochastic Signal Modelling: ARMA models, AR and MA models, Applications in Power Spectrum Estimation.

UNIT - 3

(12 hours)

Wiener Filtering: Introduction, the FIR Wiener filter, Filtering, Linear Prediction, Noise Cancellation.

Spectrum Estimation: Nonparametric models – The Periodogram, Performance of the Periodogram, The Modified Periodogram, Periodogram Averaging (Bartlett's Method).

UNIT - 4

(12 hours)

Adaptive Filtering: FIR Adaptive Filters – The Steepest Descent Adaptive Filter, The LMS Algorithm and its convergence, Normalized LMS, Application: Noise Cancellation, Channel Equalization.

Recommended Readings:

1. Monson H. Hayes; Statistical Digital Signal Processing and Modeling; Wiley India
2. Simon Haykin; Adaptive Filter Theory; Prentice Hall
3. Dimitris Manolakis, Vinay Ingle, Stephen Kogon; Statistical and Adaptive Signal Processing; Artech House
4. B. Widrow; S. Stearns; Adaptive Signal Processing; Prentice Hall

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Bias and consistency of a random variable using MATLAB
2. Generation of random processes
3. Autocorrelation of a random process using MATLAB
4. Estimate the power spectrum of a random process using MATLAB
5. ARMA model for a random process using Modified Yule-Walker Equations using MATLAB
6. Estimate the power spectrum of a random process produced by filtering white Gaussian noise and compare it to the true value of power spectrum using MATLAB
7. MATLAB program to design a Wiener Filter to estimate a random process in presence of zero mean uncorrelated white noise.
8. MATLAB program to perform adaptive linear prediction using the LMS algorithm

ETC/ECE 7.5.3 NUMERICAL METHODS AND APPROXIMATION

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.3	Numerical Methods and Approximation	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of sources of errors and problems in computation for very large data set.
2. An understanding of different numerical methods used for the solution of engineering problems.
3. An ability to develop algorithm for the numerical methods.
4. An ability to implement a particular method for a realistic engineering problem.

Course Outcomes:

The student after undergoing this course will be able to:

1. Solve non-linear equations, simultaneous linear algebraic equations, eigenvalue problems, using numerical methods.
2. Apply curve fitting to experimental data.
3. Calculate a definite integral using appropriate numerical method.
4. Evaluate a derivative at a value using appropriate numerical method.
5. Solve a differential equation using an appropriate numerical method.
6. Use C or other software tools to compute the solutions of engineering problems using appropriate numerical methods.

UNIT - 1

(12 hours)

Introduction, Approximation and errors of computation: Approximation and errors in computation, Taylor's series, Newton's finite differences (forward, backward, central and divided differences) Difference, shift, differential operators, Uses and importance of computer programming in numerical methods.

Solutions of nonlinear Equations: Bisection method, Newton Raphson method, Regula Falsi method, Secant method, fixed point iteration method, Rate of convergence and comparisons of these methods.

UNIT - 2

(12 hours)

Solution of system of linear algebraic equations: Gauss elimination method with pivoting strategies, Gauss Jordan method, LU Factorization.

Iterative methods (Jacobi, Gauss Seidal method), Eigen value and Eigen vector using Power method.

Interpolation: Newton's Interpolation(forward, backward), Central difference interpolation: Stirling's Formula, Bessel's formula, Lagrange's interpolation, Least square method of fitting linear and non-linear curve for discrete data and continuous function, Spline interpolation(cubic spline).

C programs for all above methods.

UNIT - 3

(12 hours)

Numerical Differentiation and Integration: Numerical differentiation formulae, Newton-Cote general Quadrature formula, Trapezoidal, Simpson's 1/3, 3/8 rule, Romberg integration, Gaussian integration (Gaussian- Legendre Formula 2 point and 3 point).

Solution of ordinary differential equations: Euler's and modified Euler's method, Runge Kutta methods for 1st and 2nd order ordinary differential equations, solution of boundary value problem by finite difference method and shooting method.

C programs for all above methods.

UNIT - 4

(12 hours)

Numerical solution of partial differential equation: Classification of partial differential equation (Elliptic, parabolic and Hyperbolic), Solution of Laplace equation (standard five point formula with iterative method), Solution of Poisson equation (finite difference approximation), Solution of Elliptic equation by Relaxation method, Solution of one dimensional Heat equation by Schmidt method. C programs for the methods.

Recommended Readings:

1. E. Balaguruswamy; Numerical Methods; TMH.
2. Dr. B. S. Grewal; Numerical methods in Engineering & Science, 7th Edition; Khanna Publication
3. V. Rajaraman; Computer Oriented Numerical methods; PHI
4. S. S. Sastry; Introduction methods of numerical analysis; PHI
5. Robert J. Schilling, Sandra I. Harries; Applied Numerical Methods for Engineers using MATLAB and C, 3rd Edition; Thomson Brooks
6. John H. Mathews, Kurtis Fink; Numerical Methods Using MATLAB, 3rd Edition; Prentice Hall publication

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Generate difference table
2. Bisection method, Newton Raphson method, Secant method
3. Gauss elimination, Gauss Jordan method
4. Finding largest Eigen value and corresponding vector by Power method
5. Lagrange's interpolation

6. Curve fitting by least square method
7. Differentiation by Newton's finite difference method
8. Integration using Simpson's 3/8 rule
9. Solution of 1st order differential equation using RK-4 method
10. Partial differential equation(Laplace equation)

ETC/ECE 7.5.4 ADVANCED CONTROL SYSTEMS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.4	Advanced Control Systems	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to digital control system.
2. An ability to perform analysis and design using state space model.
3. An understanding of nonlinear control problems.

Course Outcomes:

The student after undergoing this course will be able to:

1. Design controllers for plants using the state variable model based approach.
2. Analyze control systems using state variable methods.
3. Evaluate z domain representation of digital control systems.
4. Explain the concepts of nonlinear control and stability criteria.

UNIT - 1

(12 hours)

Digital Control Systems: Industrial and embedded control, digital computer as compensator, basic computer-control scheme, signal conversion principles, digital implementation of analog compensators, formulation of direct digital control design problem, z-transform, closed loop sampled data systems, s-plane to z-plane mapping, transform design of digital controls.

UNIT - 2

(12 hours)

Control system analysis using state variable methods: Introduction, matrices, state variable representation, conversion of state variable models to transfer functions, conversion of transfer functions to canonical state variable models, solution of state equations, concepts of controllability and observability, equivalence between transfer function and state variable representations.

UNIT - 3

(12 hours)

Control system design using state variable methods: State variable feedback structure, pole-placement design using state feedback, state feedback with integral control, critique

of pole-placement state feedback control, observer based state feedback control, digital control design using state feedback, optimal control problem.

UNIT - 4

(12 hours)

Nonlinear control system: Introduction, common nonlinear system behaviors, nonlinearities in control systems, describing function fundamentals, functions of common nonlinearities, stability analysis by describing function method, concept of phase plane analysis, construction of phase portraits, system analysis of phase plane, Lyapunov Stability.

Recommended Readings:

1. M. Gopal; Control Systems-Principles and Design, 3rd Ed.; Tata Mc Graw Hill
2. K. Ogata; Modern Control Engineering; PHI
3. Norman S. Nise; Control Systems Engineering, 6th Edition; Wiley & Sons

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Study of z-transform in Matlab/Scilab
2. Z-transform transfer function representation and inter conversion from s to z plane in Matlab/Scilab
3. State variable representation in Matlab/Scilab
4. Conversion of state variable models to transfer functions and vice versa in Matlab/Scilab
5. State variable model controller design using Matlab/Scilab
6. Non-linear control system in Matlab/Scilab
7. Digital PI, PD, PID controller implementation in Matlab/Scilab
8. State variable representation of PI, PD and PID controller in Matlab/Scilab

ETC/ECE 7.5.5 INTRODUCTION TO MEMS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.5	Introduction to MEMS	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An overview of Microsystems and their applications in various branches of Engineering medical science and basic sciences.
2. An understanding of the principles and applications of the Microsystems and Microactuators.
3. An understanding of the different materials used in the MEMS technology.
4. An ability to analyze the various techniques and parameters used in the microsystem fabrication.
5. An understanding of the microsystem packaging techniques.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the applications of MEMS in various branches of Engineering medical science and basic sciences.
2. Explain the principles and operation of the different microsensors and microactuators.
3. Analyze the various techniques and parameters in the microsystem fabrication.
4. Explain the microsystem packaging techniques.

UNIT - 1

(12 hours)

Basic device technology: depletion region and diffusion capacitance, junction breakdown, breakdown voltage enhancement in pn junction. Thermal properties and second breakdown phenomenon, calculation of reverse leakage current. IC technology: Lithography, diffusion, ion implantation, oxidation and epitaxial growth.

MEMS and Microsystems: Applications, Multidisciplinary nature of MEMS. The effects of miniaturization and scaling.

UNIT - 2

(12 hours)

Working principles of Microsystems: Micro sensors -Biomedical sensors and biosensors, Optical sensors, pressure sensors.

Microactuation: Actuation using piezoelectric crystals, Actuation using Electrostatic forces, (Parallel plate, Comb drive actuators) MEMS with Micro actuators: Micro grippers, micro motors, micro valves, micro pumps, micro accelerometers, Microfluidics.

UNIT - 3

(12 hours)

Materials for MEMS: Substrates and wafers, silicon as substrate material, Single crystal silicon and wafers, crystal structure, The Miller Indices, Mechanical properties of Silicon, Silicon Compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz, polymers for MEMS, Packaging materials. Microsystem fabrication – Environment for Microfabrication, Photolithography, Ion implantation, Diffusion, Oxidation, Chemical vapour deposition, Sputtering, Epitaxy, Etching.

UNIT - 4

(12 hours)

Overview of Micro manufacturing: Bulk micro manufacturing, Surface micro machining Microsystems Design - Design considerations – Selection of signal transduction ,Process design, Design of a silicon die for a micro pressure sensor, Microsystem packaging, The three levels of micro system packaging ,interfaces in micro system packaging, Signal mapping and transduction RF MEMS and optical MEMS components.

Recommended Readings:

1. Tai-Ran Hsu; MEMS and Microsystems, Design and Manufacture; TMH
2. Mark Madou; Fundamentals of Micro fabrication; CRC Press
3. Julian W Gardner; Microsensors: Principles and Applications; John Wiley & Sons
4. Sze S. M.; Semiconductor Sensors; McGraw-Hill
5. Nadim Maluf; An Introduction to Micro Electro Mechanical System Design; Artech House
6. Chang Liu; Foundations of MEMS; Pearson Education Inc.
7. M. H. Bao; Micro Mechanical Transducers, Volume 8, Handbook of Sensors and Actuators; Elsevier
8. Chang C. Y., Sze S. M.; VLSI Technology; McGraw

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Microsensors
2. Microactuators
3. Materials for MEMS
4. The Miller Indices
5. Microsystem fabrication
6. Micro manufacturing

7. Microsystem Design
8. Microsystem packaging

ETC/ECE 7.5.6 PROCESS CONTROL INSTRUMENTATION

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.6	Process Control Instrumentation	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of various Industrial Process Control Mechanisms.
2. Theoretical and practical training in the operation and maintenance of automated process control.
3. An understanding of various devices to measure physical processes in Industries.
4. An overview of Industrial Controller modes.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain Process Control Instruments used in Industry.
2. Evaluate appropriate sensor for given application.
3. Design at block system level a complete instrumentation system for a given application.
4. Evaluate Actuators and other control elements for an instrumentation system.
5. Evaluate controllers on different performance metrics.
6. Design Ladder Programming logic for controlling different processes in industries.

UNIT - 1

(12 hours)

Introduction to Process Control: Introduction; control systems; process control block diagram; servomechanisms; control system evaluation; on off control; analog and digital control; process characteristics.

Sensors: Sensor time response. Overview of Thermal sensors: RTD, thermistors, thermocouples. Overview of Mechanical sensors: Strain, motion, pressure, and flow. Optical sensors: Photodetectors, pyrometers, applications: design consideration of all sensors.

UNIT - 2

(12 hours)

Analog and digital signal conditioning; Analog signal conditioning: Linearization, Conversion, SCR and TRIAC. Final Control: Introduction; final control operation; Signal conversion.

Actuators: Electrical, pneumatic, and hydraulic; Control elements: mechanical; electrical; Fluid valves; Control valve type; Control valve sizing; Process instrumentation.

Discrete state process control: Introduction; definition; characteristics of the system; relay controllers.

UNIT - 3

(12 hours)

Controller Principles: Introduction; overview of control system parameters; continuous controller modes: proportional, integral, derivative control modes; composite control modes: PI, PD, PID; Telemetry: pneumatic telemetering system; electronic telemetry system; electrical electronic telemetering system.

Analog /digital controllers: Introduction; electronic, pneumatic, digital controller; design considerations.

UNIT - 4

(12 hours)

Computer in process control: Data logging; supervisory control; computer-based controller; digital controller for a turbine and generator. Introduction to process loops; simple control schemes for level, flow, temperature as applied to reactor, heat exchanger. Overview of signal recorders: chart recorder, fiber optic recorder, magnetic recorder, UV Recorder, printing processes: Risograph, laser printers; Process control networks: Modbus communication RS485/RS422.

Applications of PLC to process control: Traffic generation, water-bottle plant; Microprocessor/microcontroller application in process instrumentation: Microprocessor/microcontroller control of a petrol engine, microprocessor/microcontroller based data logger; process loop tuning.

Recommended Readings:

1. Curtis D. Johnson; Process Control Instrumentation Technology, 7th Edition; Pearson Education
2. Alan S. Morris; Principles of Measurement and Instrumentation, 3rd Ed.; Butterworth-Heinemann
3. C. Rangan, G. Sarma, V. Mani; Instrumentation Devices and Systems, TMH
4. S. K. Singh; Industrial Instrumentation and control; TMH
5. Donald P. Eckman; Automatic process control; Wiley
6. B. C. Kuo; Digital control systems; Oxford University Press

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Study of Temperature Transducers.
2. Study of Optical Transducers.
3. Pneumatic Actuator.
4. SCR Characteristics.
5. Nozzle Flapper System.

6. PID Controller using MATLAB SIMULINK.
7. Feedforward and Feedback PID Controller.
8. Demonstration of Water Bottling Plant using PLC.
9. Water Level Indicator using PLC.
10. Motor Speed Control using PLC.
11. Conveyor Belt using PLC.
12. Traffic Light Control using PLC.

ETC/ECE 7.5.7 SECURE COMMUNICATIONS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.7	Secure Communications	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to communications security and encryption.
2. An ability to apply appropriate encryption algorithm to a problem.
3. An introduction to firewall designs and IP security.
4. An introduction to authentication protocols.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the different aspects of security in communication.
2. Explain classical encryption and block cipher algorithms.
3. Choose appropriate encryption algorithm for a given application.
4. Explain authentication functions, protocols and applications.
5. Explain firewall design principles and IP security.

UNIT - 1

(12 hours)

Introduction of Secure Network: Key points (service, mechanisms and attacks), OSI security architecture, Security attacks, security services, security mechanisms, a model for network.

Classical encryption techniques: Symmetric cipher model substitution techniques, Transposition techniques, rotor machines, steganography and numerical on different ciphers.

Block Ciphers and DES (Data Encryption Standards): Block cipher principles, Data encryption standards, strength of DES, Block cipher design principles, Block cipher modes of operation, problems on DES.

UNIT - 2

(12 hours)

Public-Key Cryptography and RSA: Principles of public-key cryptosystems, RSA algorithm and numerical on RSA.

Key Management; Other Public Key Crypto Systems: Key management, Diffie-Hellman key exchange, ECC Diffie-Hellman key exchange algorithm, numericals.

Message Authentication and Hash Functions: Authentication requirements, Authentication functions. Message authentication codes, Requirements of Hash functions, Security of hash functions & MACs.

UNIT - 3

(12 hours)

Digital Signature and Authentication Protocol: Digital signature, Authentication protocols, Digital signature standard.

Authentication Applications: Kerberos: Kerberos Version 4, Kerberos Version 5. X.509 authentication service:-Certificates, Authentication Procedures, X.509 Version 3

Firewalls: Firewall Design Principles.

UNIT - 4

(12 hours)

Electronic Mail Security: Pretty good privacy, S/MIME.

IP Security: Overview, IP security architecture, Authentication header, ESP (encapsulating security pay load), Key management.

Recommended Readings:

1. William Stallings; Cryptography and Network Security, 4th Edition; Prentice Hall of India
2. C. Kaufman, R. Perlman, M. Speciner; Network Security: Private Communication in a Public World, 2nd Edition; Pearson Education (Asia) Pvt. Ltd

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Implementation of classical encryption techniques
 - a. Substitution cipher
 - b. Transposition cipher
 - c. Steganography
2. Implementation of DES block cipher
3. Implementation of RSA algorithm
4. Implementation of Hash functions
5. Study of Kerberos authentication application
6. Configuration of a firewall
7. Implementation of PGP protocol
8. Case study : Tor and VPN

ETC/ECE 7.5.8 INTRODCUTION TO ARM ARCHITECTURE

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.8	Introduction to Arm Architecture	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. The ability to understand the architecture and assembly instructions of ARM7TDMI processor and its internal functioning.
2. An in-depth understanding about instruction set and assembly level programming in ARM and THUMB State.
3. An understanding of how coprocessors are interfaced with ARM core and the VFP coprocessor implementation in particular.
4. An understanding of the details of AMBA bus, caches and Memory Management.

Course Outcomes:

The student after undergoing this course will be able to:

1. Describe the architecture of ARM7TDMI processor.
2. Write embedded software using ARM7TDMI assembly instructions.
3. Design embedded systems with ARM7 architecture.
4. Design embedded systems with Vector floating point processors and their interface with ARM.
5. Apply AMBA bus architecture, various HW peripherals in SoCs in embedded system designs.

UNIT - 1

(12 hours)

ARM architecture and Processor fundamentals: Types of computer Architectures, ISA's and ARM History, RISC and ARM Design, architectural inheritance, ARM Programmer's model, memory system, memory formats and data types, ARM core data flow model, Processor modes, registers: General purpose and Program status, flags, Overview of Endianness, unaligned access support.

Pipelines: ARM 3 and 5 stage Pipeline, hazards, efficiency, ARM family attribute comparison. Exceptions, interrupts and vector table, Core extensions, Jazelle extension ARM Development tools.

ARM7TDMI S block, core and functional diagrams, memory interface, bus Interface signals and bus cycle types.

UNIT - 2

(12 hours)

ARM7TDMI assembly instructions and modes: Conditional execution, addressing modes: data processing operands, memory access operands, Load and store operands, Stack operations, Shift Operations.

ARM Instruction set: Branch, data processing, comparison, SIMD, Multiply, miscellaneous data processing, status register transfer, load store, coprocessor, exception-generating instructions. Elementary assembly level programs.

Thumb state: Thumb Programmers model, Thumb exceptions, Implementation and applications. Thumb Instruction set in brief.

UNIT - 3

(12 hours)

Exception handling: ARM processor exceptions and modes, vector table, exception priorities, link offset registers. Interrupt handling: Assigning interrupts, interrupt latency, IRQ and FIQ exceptions, basic interrupt stack design, Interrupt handling schemes: non-nested, nested, reentrant and prioritized simple interrupt handler.

ARM7TDMI Exception and abort model, instructions to improve exception handling.

Caches: Memory hierarchy and cache memory, caches and memory management units, basic architecture of cache memory, set associativity. Relationship between cache and main memory, Cache policy.

UNIT - 4

(12 hours)

ARM Coprocessor Interface: Coprocessor availability, interface signals, handshaking, connecting coprocessors.

Vector Floating Point Processor (VFP) architecture: Overview, floating point model, registers, floating-point exceptions, compliance with IEEE 754 standard, VFP and ARM interactions.

Advanced Microcontroller Bus Architecture (AMBA): Overview, Typical AMBA Based Microcontroller, AHB bus features, components, bus interconnection, AHB Bus transfers, APB bus transfers, APB Bridge.

Recommended Readings:

1. ARM Architecture Reference Manual
2. Andrew N. Sloss, Dominic Symes, Chris Wright; ARM System Developers Guide, Designing and Optimizing System Software; Elsevier
3. Steve Furber; ARM System-on-Chip Architecture, 2nd Edition; Pearson
4. ARM7TDMI-S Technical Reference Manual, ARM Inc.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Writing programs using Data Transfer and arithmetic
2. Writing programs using logical and branch instructions
3. Writing Subroutines and passing parameters to subroutines
4. Developing Counters and Time Delay Routines
5. Developing programs for Code Conversion
6. Developing programs for BCD Arithmetic
7. Developing programs for 16-Bit Data Operations
8. Interfacing of I/O devices: LEDs and toggle-switches
9. Interfacing Stepper Motor
10. Interfacing ADC and DAC chips
11. Interfacing LCD
12. Programming PWM Module
13. Programming RTC Module
14. Programming I2C/ SPI Interface

ETC/ECE 7.5.9 ELECTRONIC CIRCUITS: DESIGN, SIMULATION AND TESTING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.9	Electronic Circuits: Design, Simulation and Testing	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of overall design process of electronic systems.
2. An introduction to device data sheets and associated application notes.
3. An introduction to simulation of electronic circuits using available circuit simulation tools.
4. An understanding of how to design PCB layout of a given circuit using layout design tools.

Course Outcomes:

The student after undergoing this course will be able to:

1. Design an electronic system following the data sheet information for basic electronic components.
2. Simulate electronic circuits using software tools.
3. Design, develop and fabricate layout of PCB using PCB layout design tools.
4. Develop, evaluate, and implement total design process and develop prototypes which require little or no debugging.
5. Explain industrial design and product design methodologies.

UNIT - 1

(12 hours)

Concept of Electronics Circuit Design: Functional Sections, Components and Devices, Ratings, Specifications, Design equations and selection criterion.

Approaches to analysis; Introduction to modelling of devices, components and circuits.

Computation of characteristics of simple devices (p-n junction, MOS capacitor, MOSFET, etc.)

UNIT - 2

(12 hours)

Simulation of Electronic Circuits: Role of simulation, various circuit elements and their representation.

Introduction to circuit simulator: SPICE, Simulation exercises; design of circuits and performance evaluation using simulation packages.

Introduction to schematic, Layout and Routing (OrCad/Eagle etc.).

Noise in electronic systems: Design of low noise circuits.

UNIT - 3

(12 hours)

Design considerations and guidelines for automatic insertion of components.

Electronic Product design: launch process, design management and design process.

Design guidelines for dual in line package components. Surface mounting technology of electronic components.

UNIT - 4

(12 hours)

Introduction to industrial design: product design methodology product planning and development data collection Marketing and management theory.

Recommended Readings:

1. Nihal Kularatna; Electronic Circuit Design: From Concept To Implementation; CRC Press
2. W. Bosshart; Printed Circuit Boards - Design & Technology, 1st Edition; Tata McGraw Hill
3. Richard Stillwell; Electronic product design for automated; Marcel Dekker Inc.
4. T.R. Banga, S.C. Sharma; Industrial Organization and Engineering Economics; Khanna Publishers
5. H. W. Ott; Noise Reduction Techniques in Electronic Systems; Wiley
6. Flurschiem C. H.; Industrial Design in Engineering; Springer Verlag
7. G. L. Ginsberg; Printed Circuit Design; McGraw Hill
8. L. O. Chua and P. M. Lin; Computer aided analysis and electronic circuits; Prentice Hall
9. S. Selberherr; Analysis and Simulation of Semiconductor Devices; Springer-Verlag
10. Richard Spencer, Mohammed Ghausi; Introduction to Electronic Circuit Design; Prentice Hall

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Assemble electronic circuit using circuit simulation software.
2. Simulate and test the RC, LC and RLC based electronic circuit using circuit simulation software and perform transient analysis.
3. Simulate and test a diode, transistor or MOSFET based electronic circuit using circuit simulation software.
4. Find the frequency response of RC, diode or transistor based electronic circuit using simulation software.
5. Design of low noise circuits using circuit simulator.
6. Design a PCB layout of an Electronic circuit using software.
7. Place route and generate the layout of given circuit using manual or auto routing using PCB layout design.
8. Fabricate and test a simple circuit on PCB.

ETC/ECE 7.5.10 ARTIFICIAL NEURAL NETWORK

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.10	Artificial Neural Network	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to important neural processing paradigms, and learning rules.
2. An introduction to foundations of trainable decision making networks for classification of linearly separable and linearly non-separable classes of patterns.
3. An understanding of different artificial neural networks that use Unsupervised Learning algorithms to extract features from available data.
4. The basic knowledge of associative models of artificial neural networks.

Course Outcomes:

The student after undergoing this course will be able to:

1. Describe the correspondence between a biological and artificial neuron.
2. Realize logic gates using McCulloch-Pitts model of Artificial Neural Networks
3. Distinguish between linear separable and non-separable pattern Classification
4. Compare different supervised and unsupervised learning rules.
5. Design single and multilayer perceptron networks for simple applications.
6. Design associative neural networks for simple applications.

UNIT - 1

(12 hours)

Introduction: Introduction to neural networks, structure of biological neuron, Mc-Culloch Pitts neuron model.

Logic network realization by using Mc-Culloch Pitts neuron model, Neuron modelling for artificial neuron systems, Neural learning.

Single layer network: Concept of linear separability and non-linear separability, training algorithms-

Hebbian learning rule, perceptron learning rule, Delta learning rule, Widrow-Hoff learning rule, co-relation learning rules, winner take all and outstar learning rules, and related problems.

Discriminant functions, Minimum distance classification, Single layer Discrete Perceptron, Single layer Continuous Perceptron, ADALINE. Multicatagory single layer perceptron.

UNIT - 2

(12 hours)

Multilayer network I: Error back propagation algorithm or generalized delta rule.

Setting of parameter values and design considerations (Initialization of weights, Frequency of weight updates, Choice of learning rate, Momentum, Generalizability, Network size, Sample size, Non-numeric inputs).

Pocket algorithm, quick prop algorithm, performance evaluation.

Multilayer network II: Adaptive multilayer network, network pruning algorithm.

Marchands algorithm, neural tree, tiling algorithm & problems related to adaptive multiplayer network.

Prediction network, radial basis function and its applications, polynomial network.

UNIT - 3

(12 hours)

Winner-Take-All network, Hamming Distance classifier, MAXNET.

Clustering, simple competitive learning algorithm, LQV algorithm.

Adaptive resonance theory.

Topologically organized network: SOM, SOFM, Kohonen's algorithms, Distance based learning, K-means clustering algorithms, Principal Component Analysis Networks and problems.

UNIT - 4

(12 hours)

Hopefield network: Non-iterative procedures for association, Matrix Association memories, Least square procedures, optimal linear association memory.

Discrete Hopefield networks, Continuous Hopefield networks, Energy functions, Energy minimization, Storage capacity of Hopfield networks.

Brain-state-in-a-box network, Bi-directional associative memory and problems. Applications of neural network.

Recommended Readings:

1. Kishan Mehrotra, Chilukuri Mohan, Sanjay Ranka; Elements of artificial neural network; Penram Publications.
2. J. Zurada; Introduction to Artificial neural network; Jaico Publications
3. D. Patterson; Artificial neural networks; Prentice Hall

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Write a MATLAB program to generate activation functions used in Artificial Neural Networks.
2. Generate logic functions using McCulloch-Pitts neuron model.
3. Classify the given two-dimensional input patterns using Hebbian rule.
4. Write a MATLAB program for pattern classification using perceptron network.
5. Develop a MATLAB program to perform the following using Adaline.
 - a. Adaptive prediction
 - b. System Identification

- c. Adaptive Noise Cancellation
- 6. Write a MATLAB program to obtain the weights for given patterns using hetero associative neural nets.
- 7. Design a recurrent auto associative net to store a given vector.
- 8. Introduction to MATLAB Neural Network Toolbox

ETC/ECE 7.5.11 INTRODUCTION TO RF DESIGN

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.11	Introduction to RF Design	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to passive components used in RF design and their characteristics.
2. An ability to design high frequency and low noise amplifiers for RF applications.
3. An ability to design RF subsystems such as mixers, oscillators and PLL's.
4. An introduction to various RF architectures used in modern cellular networks.

Course Outcomes:

The student after undergoing this course will be able to:

1. Design matching networks using passive elements and appropriate topology.
2. Apply concepts of MOS device physics, transmission lines, VSWR, Smith chart to RF design.
3. Design high frequency amplifiers with due considerations to bandwidth, rise time and delay.
4. Design low noise amplifiers, power amplifiers, Mixers, VCO's, PLL's and frequency synthesizers for RF applications.
5. Explain the effects of different types of noise in RF design.
6. Explain the RF architectures of modern cellular communication networks such as GSM, CDMA and UMTS.

UNIT - 1

(12 hours)

Introduction: RF systems – basic architectures, Transmission media and reflections, Maximum power transfer.

Passive RLC Networks: Parallel RLC tank, Q, Series RLC networks, matching, Pi match, T match.

Passive IC Components: Interconnects and skin effect, Resistors, capacitors, Inductors
Review of MOS Device Physics.

UNIT - 2

(12 hours)

Distributed Systems: Transmission lines, reflection coefficient,
The wave equation, examples, Lossy transmission lines, Smith charts – plotting gamma

High Frequency Amplifier Design: Bandwidth estimation using open-circuit time constants, Bandwidth estimation using short-circuit time constants, Risetime, delay and bandwidth, Zeros to enhance bandwidth, Shunt-series amplifiers, tuned amplifiers, cascaded amplifiers.

UNIT - 3

(12 hours)

Noise: Thermal noise, flicker noise review, Noise figure.

LNA Design: Intrinsic MOS noise parameters, Power match versus noise match, Large signal performance, design examples & Multiplier based mixers.

Mixer Design: Subsampling mixers. Gilbert Cell. RF Power Amplifiers: Class A, AB, B, C amplifiers, Class D, E, F amplifiers, RF Power amplifier design examples.

Voltage controlled oscillators: Resonators, Negative resistance oscillators.

UNIT - 4

(12 hours)

Phase locked loops: Linearized PLL models, Phase detectors, charge pumps, Loop filters, PLL design examples.

Frequency synthesis and oscillators: Frequency division, integer-N synthesis, Fractional frequency synthesis.

Phase noise: General considerations, Circuit examples.

Radio architectures: GSM radio architectures, CDMA, UMTS radio architectures.

Recommended Readings:

1. Thomas H. Lee; The Design of CMOS Radio-Frequency Integrated Circuits; Cambridge University Press
2. Behzad Razavi; RF Microelectronics; Prentice Hall

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Impedance matching using Pi and T networks
2. Measurement of reflection coefficients and VSWR using Smith Chart
3. Design of high frequency amplifiers:
 - a. Series-Shunt
 - b. Cascaded
 - c. Tuned
4. Design of LNA
5. Design of Mixers (Gilbert cell etc.)
6. Design of RF power amplifiers
 - a. Class A
 - b. Class AB
 - c. Class D,E,F
7. Design of VCO
8. Design of PLL
9. Design of Frequency synthesizers

ETC/ECE 7.5.12 INTRODUCTION TO DATABASES

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.12	Introduction to Databases	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to the data models of a database system and basic principles of the relational model of data.
2. The knowledge of the most important features of Structured Query Language, relational algebra and relational calculus.
3. An understanding of modeling concepts of the Entity-Relationship (ER) model
4. A basic knowledge of theory related to evaluation of relational schemas for design quality.
5. An introduction to concurrency control techniques that are used to ensure the noninterference property of concurrently executing transactions.

Course Outcomes:

The student after undergoing this course will be able to:

1. Define a database and describe the main characteristics of a database system.
2. Discuss data models and define the concept of schemas and instances.
3. Describe the types of interfaces and languages that are typically provided by a DBMS.
4. Discuss relational constraints and how these can be handled.
5. Review the basic data types in SQL, illustrate various SQL commands used for performing various tasks like retrieve, insert, delete and update on schemas and tables and demonstrate the use of Assertions, Triggers and Views in SQL.
6. Illustrate the relational algebra operations.
7. Explain the concept of Entities and Attributes and demonstrate the use of E-R Diagrams.
8. Define a functional dependency and discuss normal forms and normalization using functional dependencies.
9. Discuss concurrency control techniques based on locking protocols.

UNIT - 1

(12 hours)

Introduction: General Introduction to database systems; Database-DBMS distinction, Approaches to building a database. Implications of the Database Approach.

Data Modelling: Data models, Schemas and Instances Three-schema architecture of a database. Database Languages and Interfaces.

E/R Model Conceptual data modelling - motivation, Entities, Entity types, various types of attributes, Relationships, Relationship types, E/R diagram notation, Extended ER Diagram Examples.

UNIT - 2

(12 hours)

Relational Data Model: Concept of relations, Schema-instance distinction, Keys, referential integrity and foreign keys.

Relational Algebra Operators: Selection, Projection, Cross product, various types of joins, Division, Example queries, Tuple Relational Calculus.

Domain relational Calculus: Converting the database specification in E/R notation to the relational schema.

SQL Introduction: Data definition in SQL, Table, key and foreign key definitions, Update behaviors.

Querying in SQL: Basic select- from- where block and its semantics, Nested queries - correlated and uncorrelated, Notion of aggregation, Aggregation functions group by and having clauses, Embedded SQL.

Views: Specification of views in SQL, Embedded SQL & Dynamic SQL

Security mechanism with related Commands.

Other Relational languages: QBE (Query-By-Example)

Relational Database Design: Pitfalls, Functional dependencies, Closure of set of FD's, Closure of attribute set, Canonical cover keys.

UNIT - 3

(12 hours)

Dependencies and Normal forms: Importance of a good schema design, Problems encountered with bad schema designs, Motivation for normal forms

Normal Forms: 1NF, 2NF, 3NF and BCNF, Domain key Normal form DKNF, Multi-valued dependencies and 4NF, Join dependencies and definition of 5NF.

Query Processing: Measures of query cost selection, Translating SQL queries into Relational algebra, Sorting.

Join, Nested Loop Join, Block Nested Loop Join, Merge Join, Hybrid-Hash Join.

Using Heuristics in Query Optimization: Query tree Query graph, Converting query trees into Query evaluation plan.

UNIT - 4

(12 hours)

Transaction processing and Error recovery: Concepts of transaction processing, ACID properties, Schedules and Recoverability, Serializability of Schedules.

Concurrency Control: Concurrency control, Locking based protocols for CC.

Recommended Readings:

1. R. Elmasri, S. Navathe; Fundamentals of Database Systems, 6th Edition, Pearson
2. Abraham Silberschatz, Henry F. Korth; Database System Concepts, 3rd Edition; McGraw Hill
3. C. J. Date; An Introduction to Data Base Systems; Pearson Education
4. Desai B.; An Introduction to Database Concepts; Galgotia Publications

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Introduction to SQL
2. Creating a database
3. Creating a table with constraints
4. Altering a table
5. Adding a record to the database
6. Updating (Modify) a table
7. Generating a subquery
8. Deleting records
9. Sorting (Order by) records
10. Set Operations

ETC/ECE 7.5.13 POWER ELECTRONICS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 7.5.13	Power Electronics	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to various power semiconductor devices, their characteristics and operation.
2. An understanding of Thyristor protection, Thyristor firing circuits and Thyristor commutation techniques.
3. An introduction to AC-DC and DC-DC converters and their operation.
4. An introduction to inverter topologies, AC voltage controllers and cycloconverters.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the construction and characteristics of power semiconductor devices and fundamental of Thyristor.
2. Explain the different triggering circuits for Thyristor and their applications
3. Analyze, operate and design AC-DC and DC-DC converters
4. Analyze and operate serial and parallel inverters
5. Apply knowledge of power semiconductor devices and Thyristor in SMPS, UPS and HVDC Transmission.

UNIT - 1

(12 hours)

Power Semiconductor Devices: Construction and characteristics of Power diodes, Power Transistors, Power MOSFET, Insulated Gate Bipolar transistors (IGBTs). Power electronic converters and applications.

Introduction to Thyristor family: Structure, Symbol, V.I. Characteristics of SCR. Transistor analogy Thyristor Turn-on methods, switching characteristics of Thyristor during Turn on & Turn OFF Thyristor commutations. Thyristor Gate characteristics. Thyristor protection: over voltage protection, suppression of over voltages, over current protection, di/dt protection, dv/dt protection, gate protection, snubber circuits. Mounting of Thyristor, series and parallel operation of Thyristor.

UNIT - 2

(12 hours)

Thyristor commutations. Thyristor trigger circuits: RC firing circuits (half wave & Full wave) Ramp triggering, Ramp and pedestal triggering.

Other members of Thyristor Family: DIAC, TRIAC, PUT, IGBT & GTO: structure, characteristics, applications

AC to DC converters: Principle of phase control, single phase half-wave Thyristor rectifier with RL load and RLE load. Effect of Free-wheeling diode. Single phase full-wave mid-point & bridge Thyristor converters.

UNIT - 3

(12 hours)

DC to DC converters (choppers): principle of operation, Control Schemes: Constant frequency scheme, variable frequency scheme, and step up choppers.

Choppers classification: Class A, B, C, D, & E.

Basic DC-DC converter (switch regulator) topologies: Principle, operation and analysis for Step-down (Buck), Step-up (Boost), Step up/down (Buck- Boost), Continuous conduction and Discontinuous conduction operation

AC Voltage Controllers: Types, integral cycle control, Single Phase Voltage controllers with R and RL Load.

UNIT - 4

(12 hours)

Inverters: parallel inverter: Basic Parallel inverter, modified parallel inverter. Series inverter: Basic series inverter, modified series inverter. Single phase voltage source inverters: half bridge & full bridge (mathematical analysis) MC Murray –Bedford half bridge and full bridge inverter. Three phase inverter for 1800 and 1200 mode operations.

DC motor speed control: – principle of speed control, phase controlled converters.

AC Drives: Speed control by static voltage control, variable voltage variable frequency control.

Cycloconverters: Principle of cycloconverter operation.

Some Applications: Switched mode Power supply, UPS, HVDC transmission.

Recommended Readings:

1. P. S. Bhimbra; Power Electronics; Khanna Publications
2. M. D. Singh, K. B. Khanchandani; Power electronics, 2nd Ed.; TMH
3. V. Jagannathan; Introduction to Power Electronics; Prentice Hall of India
4. Mohammed H. Rashid; Power Electronics circuits, Devices & applications; Prentice Hall
5. M. S. Berde; Thyristor Engineering; Khanna Publications
6. P.C. Sen; Power Electronics; McGraw-Hill Education
7. Vedam Subramanyam; Power Electronics –Devices, Converters and Applications, 2nd Ed.; New Age International Publishers Pvt. Ltd

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Study of SCR characteristics
2. UJT based SCR firing circuit
3. Application of TRIAC for AC Phase control
4. Study of complementary commutation circuit
5. Study of auxiliary commutation circuit
6. Study of DC chopper
7. Study of Single phase half controlled converter
8. Study of Single phase full controlled converter
9. Study of series inverter
10. Study of parallel inverter

ETC/ECE 8.3.1 TESTING AND FAULT TOLERANCE

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.1	Testing and Fault Tolerance	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of basic theory and techniques for testing digital circuits and systems.
2. An ability to test combinational and sequential logic circuits.
3. An ability to perform fault simulation and detect faults.
4. An understanding of different techniques in Built in Self-Test (BIST).

Course Outcomes:

The student after undergoing this course will be able to:

1. Generate tests for combinational circuits.
2. Perform functional testing of sequential circuits.
3. Apply design for testability (DFT) techniques to digital design.
4. Use the fault tolerant methods to increase the reliability (fault tolerance) for system design.
5. Explain the fundamentals of reliability, accelerated tests such as burn-in, tem cycling.
6. Apply test techniques such as Iddq test, at speed test and delay.

UNIT - 1

(12 hours)

Introduction to Testing: Basic concepts (Diagnosis, Reliability, fault tolerance), fault models.

Combinational circuit test generation: Truth table methods, Algebraic methods (Boolean Difference), Path Sensitization Methods (D- algorithm, FAN, PODEM Algorithm, Critical path test).

Fault Collapsing: Fault Equivalence and Dominance, Multiple faults, Special circuits test generation for sequential circuits.

UNIT - 2

(12 hours)

Functional Testing of Sequential Circuits: (Checking Sequences and machine identification, Path Sensitization methods, Asynchronous Circuits, Delay faults and hazards).

PODEM Algorithm for Combinational circuits test.

Fault Simulation: Combinational and Sequential Circuits.

UNIT - 3

(12 hours)

Random Testing: Comparison Testing and Hybrid Testing.

Test Compaction: Transition Count Test, Linear feedback Shift Register (LFSR) Testing.

Design for Testability: Test Pattern Generation for BIST, Generic off-line BIST Architecture, Specific BIST Architecture, MBIST, LBIST.

UNIT - 4

(12 hours)

Fault Tolerant Digital Systems: Measure of fault tolerance, Reliability, MTBF, MTBR, MTTF, Redundancy Techniques (TMR), Fault Tolerant Systems (Dual Systems).

Accelerated Test: Temperature Stress test (Burn-in, Temperature Cycling), Voltage stress test, Electro Static discharge (ESD) test.

Recommended Readings:

1. Hideo Fujiwara; Logical testing & design for testability; MIT Press.
2. Mike Tien Chienlee; High level Test Synthesis of Digital VLSI circuits; Artech House
3. Vishwani D. Agarwal, Michael L. Bushnell; Essentials of Electronic Testing for Digital, Memory & Mixed Signal VLSI Circuit; Springer India

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

Programs for implementing following Algorithms:

1. D-Algorithm(Roth)
2. PODEM
3. FAN
4. Serial Fault Simulation
5. Parallel Fault Simulation
6. Deductive Fault Simulation
7. Concurrent Fault Simulation
8. Critical path Testing
9. Linear Feedback Shift Register
10. Built-in Logic Block pattern Generation

ETC/ECE 8.3.2 ELECTRONIC COMMERCE

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.2	Electronic Commerce	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to E-Commerce fundamentals, technologies and models.
2. An ability to plan and implement E-commerce platforms.
3. An understanding of security aspects of E-Commerce.
4. An introduction to Electronic payment systems.

Course Outcomes:

The student after undergoing this course will be able to:

1. Evaluate different e-commerce technologies and models.
2. Plan and implement basic E-Commerce platforms.
3. Evaluate security aspects of E-Commerce platforms.
4. Implement security technologies in E-commerce platforms.
5. Evaluate right electronic payment system for a given e-commerce model.

UNIT - 1

(12 hours)

Overview of E-Commerce technology: What is E-commerce? Types of E-commerce technologies, Types of E-Business models and markets, Types of E-Commerce providers and vendors.

UNIT - 2

(12 hours)

Designing and building E-commerce websites: hands on. E-Commerce website creation. Managing e-commerce website development.

Implementing and managing e-Commerce websites: Strategies, techniques and tools. Implementing e-commerce databases.

UNIT - 3

(12 hours)

E-Commerce security: Types of security technologies, protocols for public transport of private information. Building an E-commerce trust infrastructure. The Digital ID system. Securing and managing storefront for e-business.

Electronic payment technologies: Payment technology issues, Electronic payment methods through smart cards, Electronic payment systems, Digital currencies International E-commerce solutions.

Recommended Readings:

1. Pete Loshin, John Vacca; Electronic Commerce, 4th Edition; Charles River Media (Laxmi Publications)
2. Ravi Kalakota, Andrew Whinston; Electronic Commerce- A Manager's guide; Pearson education.
3. Daniel Minoli, Emma Minoli; Web Commerce Technology Handbook; TataMcGraw Hill.
4. Charlie Kaufman, Radia Perlman, Mike Speliner; Network Security-Private communication in public world; Pearson education.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Case study of different E Commerce platform
2. Building a user friendly web site for E-Commerce
3. Setting up a web server
4. Implementation of security aspects for web site
5. Implementing a database for E-Commerce web site
 - a. SQL
 - b. JDBC
 - c. ODBC
 - d. XML
 - e. CORBA
6. Implantation of SSL for E-Commerce website
7. Case study of different electronic payments systems
8. Study of digital currencies (like BitCoin, ZCoin)
9. Case study of UPI and BHIM payment system

ETC/ECE 8.3.3 SPEECH PROCESSING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.3	Speech Processing	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of production and classification of speech signals.
2. An understanding of Modeling of speech signals.
3. An understanding of speech analysis and synthesis techniques.
4. An understanding of speech coding and speaker recognition techniques.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the production and classification of speech signals.
2. Analyze the Modeling of speech signals.
3. Examine the speech analysis and synthesis techniques.
4. Analyze the speech coding and speaker recognition techniques.

UNIT - 1

(12 hours)

Production and Classification of Speech Signals: Introduction, Anatomy and Physiology of Speech production, Spectrographic Analysis of Speech, Categorization of speech sounds, **Prosody:** The Melody of speech, Speech Perception.

Acoustics of Speech Production: A discrete time model based on tube concatenation.

UNIT - 2

(12 hours)

Analysis and Synthesis of Pole Zero Speech Models: Introduction, All Pole Modelling of Deterministic Signals, Levinson Recursion and its associated properties, Criterion of Goodness.

Homomorphic Signal Processing: Introduction, Concept, Homomorphic system for convolution, Complex spectrum of speech like sequences, Short time homomorphic analysis of periodic sequences, Short term speech analysis, Analysis/Synthesis structures.

UNIT - 3

(12 hours)

Filter Bank Analysis Synthesis: Introduction, Phase Vocoder, Phase Coherence in the Vocoder, Auditory Modelling.

Sinusoidal Analysis/Synthesis: Sinusoidal Speech Models, Estimation of Sinewave parameters.

Frequency Domain Pitch Estimation: Correlation based pitch estimator, Pitch estimation based on comb filter, Pitch estimation based on Harmonic Sinewave Model.

UNIT - 4

(12 hours)

Speech Coding: Introduction, Statistical Models, Scalar Quantization, Vector Quantization, Frequency Domain Coding, Model based Coding.

Speaker Recognition: Introduction, Spectral Features for Speaker Recognition, Speaker Recognition Algorithms.

Recommended Readings:

1. Thomas Quatieri; Discrete-Time Speech Signal Processing: Principles and Practice; Prentice Hall.
2. L. R. Rabiner, A. W. Schafer; Digital Processing of Speech Signals; Pearson Education.
3. I. H. Witten; Principles of Computer Speech; Academic Press.
4. Lawrence Rabiner, Bing Hwang Juang; Fundamentals of Speech Recognition; Prentice Hall.
5. Ben Gold, Nelson Morgan; Speech and Audio Signal Processing: Processing and Perception of Speech and Music; John Wiley and Sons

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Program to Generating a sin wave signal
2. Program to compare two sine waves with different frequencies
3. Program to generate square wave
4. Program to add sin and square wave
5. Program to concatenate speech signals
6. Program for Concatenating into Stereo file
7. Program for Stereo to Mono conversion
8. Resonating Frequency using spectrum Analyzer
9. Resonating Frequency in mixed frequency signal
10. Resonating Frequency using Autocorrelation

ETC/ECE 8.3.4 ENTREPRENEURSHIP

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					Total
						Th	S	TW	O	P	
ETC/ECE 8.3.4	Entrepreneurship	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. Requisite knowledge so that they can take up entrepreneurship as their career.
2. An understanding of qualities and requirements of an entrepreneur.
3. An ability to understand the requirements of Project identification, formulation and implementation.
4. An understanding of breakeven analysis.
5. An understanding of the complexity of managing in a global world.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the skills for project identification, formulation and implementation.
2. Explain the essential qualities and requirements of an entrepreneur.
3. Apply the concepts of breakeven analysis.
4. Apply managerial concepts to solve complex problems related to global issues.

UNIT - 1

(12 hours)

Entrepreneurship Development: Meaning, objectives, scope & philosophy, type of entrepreneurs, factors affecting entrepreneurship, entrepreneurial qualities, major motives influencing an Entrepreneur, need for promotion of entrepreneurship & small business, linkage between entrepreneurship and economic development, Entrepreneurship Support System.

Identification of Business Opportunities- SWOT Analysis, Environmental Screening-features, why, significance of environmental screening, Identification of business opportunities.

Small Scale Industry: Definition; Characteristics; Need and rationale: Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start an SSI – Government policy towards SSI; Different policies of S.S.I

UNIT - 2

(12 hours)

Project identification- assessment of viability, formulation, Evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods. Guidelines by Planning Commission for Project report, network Analysis, Errors of Project Report, Project Appraisal.

Project Planning and control:

The financial functions, cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures. Profit planning and programming, planning cash flow, capital expenditure and operations. Control of financial flows.

UNIT - 3

(12 hours)

Financing and Accounting: Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis.

Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control. Marketing, industrial relations. Sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.

UNIT - 4

(12 hours)

Introduction to Production Management: Types of production systems, production planning and control, functions of production manager & materials management.

Introduction to Human Resource Management: Manpower planning, recruitment, selection, placement & induction, training & development, compensation.

Laws concerning entrepreneur viz, partnership laws, business ownership, income taxes and workman compensation act.

Role of various national and state agencies which render assistance to small scale industries.

Recommended Readings:

1. Havinal Veerbhadrappa; Management and Entrepreneurship; New Age International
2. Forbat John; Entrepreneurship; New Age International.
3. Prasanna Chandra; Fundamentals of Financial Management, 3rd Edition; Tata McGraw-Hill
4. C. B Gupta; Management: Theory and Practice; 7th Edition; Sultan Chand & Sons.
5. P. C. Tripathi, P. N. Reddy; Principles of Management, 2nd Edition; Tata McGraw Hill

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. SWOT Analysis
2. Policies of S.S.I
3. Project identification
 - a. Assessment of viability
 - b. Formulation and evaluation
 - c. Finance
 - d. Field-study and collection of information
 - e. Preparation of project report
 - f. Demand analysis
 - g. Benefit cost analysis
4. Project planning
 - a. Economic evaluation
 - b. Risk analysis
 - c. Capital expenditures
 - d. Profit planning and programming
 - e. Planning cash flow and operations
5. Break even analysis
6. Preparation of balance sheets
7. Preparation of financial reports
8. Manpower planning
9. Laws concerning entrepreneur

ETC/ECE 8.3.5 MOBILE ROBOTICS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.5	Mobile Robotics	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of kinematics of mobile robots.
2. Ability to select appropriate sensors and image processing technique for perception.
3. An ability to solve localization problems for mobile platforms.
4. An ability to implement SLAM models and navigation algorithms.

Course Outcomes:

The student after undergoing this course will be able to:

1. Evaluate forward kinematics of mobile robots.
2. Evaluate different sensors for a given application of mobile robots.
3. Explain different image processing techniques used as part of perception system
4. Explain the challenges of localization for mobile platforms.
5. Evaluate localization strategies and select appropriate one for given application
6. Implement basic SLAM techniques.
7. Evaluate navigation and path planning algorithms and implement for a given application.
8. Design simple mobile robots and implement sensing, localization and navigation algorithms on them.

UNIT - 1

(12 hours)

Introduction to mobile robots, Classification and applications. Locomotion: Key issues, Legged, wheeled and aerial mobile robots.

Mobile robot kinematics: Kinematic Models and Constraints: Representing robot position, Forward kinematic models, Wheel kinematic constraints, Robot kinematic constraints.

Mobile Robot Maneuverability. Mobile Robot Workspace. Path and trajectory considerations.

UNIT - 2

(12 hours)

Perception: Sensors for Mobile Robots: Sensor classification, Characterizing sensor performance, Representing uncertainty, Wheel/motor sensors, heading sensors,

Accelerometers, Inertial measurement unit, Ground beacons, Active ranging, Motion/speed sensors, and Vision sensors.

Fundamentals of Image Processing: Image filtering, Edge detection, computing image similarity. Feature Extraction. Feature Extraction Based on Range Data.

UNIT - 3

(12 hours)

Mobile Robot Localization: The Challenge of Localization: Noise and Aliasing, Localization-Based Navigation Versus Programmed Solutions. Belief Representation. Map Representation.

Probabilistic Map-Based Localization: Introduction, The robot localization problem, the ingredients of probabilistic map-based localization. Classification of localization problems.

Examples of Localization Systems: Landmark-based navigation, globally unique localization, Positioning beacon systems, Route-based localization.

UNIT - 4

(12 hours)

Autonomous Map Building: SLAM: The simultaneous localization and mapping problem, Mathematical definition of SLAM, Extended Kalman Filter (EKF) SLAM.

Planning and Navigation: Path Planning, Obstacle avoidance: Bug algorithm, Vector field histogram, The bubble band technique, Curvature velocity techniques, Dynamic window approaches, The Schlegel approach to obstacle avoidance, Nearness diagram, Gradient method.

Recommended Reading:

1. Roland Siegwart, Illah R. Nourbakhsh, and Davide Scaramuzza; Introduction to Autonomous Mobile Robots, 2nd Ed.; MIT Press.
2. Dieter Fox, Sebastian Thrun, and Wolfram Burgard; Probabilistic Robotics; MIT Press.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments)

1. Differential drive wheeled robot
2. Omni drive wheeled robot
3. Bi-pedal robot
4. Multiple legged robot
5. Wheel/motion sensors
6. Solid state IMU
7. Range sensors
8. Image processing using OpenCV
9. Implementation of localization algorithms [Matlab]
10. Implementation of SLAM algorithms [Matlab]
11. Implementation of Obstacle avoidance algorithms
12. Introduction to ROS
13. Implementation of wheeled robot using ROS

ETC 8.3.6 ADVANCED COMPUTER NETWORKS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.6	Advanced Computer Networks	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to modern networking paradigms.
2. An introduction to software defined networking and virtualization concepts.
3. An ability to apply software defined networking and virtualization concepts.
4. An introduction to cloud computing and internet of things networking.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the modern networking architectures and their advantages.
2. Explain the need for high performance networking architectures.
3. Evaluate the feasibility of software defined networks and network virtualization for a given scenario.
4. Explain the architecture vis a vis data and control plane of SDN.
5. Apply SDN concepts using platforms such as OpenFlow and OpenDaylight.
6. Implement network virtualization techniques such as VLAN and VPN.
7. Explain the features and architecture of cloud computing and Internet of Things.

UNIT - 1

(12 hours)

Elements of modern networking: Networking ecosystem and architectures, Ethernet, Wi-Fi, Cloud computing and IoT.

Requirements and Technology: Types of networks and traffic, Data demand, QoS and QoE, Routing, Congestion control, SDN and NFV, Modern networking elements.

UNIT - 2

(12 hours)

Software Defined Networks: Network requirements, SDN approach.

SDN Data Plane and Open Flow. SDN control plane architecture. OpenDaylight.

Data Centre networking.

UNIT - 3

(12 hours)

Network Function virtualization: Background and motivation, Virtual machines, NFV concepts, benefits and requirements. NFV architecture, NFV infrastructure.

Network virtualization: VLAN, VPN, Network virtualization example and architecture. Software defined infrastructure.

UNIT - 4

(12 hours)

Modern Network architecture: Cloud computing: basic concepts, cloud services, cloud deployment models, cloud architecture.

Internet of things: Components, Architecture. Implementation examples.

Recommended Readings:

1. William Stallings; Foundations of Modern Networking, 1st Ed.; Pearson Education India
2. Thomas D. Nadeau and Ken Gray; SDN: Software Defined Networks; O'Reilly
3. Paul Goransson, Chuck Black; Software Defined Networks: A Comprehensive Approach, 1st Edition; Morgan Kaufmann

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Setup of a Software Defined Network
2. Open Flow protocol
3. Open Daylight protocol
4. Virtual Machine
5. Network function virtualization demonstration
6. Setup VLAN
7. Setup VPN
8. Setup Basic Cloud Computing model
9. Setup basic cloud based service
10. Setup internet of things

ETC/ECE 8.3.7 MOTORS AND DRIVES

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.7	Motors and Drives	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of construction and principal of operations of DC and AC motors.
2. An understanding of control strategies used for speed, power and torque control of different AC and DC motors.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the working of permanent magnet, brushless and stepper DC motors.
2. Explain the working of single phase and 3 phase AC motors.
3. Explain the construction of different types of AC and DC motors.
4. Explain different control strategies used to control speed, power and torque of AC and DC motors.
5. Choose appropriate DC or AC motor for a given application.
6. Choose appropriate control strategy for a given application.
7. Analyze an application and calculate the appropriate motor characteristics to suit that application.

UNIT - 1

(12 hours)

D.C Motors: Working Principle of DC motors, predetermination of external characteristic of DC motors. Starting of DC motors, speed control methods.

Permanent Magnet Brushless DC Motors: Constructional features, principle of operation, Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors. Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Torque and emf equation, Torque-speed characteristics, and Controllers-Microprocessor based controller.

UNIT - 2

(12 hours)

Stepping Motors: Principle of operation, modes of excitation, torque production in stepping motors, Drive systems and circuit for open loop control, closed loop control of stepping motor.

A.C. Motors: Construction of three phase Induction Motor, flux and mmf waves, rotating mmf and torque, development of equivalent circuit model, power across air gap, torque and power output, torque-slip characteristics, condition for maximum power output.

UNIT - 3

(12 hours)

Single phase induction motors: construction, rotating field theory, performance analysis and circuit model for single winding machines, split phase motors- resistance, capacitance split phase motors, capacitor start and two value capacitor motors, shaded pole motors, comparison of single phase and three phase motors.

Drives: General concept of Electric drives, Classification of electric drives, Advantages of electric drives, components of electric drives, choice of electric drives, Selection of motor power rating.

Braking: Types of braking, dynamic braking, counter current braking, Regenerative Braking of DC and AC motors.

UNIT - 4

(12 hours)

Control of DC Drives: Basic parameters, operating modes, motoring modes, Braking modes, schemes for DC motor speed control, Ward Leonard method, buck boost control, single phase, three phase fully controlled, half controlled DC drives, chopper controlled DC motor drives.

Control of AC Motor Drives: Basic parameters, speed control of induction motor drives, Induction Motor torque production, speed torque characteristics with variable voltage operation, variable frequency operation, constant voltage /frequency operation.

Recommended Reading:

1. R. Krishnan; Electric Motor Drives – Modeling, Analysis and Control; Prentice-Hall of India
2. B.K. Bose; Modern Power Electronics and AC drives; Prentice-Hall of India
3. Gopal K. Dubey; Fundamentals of Electric Drives, 2nd Ed.; Narosa Publishing House
4. I. J. Nagrath and D. P. Kothari; Electric Machines; Tata McGraw Hill
5. Kenjo T.; Stepping motors and their microprocessor control; Clarendon Press, Oxford
6. Miller, T.J.E.; Brushless permanent magnet and reluctance motor drives; Clarendon Press, Oxford
7. Kenjo T. and Naganori S.; Permanent Magnet and brushless DC motors; Clarendon Press, Oxford
8. Nisit K. De, Prashanta K. Sen; Electric Drives; Prentice-Hall of India
9. Mohammed A EL-Sharakawi; Electric Drives; Vikas Publishing house.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Open loop and closed loop speed control of DC motor
2. Speed control using hall sensor and optical sensor
3. Torque-speed analysis of DC motor
4. Closed loop speed control of Brushless DC motor
5. Torque – speed analysis of BLDC motor
6. Open loop control of Stepper motor
7. Torque analysis of stepper motor
8. Torque, speed and power analysis of AC 3 phase motor
9. Torque, speed and power analysis of AC 1 phase motor
10. Braking techniques for AC and DC motors
11. Control of DC drives
12. Control of AC drives

ETC/ECE 8.3.8 WIRELESS COMMUNICATION

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.8	Wireless Communication	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of IEEE 802.11x protocols and their features.
2. An understanding of IEEE 802.15.4 and ZigBee protocols and their features.
3. An understanding of Bluetooth and Bluetooth Low energy protocol and their features.
4. An ability to use IEEE 802.11x, ZigBee and Bluetooth communication protocols in given application.

Course Outcomes:

The student after undergoing this course will be able to:

1. Differentiate between different protocols under IEEE 802.11x protocol family
2. Explain in detail MAC layer, framing techniques and security features of IEEE 802.11x protocol.
3. Explain in detail PHY layer features of IEEE 802.11x protocol.
4. Evaluate suitability of ZigBee, IEEE 802.11 and Bluetooth protocols for given application.
5. Explain in detail the ZigBee protocol and advantages, disadvantages and application.
6. Explain the Bluetooth protocol structure and advantages, disadvantages and application.
7. Explain the difference in Bluetooth protocol at module and at host.
8. Explain the features of Bluetooth low energy protocol.

UNIT - 1

(12 hours)

Overview of 802.11 Networks: IEEE 802 Network Technology Family Tree, 802.11 Nomenclature and Design, 802.11 Network Operations.

802.11 MAC Fundamentals: Challenges for the MAC, MAC Access Modes and Timing, Fragmentation and Reassembly, Frame Format.

802.11 Framing in Detail: Data Frames, Control Frames, Management Frames, Frame Transmission and Association and Authentication States.

Security: Wired Equivalent Privacy (WEP), Cryptographic Background to WEP, WEP Cryptographic Operations, Problems with WEP, Dynamic WEP. The Extensible Authentication Protocol .The Temporal Key Integrity Protocol (TKIP).

UNIT - 2

(12 hours)

802.11 Physical Layer Overview, Physical-Layer Architecture, the Radio Link, RF Propagation with 802.11, RF Engineering for 802.11.

The Frequency-Hopping (FH) PHY, Frequency-Hopping Transmission, Gaussian Frequency Shift Keying (GFSK), FH PHY Convergence Procedure (PLCP, Frequency-Hopping PMD Sub layer, Characteristics of the FH PHY.

The Direct Sequence PHYs: DSSS and HR/DSSS (802.11b): Direct Sequence Transmission, Differential Phase Shift Keying (DPSK), the “Original” Direct Sequence PHY, Complementary Code Keying, High Rate Direct Sequence PHY.

802.11a and 802.11j: 5-GHz OFDM PHY: Orthogonal Frequency Division Multiplexing (OFDM), OFDM as Applied by 802.11a, OFDM PLCP, OFDM PMD, Characteristics of the OFDM PHY.

UNIT - 3

(12 hours)

Introduction to ZigBee, ZigBee vs. Bluetooth and Wi-Fi. ZigBee: frequency of operation and data rates, device types and roles, networking topologies.

ZigBee and IEEE 802.15.4 standards: CSMA-CA, beacon and non-beacon networking, data transfer methods, data verification, addressing.

ZigBee applications: security systems, meter reading, irrigation, light control and HVAC. Applications in industrial automation, healthcare and other applications.

ZigBee and IEEE 802.15.4 networking layers: PHY specifications, ZigBee MAC layer, NWK layer, Security.

UNIT - 4

(12 hours)

Bluetooth: Overview, the protocol stack, security, applications and profiles.

Bluetooth module: Radio: introduction, frequency hopping, modulation, symbol timing, power emission and control, simple RF architecture Baseband: Bluetooth device address, masters, slaves and piconet, system timing, physical links: SCO and ACL, Bluetooth packet structure, packet types and packet construction, logical channels, frequency hopping.

Bluetooth host: logical link control: multiplexing using channels, L2cap signaling, establishing and configuring connection. RFCOMM: serial ports and UART, types, RFCOMM Frame types connecting and disconnecting.

Introduction to Bluetooth low energy.

Recommended Reading:

1. Matthew S. Gast; 802.11 Wireless Networks: The Definitive Guide, 2nd Edition; O'Reilly Media
2. Shahin Farahani; ZigBee Wireless Networks and Transceivers; Newnes
3. Jennifer Bray, Charles F. Sturman; Bluetooth : Connect Without Cables, 1st Ed.; Prentice Hall
4. Kevin Townsend , Carles Cuff , Akiba , Robert Davidson; Getting Started with Bluetooth Low Energy: Tools and Techniques for Low-Power Networking; O'Reilly Media

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Study of IEEE 802.11 MAC and PHY layers [NS2 / Matlab]
2. Study of ZigBee hardware modules.
3. One to one communication using ZigBee
4. One to Many communication using ZigBee
5. Mesh networking using ZigBee
6. Implementation of simulated intruder alert system using ZigBee
7. Implementation of simulated irrigation system using ZigBee
8. Implementation of any simulated industrial application using ZigBee
9. Study of Bluetooth hardware modules.
10. Implementation of simulated intruder alert system using Bluetooth
11. Implementation of simulated irrigation system using Bluetooth
12. Implementation of any simulated industrial application using Bluetooth
13. Implementation of any application using Bluetooth low energy

ETC/ECE 8.3.9 AUDIO AND VIDEO ENGINEERING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.9	Audio and Video Engineering	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of transmission and reception of signal in color television system.
2. An introduction to digital television and display systems.
3. An introduction to different standards of compression adopted by digital television.
4. An understanding of audio- video recording and acoustics.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the Chromaticity diagram, color signal transmission and modulation
2. Compare NTSC, PAL and SECAM system.
3. Explain working of digital TV transmitter and receiver system.
4. Explain the working principles of advanced TVs (LED, LCD, TFT, Plasma TV, HDTV).
5. Explain the working of acoustic chamber and cordless Microphone system.
6. Evaluate different TV systems for a given application.
7. Apply TV system and acoustics knowledge to setup Audio-Video recording and playback facilities.

UNIT - 1

(12 hours)

Fundamentals of Color Television: Color TV systems, fundamentals, mixing of colors, color perception, chromaticity diagram.

NTSC, PAL, SECAM systems, Color TV transmitter, (high level, low level), colour TV Receivers, remote control.

UNIT - 2

(12 hours)

Digital TV and Display Devices: Introduction to Digital TV, Digital TV signals and parameters, Digital TV Transmitters, MAC signals, advanced MAC signal transmission, Digital TV receivers, Basic principles of Digital Video compression techniques, MPEG Standards. Digital TV recording techniques. Display devices: LED, LCD, TFT, Plasma.

UNIT - 3

(12 hours)

High Definition Television (HDTV) Standards: HDTV standards and systems, HDTV transmitter and receiver/encoder, Digital TV satellite Systems, video on demand, CATV, direct to home TV, set top box with recording facility, conditional access system (CAS), 3D TV systems, Digital broadcasting.

Advanced TV Systems: IP Audio and Video, IPTV systems, Mobile TV, Video transmission in 3G mobile System, iPod (MPEG4 Video player), Digital Video Recorders, Personal Video Recorders, Wi-Fi Audio.

Video Transmitter and Receivers: Video Projectors, HD Video projectors, Video Intercom systems, Video door phones.

UNIT - 4

(12 hours)

Fundamentals of Audio-Video Recording and Acoustics: Methods of sound recording & reproduction, optical recording, CD recording, audio standards. Digital Sound Recording, CD/ DVD player, MP3 player, Blue Ray DVD Players, MPEG, MP3 Player.

Fundamentals of Acoustics: Studio acoustics & reverberation, Public address system for auditorium, Acoustic chambers, Cordless microphone system, special types of speakers & microphones, Digital Radio Receiver Satellite radio reception.

Recommended Reading:

1. A. M. Dhake; Television and Video Engineering, 2nd Edition, TMH Publication.
2. Keith Jack; Video Demystified: A Handbook for the Digital Engineer, 5th Edition; Penram International Publication.
3. R. G. Gupta; Audio Video Systems: Principles, Maintenance and Troubleshooting; TMH Publication
4. S. P. Bali; Color Television: Theory and Practice; Tata McGraw Hill Publications.
5. Bernard Grobb, Charles Herndon; Basic TV and Video Systems, 6th Edition; McGraw Hill Publication.
6. Michael Robin, Michael Poulin; Digital Television Fundamentals, 2nd Edition; McGraw Hill
7. Marcelo S. Alencar; Digital Television Systems; Cambridge University Press.
8. John Arnold, Michael Frater, Mark Pickering; Digital Television: Technology and Standards; John Wiley Publications.
9. Walter Fischer; Digital Video and Audio Broadcasting technology, 3rd Edition; Springer

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Voltage waveform analysis for color TV.
2. Study of direct to home TV and set top box.
3. Study of Wi-Fi TV / IPTV system
4. Fault finding in Digital TV using pattern generator.
5. Study of Digital TV and different standards.
6. Simulation of video, Audio and Image compressing techniques (Software

Assignments)

7. Study of Audio system: CD, DVD players and MP3 player.
8. Configuration of PA system with chord less microphone
9. Directivity pattern of Microphones / Loud speakers
10. Study/building an AM and FM receiver.
11. Study of characteristics of various amplifier systems used in audio and video systems.

ETC/ECE 8.3.10 MOBILE COMPUTING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.10	Mobile Computing	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to mobile computing and its applications.
2. An introduction to wireless mobile technologies and standards.
3. An introduction to Voice and multimedia communication in wireless mobile networks.
4. An overview of various security aspects in mobile networks.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain mobile computing, its advantages and architecture.
2. Compare emerging technologies in mobile computing.
3. Evaluate 3G, wireless LAN and 3rd Generation networks on suitability for mobile computing.
4. Explain Intelligent networks and their architecture.
5. Explain voice over IP and IP multimedia subsystems architectures.
6. Explain the security aspects of mobile computing.
7. Explain the features and advantages of next generation networks.

UNIT - 1

(12 hours)

Mobile Computing architecture: Introduction, Architecture for mobile computing, 3 tier architecture, Design consideration for mobile computing, mobile computing through internet.

Mobile computing through telephony: Multiple access Procedures, Satellite communication systems, Mobile computing through telephone, IVR application. Voice XML.

Emerging Technologies: Bluetooth, RFID, WiMAX, IPv6 and mobile IP.

UNIT - 2

(12 hours)

CDMA and 3G: Introduction, Spread Spectrum technology. CDMA v/s GSM. 3rd Generation Networks. Applications on 3G.

Wireless LAN: Introduction, Advantages, Standards, Architecture, Mobility Security. Deploying Wireless LAN, Mobile Ad-Hoc networks and Sensor Networks. Wireless in vehicular environment. WLL, HiperLAN. Wifi v/s 3G.

UNIT - 3

(12 hours)

Intelligent Networks and Interworking: Introduction, Fundamentals of call processing, Intelligence in networks, SS#7 signalling, IN conceptual model, Soft switch, Programmable networks, Technologies and Interfacing for IN, SS7 security, VPN.

Voice over IP: Introduction, H.323 framework, Session Initiation Protocol, Real Time Protocol, Convergence technologies, Call routing, VoIP applications, Mobile VoIP, Voice over WiLAN.

UNIT - 4

(12 hours)

IP Multimedia subsystems: Introduction, IMS and its Evolution, Advantages, Architecture, Protocols, IMS networks, Call flow, Charging, Service creation, Policy management, Security.

Security Issue in Mobile Computing: Introduction, Information security, Security techniques and algorithms, Security protocols, Public key infrastructure.

Next Generation Networks: Narrowband to broadband, All IP and B3G networks, OFDM, FAMA/DAMA, MPLS, Wireless Asynchronous transfer mode, multimedia broadcast service. Multiple play.

Recommended Readings:

1. Asoke K. Talkukder, Roopa R. Yavaga; Mobile Computing: Technology, Applications and Service Creation, 2nd Edition; Tata McGraw Hill
2. Raj Kamal; Mobile Computing; Oxford University Press
3. Reza B'Far; Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, 5th Edition; Cambridge University press
4. Uwe Hansmann, Lothar Merk, Martin S Nicklous and Thomas Stober; Principles of Mobile Computing, 2nd Edition; Springer International Edition

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Study of spread spectrum technology
2. Study of satellite communication
3. Configuration of wireless LAN
4. Study of SS#7 protocol
5. Configuration of virtual private network
6. Configuration of VoIP link
7. Study of OFDM
8. Study of MPLS routing
9. Study of encryption algorithms

ETC/ECE 8.3.11 NANOELECTRONICS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.11	Nanoelectronics	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to quantum mechanics of electron.
2. An introduction to single electron and few electron phenomena and devices.
3. An understanding on quantum well, quantum wires and quantum dots.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain top down and bottom up approach in nanoelectronics.
2. Derive Schrodinger time dependent equation for free particle.
3. Explain concept of quantum transport, quantum well and tunneling effect.
4. Describe the spin dependent electron transport in magnetic devices.
5. List advantages and disadvantages of carbon nanotubes.
6. Explain the influence of capacitance and energy on tunneling.
7. Explain density of states of electrons in nano structure.
8. List the fabrication techniques used for nano technology.

UNIT - 1

(12 hours)

Introduction to Nanoelectronics: Top down approach, bottom up approach and Nanotechnology potential. Comparison of classical and Quantum systems. Light as a wave, light as quantum particle. Electron as a particle and electron as a wave.

Quantum mechanics of electron: General postulates of quantum mechanics. Time dependent Schrodinger's equation. Analogies between quantum mechanics and classical electromagnetics. Probabilistic current density, Multiple Particle system, Spin and angular momentum.

UNIT - 2

(12 hours)

Free and confined electrons: Free electron Gas theory of metals. Fermi level and chemical Potential. Partially confined electrons, electrons confined to atom. Quantum dots, wires and wells.

Band theory of solids: Electrons in a periodic potential, Kronig-Penny model of band structure. Band theory of solids, Graphene and carbon nanotubes.

UNIT - 3

(12 hours)

Tunnel junction: Tunneling through a Potential barrier. Potential energy profiles for material interfaces. Applications of Tunneling.

Coulomb Blockade: Coulomb Blockade in a Nano capacitor, Tunnel junction, Coulomb Blockade in a quantum dot circuit. Single-Electron transistor, Other SET and FET structures.

Particle statistics and density of states: Density of states, classical and quantum statistics.

UNIT - 4

(12 hours)

Model of semiconductor quantum well, quantum wires: Semiconductor heterostructures and quantum wells. Quantum wires and nanowires. Quantum Dots and Nanoparticles. Fabrication techniques for nanostructures.

Nanowires, Ballistic transport, and spin transport: Classical and semi classical transport, Ballistic transport, Carbon nanotubes and nanowires, Transport of spin and Spintronics.

Recommended Readings:

1. George W. Hanson; Fundamentals of Nanoelectronics; Pearson
2. K. Gosser, P. Glosekotter, J. Dienstuhl; Nanoelectronics and Nanosystems; Springer International Edition
3. M. Ratner, D. Tatner; Nanotechnology; Pearson Education.
4. M. Wilson, et al.; Nanotechnology: Basic Science and Emerging Technologies; Chapman and Hall/CRC
5. A. Lakhtakia (ed.); Nanometer Structures; Prentice Hall of India.
6. R. Booker, E. Boysen; Nanotechnology; Wiley-Dreamtech India Pvt. Ltd.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Spin and angular momentum of electron.
2. Coulomb Blockade in a Nano capacitor
3. Single-Electron Transistor
4. Density of states
5. Semiconductor heterostructures.
6. Quantum well.
7. Classical and semi classical transport.
8. Carbon nanotubes
9. Quantum Dots and Nanoparticles
10. Study of Spintronics.

ETC/ECE 8.3.12 BIOMEDICAL ELECTRONICS AND INSTRUMENTATION

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.12	Biomedical Electronics and Instrumentation	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to human physiological system which is very important with respect to electronic design considerations.
2. The knowledge of the principles of operation and design of biomedical electronics & instruments.
3. An understanding of medical diagnosis and therapy techniques.
4. An ability to solve electronic engineering problems related to medical field.

Course Outcomes:

The student after undergoing this course will be able to:

1. Describe physiology of heart, lung, blood circulation and nervous system.
2. Evaluate different biosensors, biochemical transducer used for measuring different biological parameters of human system
3. Define safety parameters and measures to be taken while designing biomedical Equipment
4. Explain different measuring and monitoring systems such as ECG, EEG, EMG.
5. Explain different medical assistance/techniques and therapeutic equipment's
6. Categorize different imaging systems based on their application, advantages and disadvantages for a given problem

UNIT - 1

(12 hours)

Cell and its structure: Resting and Action Potential, Nervous system: Nerve fibres, neuron system; heart potentials, eye and vision, ear and hearing, Cardiovascular system, respiratory system.

Basic components of a biomedical system: Transducers, selection criteria, Piezoelectric, ultrasonic transducer, temperature measurements, temperature sensors.

Electrodes: basic electrode theory, Nernst equation, biopotential electrodes, biochemical transducers.

Patient safety: Intensive care system, electric shock hazards, leakage currents; testing instruments for checking safety parameters of biomedical electronic equipment.

UNIT - 2

(12 hours)

Measuring and monitoring systems: EEG, ECG, EMG with block diagrams, Vector Cardiography, Holter monitoring.

Pacemakers: properties, lead wires and electrodes, synchronous pacemaker; rate responsive pacing.

Defibrillators: AC and DC, Blood pressure monitoring; direct and indirect measurement.

UNIT - 3

(12 hours)

Controller and stimulators: Electroneurography; spirometry; Audiometers, Block diagram of heart-lung machine.

Surgical diathermy; physiotherapy equipment: microwave diathermy; laser therapy, ultrasonic therapy unit, cryotherapy.

Biomedical telemetry: Wireless, single channel, multi-channel.

X-Rays: X ray diagnostic methods, Production of X-ray, Use of X-ray imaging.

UNIT - 4

(12 hours)

Computed Tomography: Basic principles, system components, Medical applications and safety precautions.

Ultrasound: Functional block diagram of basic pulse echo system for diagnostic purposes, A-SCAN, M-SCAN, B-SCAN, Application of ultrasound imaging.

Radio Nuclide Imaging: Principles, radiation detectors, schematic functional diagram and components of gamma camera, Medical applications, safety precautions.

Magnetic Resonance Imaging: Basic principles, Schematic functional diagram of MRI scanner with its sub systems.
Medical applications, safety precautions.

Recommended Readings:

1. R. S. Khandpur; Handbook of Biomedical Instrumentation; McGraw Hill Education
2. Leslie Cromwell; Biomedical Instrumentation and Measurements; Prentice Hall India
3. J. G. Webster; Medical Instrumentation – Application & Design; John Wiley & Sons
4. W. Blesser; Systems approach to biomedicine; McGraw Hill
5. Tatsuo Togawa, Toshiyo Tamura, P. Ake Oberg; Biomedical transducers and instruments; CRC Press
6. S. K. Guha; Introduction to medical electronics; Bharati Bhavan
7. C. A. Caceress; Biomedical telemetry; Academic press
8. L. Geddes and L. Baker; Principles of applied biomedical instrumentation; Wiley-Blackwell
9. Laurence J. Street; A Guide to Patient Care Technology: A Review of Medical Equipment; Taylor & Francis.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Study characteristics of temperature sensors – thermistor, thermocouple and RTD
2. Blood pressure Measurement
3. Monitoring of EEG
4. Monitoring of ECG
5. Monitoring of EMG
6. Measurement of pulse rate(Finger plethysmography)
7. Surgical Diathermy – Cutting, Coagulation, Fulguration
8. Defibrillator
9. Study of Heart lung Machine
10. Study of Holter Machine

ETC/ECE 8.3.13 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.3.13	Introduction to Artificial Intelligence	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to Artificial Intelligence techniques for building well-engineered and efficient intelligent systems.
2. An understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs.
3. An introduction to predicate logic, symbolic reasoning and filter structures.
4. Introduction to natural language processing, expert systems and artificial neural networks.

Course Outcomes:

The student after undergoing this course will be able to:

1. Define a problem in terms of its characteristics and identify the design issues.
2. Implement different search techniques used for problem solving.
3. Understand the fundamentals of knowledge representation.
4. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.

UNIT - 1

(12 hours)

Introduction to AI and Techniques.

Problems, Problem Spaces and Search: Defining the Problem, Production Systems, Problem characteristics, Production System Characteristics, Design Issues.

Problem Solving: Heuristic Search Techniques, Hill Climbing, Best First Search, A*, OR graphs, Problem Reduction - AND-OR-Graph, AO* Means Ends Analysis.

UNIT - 2

(12 hours)

Knowledge Representation: Representation and Mapping, Approaches to knowledge representation.

Predicate Logic: Representing simple facts and logic, Representing instance and ISA relationship, Computable functions and predicates, Resolution.

Symbolic reasoning under uncertainty: Introduction to non-monotonic Reasoning, Logic for non-monotonic reasoning.

Weak slot and filter structures: Semantic nets, Frames.

Strong Slot and Filter Structures: Conceptual dependency, Scripts.

UNIT - 3

(12 hours)

Game Playing: MiniMax Search Procedure, Adding alpha-beta cut offs.

Planning: Overview, An example domain: Blocks world, Components of a planning system.

Goal Stack Planning: Non –linear Planning, Hierarchical Planning.

Introduction to natural language processing.

UNIT - 4

(12 hours)

Learning: Inductive learning, Learning Decision Trees.

Types of learning: Rote learning, Learning by taking advice, Learning in problem solving, Version Space.

Expert Systems: Representing and using domain knowledge, Expert System Shells, Knowledge Acquisition Explanation. Introduction to Neural Networks.

Recommended Readings:

1. Elaine Rich, Kevin Knight; Artificial Intelligence, TMH
2. Stuart Russell, Peter Norvig; Artificial Intelligence: a Modern Approach; Pearson
3. Nils J. Nilsson; Artificial Intelligence: A new Synthesis; Harcourt Asia
4. Patrick Winston; Artificial Intelligence; Pearson Education
5. Ivan Brakto ;Prolog Programming for Artificial Intelligence; Pearson Education
6. Efraim Turban; Decision Support Systems and Intelligent Systems, Prentice Hall
7. George F. Luger; Artificial Intelligence : Structures and strategies for complex problem solving; Pearson education

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Implement Water Jug Problem
2. Implement Missionaries and Cannibals problem
3. Implement Tic tac toe problem
4. Unification Problem
5. 8 queens problem
6. Maze problem
7. Expert system
8. Cryptarithmic problem
9. To check whether a well formed formula is valid, satisfiable or unsatisfiable.

The programs could be written using Lisp, C/C++ or Python

ETC 8.3.14 ERROR CONTROL CODING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC 8.3.14	Error Control Coding	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understating of Concepts of Galois Fields.
2. Knowledge of various coding techniques.
3. Mathematical and computational skills required in coding theory.
4. Ability to decode and correct the errors in the communication systems.

Course Outcomes:

The student after undergoing this course will be able to:

1. Design and generate codes using the knowledge of Galois field.
2. Encode the data using various coding techniques.
3. Decode and correct the errors in the received code.

UNIT - 1

(12 hours)

Introduction to Algebra: Groups, Fields, Construction of fields, Binary field arithmetic. Basic properties of a Galois field, Primitive field elements. Minimal polynomial, Computations using Galois field GF (2^m) Arithmetic: Realization & Implementation., Vector spaces, matrices.

Revisiting linear block and cyclic codes: Generator and parity check matrices, Implementation of encoder & decoder. Hamming code systematic, standard array and syndrome decoding, Non-systematic hamming code.

UNIT - 2

(12 hours)

Hamming codes; Weight enumerators and the MacWilliams identities; Perfect codes.

Introduction to BCH codes: encoding & decoding of BCH codes, Implementation of error correction in BCH codes, Non-binary BCH codes. Idempotent and Mattson-Solomon polynomials. Reed-Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes.

Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp - Massey algorithm, Peterson-Gorenstein-Zierler decoder.

UNIT - 3

(12 hours)

Spectral properties of cyclic codes, generation of cyclic codes in frequency domain.

Convolution codes; Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm, stack algorithm-ZJ algorithm method.

Trellis Coded Modulation: Introduction to TCM, concept of coded modulation, mapping by set partitioning, Ungerboeck's TCM design rules, TCM example.

UNIT - 4

(12 hours)

Low-Density Parity-Check Codes: Introduction to LDPC Codes, tanner graphs for linear block codes, Geometric construction of LDPC codes, Decoding of LDPC Codes. Code construction by row and column Splitting, breaking cycles in Tanner graphs. Construction of Gallager LDPC Codes, Random LDPC Codes, Irregular LDPC Codes. Construction of LDPC Codes based on balanced incomplete block designs.

Recommended Readings:

1. Shu Lin, Daniel J. Costello; Error Control Coding- Fundamentals and Applications, 2nd Ed.; Pearson/Prentice Hall, Second Edition
2. Bernard Sklar; Digital Communications : Fundamental & Applications, 2nd Edition; Pearson Education
3. Ranjan Bose; Information Theory, Coding & Cryptography, 2nd Edition; Tata McGraw Hill Publishing Company Limited.
4. Peter Sweeney; Error Control Coding: From Theory to Practice; John Wiley & Sons Ltd.
5. F. J. MacWilliams, N. J. A. Sloane; The theory of error correcting codes; North Holland
6. R.E. Blahut; Theory and Practice of Error Control Codes, Addison Wesley
7. Alvatore Gravano; Introduction to Error Control Codes; Oxford University Press
8. W. Cary Huffman, Vera Pless; Fundamentals of Error Correcting Codes; Cambridge University Press
9. Paul Garrett; Mathematics of Coding Theory: Information, Compression, Error Correction, and Finite Fields; Prentice Hall
10. Todd K. Moon; Error Correction Coding : Mathematical methods and Algorithms; John Wiley and Sons

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Program to generate GF (2^m) field elements.
2. Program to generate Mattson –Solomon polynomial.
3. program to encode and decode data using cyclic code
4. Program to generate BCH code.

5. Program to decode data using Peterson-Gorenstein-Zierler decoder.
6. Program to generate Reed Solomon code.
7. Program to generate Goppa code.
8. program to generate Justen code
9. program to generate alternate code
10. Program to decode data using Wozencraft's sequential decoding algorithm.
11. Program to encode and decode LDPC code

ETC/ECE 8.4.1 SYSTEM ON CHIP

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.1	System on Chip	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to system on Chip Technology.
2. An introduction to inter and intra chip communication in SOC design.
3. An ability to write system C code for a given task.
4. An understanding on synthesis, simulation and co-verification of SOC.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the typical challenges faced in SOC technology.
2. Explain Parameterized SOC design.
3. List the advantages and disadvantages of Block based design over timing driven design methodology.
4. Explain the timing diagram of 8 beat incrementing burst for read operation on AMBA AHB.
5. Implement System C code for half adder.
6. Explain the use of optical interconnects for intra-chip communication in SOC design.
7. Explain System, Block level verification and hardware/software co-verification of SOC design.
8. Compare event based and cycle based simulation.

UNIT - 1

(12 hours)

System on Chip: Technology, Challenges, System On a Chip (SOC) components.

SOC Design: System Design Flow, Waterfall vs. Spiral, Top down vs. Bottom up approach. The Specification Problem: Specification Requirements, Types of Specifications, System Design Process.

Design Methodology: Timing-Driven Design, Block based Design, Platform based Design. Parameterized Systems-on-a-Chip.

UNIT - 2

(12 hours)

System-on-a-chip Peripheral Cores, SoC interconnect centric Architectures:

Introduction to AMBA Bus, AMBA AHB arbitration, AHB Operation, AHB Control signal, AHB transfer timing diagram (read, write, incrementing and burst type transfer). AMBA APB state diagram and APB transfer timing diagram. System level design representations and modelling languages (System C).

UNIT - 3

(12 hours)

Intra-chip communication. Graph partitioning algorithms. Task time measurement. Interconnect latency modelling. Back annotation of lower level timing to high-level models.

UNIT - 4

(12 hours)

Synthesis of SOC components. System Level: System design, System verification. Block Level verification: Block IP, Block level verification. Simulation: Functional Simulation, Testbench Wrappers, Hardware/Software Co-verification. SOC components: emulation, co-simulation, Physical Verification.

Recommended Readings:

1. Wayne Wolf; Modern VLSI Design: SOC Design; Prentice Hall
2. Prakash Rashnikar, Peter Paterson, Lenna Singh; System-On-A-Chip Verification methodology & Techniques; Kluwer Academic Publishers.
3. Alberto Sangiovanni Vincentelli; Surviving the SOC Revolution: A Guide to Platform-based Design; Kluwer Academic Publishers.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. System C code to implement Half adder
2. System C code to implement Full adder
3. System C code to implement Flip flops
4. System C code to implement Subtractor
5. System C code to implement Multiplexer
6. System C code to implement Decoder
7. System C code to implement Counter
8. System C code to implement Encoder
9. System C code to implement Registers
10. System C code to implement Demultiplexer

ETC/ECE 8.4.2 MOBILE PHONE PROGRAMMING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.2	Mobile Phone Programming	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to android programming and app development.
2. An understanding of android application and OS architecture.
3. An ability to write programs for android OS.
4. An ability to design user interfaces for android applications.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain features of Android OS and application development environment.
2. Write basic android applications.
3. Build user interfaces for android applications.
4. Write android applications utilizing hardware sensors.
5. Write android applications utilizing audio and camera sensors.
6. Write android applications incorporating location based services.

UNIT - 1

(12 hours)

Google Android: Background, an Open Platform for Mobile Development, Native Android Applications, Android SDK Features, Introducing the Open Handset Alliance, Introducing the Development Framework.

Android Development: Developing for Android, Developing for Mobile Devices, Android Development Tools.

Creating Applications and Activities: What Makes an Android Application?, Introducing the Application Manifest, Using the Manifest Editor, The Android Application Life Cycle, Understanding Application Priority and Process States, Externalizing Resources, A Closer Look at Android Activities.

UNIT - 2

(12 hours)

Building User Interfaces: Fundamental UI design, Android UI fundamentals, Introducing Layouts, Fragments, Creating new views and Introducing adapters.

Intents, Broadcast Receivers, Adapters, and the Internet: Introducing Intents, Introducing Adapters, Using Internet Resources, Introducing Dialogs, Creating an Earthquake Viewer.

Data Storage, Retrieval, and Sharing: Saving Simple Application Data, Saving and Loading Files, Databases in Android, Introducing Content Providers.

UNIT - 3

(12 hours)

Hardware Sensors: Using Sensors and sensor manager, Monitoring a device's movement and orientation. Introduction to environment sensors.

Maps, Geocoding, and Location-Based Services: Using Location-Based Services, Setting up the Emulator with Test Providers, Finding Your Location, Using the Geocoder, Creating Map Based Activities, Mapping Earthquakes Example.

UNIT - 4

(12 hours)

Audio Video and Camera: Playing audio and video, Manipulating raw audio, using camera for pictures and video.

Bluetooth, Wi-Fi and NFC: Using Bluetooth, Managing Network and Wi-Fi, Wi-Fi Direct, NFC.

Peer-to-Peer Communication: Introducing Android Instant Messaging, Introducing SMS.

Recommended Readings:

1. Reto Meier; Professional Android Application Development; Wiley Publishing Inc.
2. Frank H.P. Fitzek, Frank Reichert; Mobile Phone Programming and its Application to Wireless Networking; Springer.
3. Jerome DiMarzio; Android: A Programmer's Guide; McGraw Hill Inc.
4. Saurabh Jain; Mobile Phone Programming; BPB Publications.
5. Rich Ling; Mobile Phones and Mobile Communication; Polity Press.
6. Ed Burnett; Hello, Android: Introducing Google's Mobile Development Platform; Pragmatic Bookshelf.
7. Rick Rogers, John Lombardo, Zigurd Mednieks; Android Application Development: Programming with the Google SDK; O'Reilly Media.
8. Sayed Y Hashimi, Satya Komatineni; Pro Android: Developing Mobile Applications for G1 and Other Google Phones; Apress Publications.
9. Chris Haseman; Android Essentials; Apress Publications.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. User interfaces
2. To do list application
3. Writing widgets
4. Earthquake monitor
5. Device movement and orientation
6. Location based services

7. Audio
8. Video
9. Bluetooth
10. NFC
11. Wi-Fi Direct
12. Instant Messaging and SMS

ETC/ECE 8.4.3 OPTICAL COMPUTING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.3	Optical Computing	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. Understanding of mathematical and image processing fundamentals for optical computing.
2. An Introduction to Analog Optical Arithmetic and systems.
3. An understanding of Digital Optical Computing Devices and Processing.
4. An understanding of Optical Computing using Matrix operations and Artificial Intelligence.

Course Outcomes:

The student after undergoing this course will be able to:

1. Apply techniques of enhancement and restoration to a given image.
2. Apply Spatial Filtering for Optical Processing of Image.
3. Apply Analog Arithmetic for Optical Processing.
4. Perform recognition using Analog Optical systems.
5. Explain the Digital Optical Computing Devices.
6. Explain POSC system and its application to image processing.
7. Apply Matrix operations for Optical Computing.
8. Explain Artificial Intelligent Computations.

UNIT - 1

(12 hours)

Mathematical and digital image fundamentals: Introduction, Fourier Transform, discrete Fourier transform, basic diffraction theory.

Fourier transform property of lens, sampling and quantization, image enhancement, image restoration.

Linear Optical Processing: Introduction, Photographic film, Spatial filtering using binary filters. Holography, Inverse filtering, Deblurring.

UNIT - 2

(12 hours)

Analog optical arithmetic: Introduction, Halftone processing, Nonlinear Optical Processing, Arithmetic operations.

Recognition using analog optical systems: Introduction, Matched filter, Joint transform correlation Phase-only filter, Amplitude Modulated Recognition Filters, Generalized correlation filter, Mellin transform based correlation.

UNIT - 3

(12 hours)

Digital optical computing devices: Introduction, Nonlinear devices, integrated optics, Threshold devices. Spatial high modulators, Theta modulation devices.

Shadow-casting and symbolic substitution: Introduction, Shadow casting system and Design algorithm, POSC logic operations, POSC multiprocessor, Parallel ALU using POSC, Sequential ALU using POSC

POSC image processing, Symbolic substitutions, Optical implementation of symbolic substitution, Limitations and challenges.

UNIT - 4

(12 hours)

Optical matrix processing: Introduction, Multiplication, Multiplication using convolution, Matrix operation.

Cellular logic architecture, Programmable logic array. Artificial intelligent computations: Introduction, Neural networks, Associative memory.

Optical implementations, Interconnections, Artificial Intelligence.

Recommended Readings:

1. Mohammed A. Karim; Optical Computing: An Introduction; John Wiley & Sons.
2. Anthony VanderLugt; Optical Signal Processing; Wiley
3. Bradley G. Boore; Signal Processing in Optics; Oxford University Press.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Image enhancement and Image restoration.
2. Spatial Filtering for Optical Processing of Image.
3. Inverse filtering.
4. Deblurring.
5. Matched filter.
6. Joint transform correlation Phase-only filter.
7. Amplitude Modulated Recognition Filters.
8. Generalized correlation filter.
9. POSC image processing
10. Multiplication using convolution.
11. Matrix operation
12. Neural networks for optical computing.

ETC/ECE 8.4.4 ADVANCED MOBILE NETWORKS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.4	Advanced Mobile Networks	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of limitations to performance of wireless channel and methods to overcome the same.
2. A thorough understanding of MIMO systems and their performance characteristics.
3. An understanding of OFDM scheme and its advantages and limitations.
4. Introduction to cognitive radio and software defined radio systems.

Course Outcomes:

The student after undergoing this course will be able to:

1. Describe code division multiplexing techniques and its uplink and downlink subsystems.
2. Evaluate capacity of and model AWGN channels.
3. Evaluate performance of MIMO systems.
4. Explain Singular value decomposition based MIMO systems.
5. Evaluate performance of SVD MIMO systems.
6. Explain OFDM schemes and evaluate their performance in AWGN channel.
7. Explain concepts of Cognitive radio and the importance techniques such as spectrum sensing.
8. Explain SDR architectures and their applications.

UNIT - 1

(12 hours)

Review of Spread spectrum technique and CDMA: CDMA Near-Far Problem, RAKE Receiver, Multi-User CDMA Downlink, Multi-User CDMA Uplink and Asynchronous CDMA. Wideband CDMA.

Capacity of wireless channel: AWGN channel capacity, Resources of AWGN channel, linear time invariant Gaussian channel, Capacity of fading channels.

UNIT - 2

(12 hours)

Introduction to MIMO: MIMO System Model and Zero-Forcing Receiver, MIMO MMSE receiver.

Introduction to SVD: SVD based Optimal MIMO Transmission and Capacity, SVD based Optimal MIMO Transmission and Capacity, OSTBCs and Introduction to V-BLAST Receiver, MIMO beamforming.

UNIT - 3

(12 hours)

OFDM and Multi-Carrier Modulation, IFFT Sampling for OFDM, OFDM Schematic and Cyclic Prefix, OFDM Based Parallelization and OFDM Example, Introduction to MIMO-OFDM.

Impact of Carrier Frequency Offset (CFO) in OFDM, PAPR in OFDM Systems, Introduction to SC-FDMA.

UNIT - 4

(12 hours)

Cognitive Radio: Introduction. Spectrum management. Applications of cognitive radio. Cognitive radio network design. Hardware and system design consideration.

Spectrum sensing: white space detection: energy sensing, coherent detection, cyclostationary and autocorrelation based detection.

Software defined radio as a platform for cognitive radio: hardware and software architecture, SDR development and design. Applications of SDR.

Recommended Reading:

1. David Tse and Pramod Vishwanathan; Fundamentals of Wireless Communications; Cambridge University Press
2. Andrea Goldsmith; Wireless Communications; Cambridge University Press.
3. Theodore Rappaport; Wireless Communications: Principles and Practice; Prentice Hall.
4. Ezio Biglieri; MIMO Wireless Communications; Cambridge University Press.
5. John G Proakis; Digital Communications; McGraw Hill
6. Bruce A. Fette; Cognitive Radio Technology, 2nd Edition; Academic Press
7. Ezio Biglieri, Andrea J. Goldsmith, Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor; Principles of Cognitive Radio, 1st Ed.; Cambridge University Press
8. Ekram Hossain, Vijay K. Bhargava; Cognitive Wireless Communication Networks, Springer

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Modelling of a AWGN channel [MATLAB/SIMULINK]
 2. Capacity of a AWGN Channel – BER Analysis [MATLAB/SIMULINK]
 3. Capacity of a Fading Channel – BER Analysis [MATLAB/SIMULINK]
 4. MIMO channel modelling and Performance evaluation [MATLAB/SIMULINK]
 5. Simulation of SVD based MIMO system [MATLAB/SIMULINK]
 6. Simulation of V-BLAST system [MATLAB/SIMULINK]
 7. Simulation of MIMO Beamforming [MATLAB/SIMULINK]
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8. Simulation of OFDM system [MATLAB/SIMULINK]
9. Simulation of MIMO-OFDM system [MATLAB/SIMULINK]
10. PAPR analysis OFDM system [MATLAB/SIMULINK]
11. Simulation of SC-FDMA system [MATLAB/SIMULINK]
12. Simulation and modelling of SC-FDMA system [MATLAB/SIMULINK]
13. Study of software defined radio
14. Spectrum sensing using SDR

ETC/ECE 8.4.5 UNDERWATER ROBOTICS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.5	Underwater Robotics	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of different types of underwater robotic platforms and their applications.
2. An introduction to different mechanical aspects of designing of an underwater vehicle.
3. An understanding of electrical and control aspects of underwater vehicle.
4. An ability to design small underwater vehicles for simple tasks.

Course Outcomes:

The student after undergoing this course will be able to:

1. Describe common types of modern underwater vehicles and the major challenges involved in their design.
2. Explain how the properties of water present new challenges in designing underwater vehicles.
3. Select appropriate building materials to use for design of a small ROV or AUV.
4. Determine the required thrust required to propel a vehicle underwater.
5. Explain the working of propellers and design simple electric thruster systems.
6. Budget for power required for all basic systems necessary in an underwater vehicle.
7. Describe different control and navigation strategies used in underwater vehicles.

UNIT - 1

(12 hours)

Introduction: Types of underwater vehicles, applications of underwater vehicles and technology. Case study of underwater vehicle operations.

Design methodology for underwater vehicles: establishing performance requirements, identifying constraints, listing vehicle systems, generating concept design, fabrication and conducting water trials.

Review of physical properties of water: chemical, electrical, mechanical, acoustic, optical and thermal. Review of properties of water column: Light, temperature, salinity and density.

UNIT - 2

(12 hours)

Structures and materials: Structural performance criteria: strength and stiffness, weight, compatibility with underwater environment. Good structural shapes for underwater vehicles: good shapes for pressure hulls and canisters, frames and fairings. Good structural materials: metals, plastics. Other useful materials.

Buoyancy and stability: brief review of buoyancy. Design for optimal buoyancy. Stability of vehicle under water and surface. Ballast systems.

UNIT - 3

(12 hours)

Basics of moving a vehicle under water: forces on underwater vehicles. Estimating thrust requirements. Review of DC motors. Introduction to propellers and their classification. Simple design of thruster system. Thruster placement criteria and guidelines.

Electrical power budget for underwater vehicles: power for propulsion and other systems. Sample power budget. Electrical power sources: batteries, battery performance, contemporary battery choices.

Transmission and distribution of electrical power: wires, cables and connectors, fuses, tethering. Power distribution systems: case study.

UNIT - 4

(12 hours)

Underwater vehicle modelling: general equations of motion, kinematics, hydrodynamics and hydro statics, actuators and sensors.

Review of Control systems: Linear versus nonlinear control. Linear control: frequency domain and time domain optimal control.

Control system: Trajectory tracking, Path following, Cooperative strategies.

Navigation: Introduction to Navigation: an historical perspective, Problem formulation, Introduction to estimation theory: Kalman filtering. Dead reckoning navigation systems, acoustic-range based navigation.

Localization: Single Range Localization, Terrain and Geomagnetic based navigation.

Case studies.

Recommended Reading:

1. Steven W. Moore, Harry Bohm and Vickie Jensen; Underwater Robotics: Science, Design and Fabrication; Marine Advanced Technology Edu.
2. Antonelli Gianluca; Underwater Robots, 3rd Ed.; Springer Tracts in Advanced Robotics

3. Robert D. Christ and Robert L. Wernli Sr; The ROV Manual: A User Guide for Remotely Operated Vehicles, 2nd Edition; Butterworth-Heinemann

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Study of an autonomous underwater vehicle
2. Study of DC motors and their control
3. Study of a simple electric propulsion system and thrust estimation
4. Study of different battery chemistries and their performance characteristics
5. Implementation of trajectory following algorithm [Matlab]
6. Implementation of simple Kalman filter sensor system
7. Study of solid state IMU
8. Study of underwater acoustic sensor and range estimation
9. Study of depth sensor
10. Study of GPS module
11. Implementation of small ROV
12. Implementation of Autonomous ROV

ETC/ECE 8.4.6 RADAR SYSTEM ENGINEERING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.6	Radar System Engineering	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of Working of Radar using Radar equations.
2. An understanding of Classification of Radars.
3. An understanding of Different types of tracking techniques.
4. An understanding of Radar applications.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the Working of Radar using Radar equations.
2. Analyze the Target detection techniques.
3. Explain the applications of Radar.
4. Analyze the Different types of tracking techniques.

UNIT - 1

(12 hours)

The radar range equation: Radar fundamentals. Derivation of range equation, the search radar equation, jamming and radar range with jamming, radar clutter and radar range with clutter. Radar range with combined interferences sources.

The theory of target detection: Noise and false alarms. Detection of one sample of signal with noise, integration of pulse trains, detection of fluctuating targets, CFAR, Optimum and matched filter Theory. Loss factors in detection.

UNIT - 2

(12 hours)

Targets and interference: Definition of radar cross section. Radar cross section of simple and complex objects, spatial distribution of cross section. Bistatic cross section.

CW and FM Radar: Doppler Effect. CW and FMCW Radar, Airborne Doppler Navigation, Multi frequency CW Radar.

UNIT - 3

(12 hours)

MTI Radar: Delay lines and line cancellers, subclutter Visibility. MTI using range gates and filters, pulse Doppler radar. Non-coherent MTI radar. Application of Digital signal processing to radar system.

Tracking Radar: Different types of tracking techniques. Tracking in range. Tracking in Doppler. Search Acquisition radar. Comparison of Trackers.

UNIT - 4

(12 hours)

Pulse compression: Ambiguity diagram, range resolution, need for pulse compression, Linear frequency modulation pulse compression, Binary Phase-coded pulse compression, Generic compressed signal, comparison of pulse compression waveforms.

Radar Imaging using synthetic Aperture Radar, Height finding radars. Airborne Radars, Secondary surveillance Radars.

Recommended Readings:

1. David K. Barton; Modern radar system analysis; Artech house
2. Fred E. Nathanson; Radar Design Principles; McGraw Hill
3. Cook C. E., Bernfield M.; Radar signals; Academic press
4. Merrill Skolnik; Introduction to Radar Systems, 3rd Edition; Tata McGraw Hill

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Introduction to RADAR (Radio Detection And Ranging)
2. Analysis OF RADAR Range Equation.
3. Analysis of Radar Signal to Noise Ratio against target detection range for different values of target Radar cross section.
4. Analysis of Radar Signal to Noise Ratio against target detection range for different values of Radar peak value.
5. Determination of the velocity of the object moving in the Radar range
6. Understanding the principle of Doppler radar of time and frequency measurement with the help of moving pendulum.
7. Study of the object counting with the help of Radar.
8. Study the effect of different types of materials on Radar receiving or detection.

ETC/ECE 8.4.7 OPTICAL NETWORKING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.7	Optical Networking	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to optical networks architecture, protocols and infrastructure.
2. An ability to design, maintain and troubleshoot optical networks.
3. An understanding of optical network control and management techniques.
4. An introduction to next generation optical networks and their advantages.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain optical network architecture and underlying protocols.
2. Evaluate different topologies & access, routing, scheduling protocols.
3. Design virtual optical network topologies.
4. Identify and manage faults in any optical network.
5. Explain the concepts of packet switching in optical networks.
6. Explain the features, architectures and advantages of next generation optical networks.

UNIT - 1

(12 hours)

First Generation Optical Networks: SONET/SDH, Computer Interconnects, Metropolitan Area Networks, Layered Architecture.

Broadcast and Select Networks: Topologies for Broadcast Networks, Media Access Control (MAC) Protocols, Scheduling Protocols.

UNIT - 2

(12 hours)

Wavelength Routing Networks: The Optical layer, Node Designs, Network design and operation, Routing and Wavelength Assignment.

Virtual Topology Design: Virtual Topology Design Problems, Combined SONET/WDN, Network Design, Integer Linear Programming formulation, Regular virtual topologies.

UNIT - 3

(12 hours)

Control and Management: Network Management Functions, Configuration management, Performance Management, Fault Management, Ring Networks, Mesh Networks.

Access Networks: Network Architecture Overview, Optical Access Network Architecture.

UNIT - 4

(12 hours)

Photonic Packet Switching: OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM Networks, Switch based Networks.

Next Generation Optical Internet Networks: Optical circuit switching, Optical burst switching, MPLS in WDM Networks.

Recommended Readings:

1. Raju Ramaswami, Kumar Sivarajan,; Optical Networks: A Practical Perspective; Morgan Kauffmann
2. C. Siva Ram Murthy, Mohan Guruswamy; WDM Optical Networks: Concepts, Design and Algorithms; Prentice Hall of India.
3. Ulysses Black; Optical Networks: Third Generation Transport Systems; Pearson Education.
4. Biswajit Mukherjee; Optical Communication Networks; McGraw Hill
5. Walter Goralski; Optical Networking and WDM; Tata Mcgraw Hill.
6. Achyut G. Dutta, Niloy K. Dutta, Masahiko Fujiwara; WDM Technologies: Optical Networks; Elsevier

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

Recommended to use simulation software's such as Optinet

1. Performance Evaluation of different Optical network topologies
2. Performance Evaluation of MAC protocols
3. Performance Evaluation of Scheduling protocols
4. Performance Evaluation of routing techniques
5. Design of a optical network
6. Design of virtual topologies
7. Fault simulation and troubleshooting
8. Multiplexing and demultiplexing
9. WDM
10. Optical switching
11. MPLS in optical networks

ETC/ECE 8.4.8 WIRELESS SENSOR NETWORKS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.8	Wireless Sensor Networks	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to wireless sensor network architectures, hardware and applications.
2. An understanding of protocol stack used in wireless sensor networks.
3. An understanding of different strategies used for routing, synchronization, localization etc.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain all the components and subsystems of a wireless sensor networks.
2. Evaluate the trade-off associated with WSN for a given application.
3. Explain the Phy, MAC and network layer protocols of WSN.
4. Explain the different time synchronization, localization and power management strategies used in WSN.
5. Explain the security challenges and applications of WSN.
6. Select appropriate protocols and strategies for use in WSN for a given application.

UNIT - 1

(12 hours)

Introduction to WSN: Applications of WSN. WSN hardware – Sensing subsystem, processor subsystem, communication interfaces. Node examples.

WSN software: Functional aspects of operating systems. Examples of OS for nodes.

Medium access control: Overview, wireless MAC protocols, Characteristics of MAC protocols in sensor networks.

Contention-free MAC protocols: Characteristics, traffic-adaptive medium access, Y-MAC.

UNIT - 2

(12 hours)

Contention-based MAC protocols: Power aware multi-access with signalling, Sensor MAC, Timeout MAC, Pattern MAC, Routine enhanced MAC, Data Gathering MAC.

Hybrid MAC: Zebra MAC, Mobility adaptive hybrid MAC.

Network Layer: Introduction, routing metrics, flooding and gossiping, data centric routing algorithms, proactive routing algorithms, on-demand routing algorithms, hierarchical routing, location based routing algorithms and QoS based routing.

UNIT - 3

(12 hours)

Power Management: Local power management aspects, dynamic power management.

Time synchronization: The synchronization problem. Reasons and challenges in time synchronization. Basics of time synchronization. Time synchronization protocols: reference broadcasts using global sources, lightweight tree based synchronization, timing sync protocol, flooding time synchronization protocol, reference broadcast synchronization, time diffusion synchronization protocol, mini sync and tiny sync.

UNIT - 4

(12 hours)

Localization: Introduction, ranging techniques: ToA, TDoA, AoA, RSSI. Range based localization. Range-free localization. Event driven localization.

Security: Challenges of security in wireless sensor networks. Security attacks in sensor networks, protocols and mechanisms for security.

Recommended Reading:

1. Waltenegus W. Dargie ; Christian Poellabauer; Fundamentals of Wireless Sensor Networks: Theory and Practice; Wiley-Blackwell
2. Feng Zhao, Leonidas J. Guibas,; Wireless Sensor Networks: An Information Processing Approach; Morgan Kaufmann
3. Kazem Sohraby, Daniel Minoli and Taieb Znati; Wireless Sensor Networks: Technology, Protocols, and Applications; Wiley-Blackwell
4. Holger Karl and Andreas Willig; Protocols and Architectures for Wireless Sensor Networks; Wiley-Interscience

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Study of hardware for wireless sensor node [Arduino/raspberry pi]
2. Study of operating system for wireless sensor node [tinyOS etc.]
3. Performance evaluation of Contention-free MAC protocols [Matlab/NS2]
4. Performance evaluation of Contention-based MAC protocols [Matlab/NS2]
5. Performance evaluation of Hybrid MAC protocols [Matlab/NS2]
6. Performance evaluation of flooding and gossiping routing protocols [Matlab/NS2]
7. Performance evaluation of data centric routing protocols [Matlab/NS2]
8. Performance evaluation of proactive routing algorithms [Matlab/NS2]
9. Performance evaluation of location based routing algorithms [Matlab/NS2]

10. Performance evaluation of flooding time synchronization protocols [Matlab/NS2]
11. Performance evaluation of reference broadcast synchronization protocols [Matlab/NS2]
12. Performance evaluation of Range based localization protocols [Matlab]
13. Performance evaluation of Range free localization protocols [Matlab]

ETC/ECE 8.4.9 CONSUMER ELECTRONICS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.9	Consumer Electronics	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of basic characteristics of sound, microphones, loudspeakers, sound recording with its reproduction and public address systems.
2. An understanding of signal generation to test various sections of TV receiver.
3. An introduction to various electronic household and office appliances.
4. An understanding of the concepts and techniques in marketing.

Course Outcomes:

The student after undergoing this course will be able to:

1. Evaluate the choice of appropriate microphones and loudspeakers for recording and reproduction of sound for various environmental surroundings.
2. Design block level and circuit level systems for sound recording and reproduction.
3. Explain the construction and working of the different types of electronic household and office appliances.
4. Identify major risks associated with the circuits in electrical appliances and strategies to mitigate those risks.
5. Develop, evaluate, and implement marketing management in a variety of business environments.

UNIT - 1

(12 hours)

Electro acoustical Transducers: Microphones, Loudspeakers, Pick-up characteristics, specifications and applications.

Sound Recording and Reproduction: Principle and Block schematic of disc recording system, magnetic recording system, optical recording system, compact disc and video recording.

Audio Amplifier and subsystems: Audio mixers, tone controls, Graphic equalizers, Features of Hi-Fi and stereo systems, Dolby system, Public Address systems.

UNIT - 2

(12 hours)

Testing, Alignment & Servicing of Television Receivers: Testing and Alignment of TV receivers, TV Wobblescope, Video Pattern Generators, Marker Generator, Colour bar generator, Vectroscope.

Cable Television: Modern cable TV system, signal processing, Cable TV converter, Satellite Television, Direct broadcast satellite TV.

Digital Television System, Three-dimensional (3D) TV, stereoscopic effect with the aid of special glasses, autostereoscopic methods.

Projection Television: Laser Projection system, LCD projection system.

High Definition television systems: HDTV Systems, HDTV standards and compatibility.

UNIT - 3

(12 hours)

Modern home appliances with electronic control: Microwave oven, washing machine, Air-conditioner, Digital video disc (DVD) player , Blu –Ray Disc, MP3 player, Digital Camera, Remote control, Inverters, UPS, Refrigerator, Iron, Kettle.

Working principle of photocopying, scanner, fax machine, Risograph, solar cell panels and solar water heater. Maintenance and safety measures.

Electricity in home: electric lighting, electric heating, Dangers of Electricity & Safety Precautions.

UNIT - 4

(12 hours)

Marketing planning: Importance of marketing planning, steps involved in marketing planning process scanning the marketing environment and spotting the business opportunities, setting the market objectives.

Marketing strategy: the meaning & significance of marketing strategy, formulating the marketing strategy. Techniques and practices for mass production for reliable production.

Costing: overview of costing and marketing communication.

Entrepreneurship Awareness. Introduction to Energy auditing.

Patents: Introduction to patents.

Recommended Readings:

1. Gupta B. R.; Consumer Electronics; S.K. Kataria & Sons
2. R. G. Gupta; Audio and Video Systems: Principles, Maintenance and Troubleshooting; Tata McGraw-Hill
3. S. P. Bali; Consumer Electronics; Pearson
4. V. S. Ramaswamy, J. Namakumari; Marketing management planning, implementation and control, 2nd Edition; McMillan
5. Tom Duncan; Electronics for Today and Tomorrow; Hodder Education
6. R. G. Gupta; Television engineering and video systems; Tata McGraw-Hill
7. H. S. Kalsi; Electronic Instrumentation; Tata McGraw Hill

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Determination of frequency response of microphone.
2. Determination of frequency response of loudspeaker.
3. Determination of frequency response of crossover networks.
4. To study the working of a microwave oven.
5. Study of Semi-Automatic Washing machine trainer & Fault finding.
6. To study the various components of a Fully Automatic Washing Machine.
7. To study Risograph machine.
8. To study the basic operation of facsimile.
9. To study the various components of sound mixer.
10. To Study Fault simulation and step-by-step Fault finding of B/W TV.
11. To study the basic operation of TV pattern generator
12. To identify and understand different sections and components of mobile phone unit such as ringer section, dialer section, receiver section, transmitter section, etc.
13. To study the basic operation of photocopying machine.
14. To study the various components of Iron and kittle.

**ETC/ECE 8.4.10 ELECTROMAGNETIC INTERFERENCE /
ELECTROMAGNETIC COMPATIBILITY**

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.10	Electromagnetic Interference /Electromagnetic Compatibility	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of EMC standards.
2. An understanding of EMC measurements.
3. An understanding of filtering and shielding.
4. An understanding of CE marking.

Course Outcomes:

The student after undergoing this course will be able to:

1. Explain the different types of EMC standards.
2. Measurement of Conducted Emission, Radiated Emission, Conducted Immunity and Radiated Immunity in a test setup.
3. Design EMC compliant circuits for PCBs.
4. Analyze the methods of grounding and cabling.
5. Explain the CE marking.

UNIT - 1

(12 hours)

Introduction to EMI/EMC: Problem of EMI, effects of EMI, need for EMC, realization of EMC, EMC tests and measurement, elements of EMI, coupling mechanisms, EMI victims.

EMC standards: Contents of EMC standards, types of EMC standards, civilian EMC standards, military EMC standards, introduction to EMC testing.

Indian EMC standards: Indian standards based on IEC.

Conducted emission measurement: Test setup, measurement instrumentation, EMI receiver, receiver stages in detail, units of measurement, conducted emission limits laboratory test setup, EUT configuration, measurement procedure, discontinuous emission or clicks, measurement of clicks, low frequency conducted emission: harmonics, low frequency conducted emission : flicker, test reports.

UNIT - 2

(12 hours)

Radiated emission measurement: Basic test setup, measurement instrumentation, units of measurement, frequency range of measurement, limits, measurement site, measurement procedure, disturbance power measurement, near field emission measurement, test reports.

Conducted immunity/susceptibility testing: General test setup, electrical fast transients / burst (eft/b), surge testing, conducted susceptibility – continuous wave (CW), electrostatic discharge test, evaluation of test results, test reports.

Radiated immunity/susceptibility testing: General test set-up, shielded enclosures, antennas and radiating systems, signal generators and amplifiers, measuring equipment, ancillary equipment, severity levels and frequency ranges, RF electromagnetic field immunity test, magnetic field immunity test, evaluation of test results and test reports.

Uncertainty in EMC testing: Some definitions, uncertainty during emission measurement, uncertainty during immunity testing.

UNIT - 3

(12 hours)

Filtering: Filter types, filter impedance, power line filters, basic elements of filters, power line filter design, other filter components, transient suppression in relays and motors, multistage power line filters, ferrite beads, filters for DC lines, filtered pin connectors, filter installation, filter performance evaluation.

Shielding: Mechanism of radiation, shielding mechanisms, choice of shield material, shielding and equipment enclosures, penetrations and apertures, leakages at seams, shielding for connector openings, ensuring shielding effectiveness over openings –a summary, shielding of plastic enclosures, shields for cables.

PCB design for EMC: Need for EMC design at PCB level, printed circuit board (PCB), board zoning, aspects of a good PCB design, common impedance coupling in PCBs, general considerations for a PCB, multilayer board and high speed PCB design, multilayer concepts, power and ground planes, plane resonance, cavity resonance between planes, fringing fields and their reduction, openings and discontinuities in ground plane, optimizing anti-pad design, routing traces close to antipads, issues with a split plane, traces crossing and changing layers, connection of devices to planes, placement of decoupling capacitors, advantages of multiple decaps, position of devices, layer stacking in boards, high density interconnect (HDI) technology, board segregation, onboard connectors.

UNIT - 4

(12 hours)

Grounding and bonding: Purpose of grounding, standards regarding safety ground, equipment and system grounding, types of grounding, reducing common ground impedance coupling, grounding of cable shields, grounding of faraday shielded transformers, earth pits, electrical bonding.

Cable selection and routing: Cable coupling mechanisms, cable classes, type of cables for a particular class, cable segregation, reducing common mode (CM) coupling, reducing differential mode (DM) coupling, cable routing in an electronics control panel, running cables in an installation, shape of cable ways.

CE marking: The European union background, EU institutional structure, type of legislative actions, CE marking and other marks, essential requirements of CE marking, the new approach to conformity, EU directives, harmonized European standards, the global approach to conformity, notified bodies, the CE marking procedure, modules prescribed by some directives, CE marking -some examples, contents of the declaration of conformity (DOC), contents of the technical documentation, affixing the CE marking, products imported from third countries, market surveillance.

Recommended Readings:

1. Chetan Kathalay; A Practical Approach to Electromagnetic Compatibility -With Introduction to CE Marking (EMC SERIES), 2nd Ed.; EMC Publications.
2. Henry W. Ott; Electromagnetic Compatibility Engineering; John Wiley & Sons.
3. Clayton R. Paul; Introduction to Electromagnetic Compatibility, 2nd Edition; John Wiley & Sons
4. Mark I. Montrose; Printed Circuit Board Design Techniques for EMC Compliance: A Handbook for Designers, 2nd edition; Wiley-IEEE Press
5. Bernhard Keiser; Principles of Electro-magnetic Compatibility; Artech House, Inc.

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. To Study Conducted emission measurement
2. To Study Radiated emission measurement
3. To Study Conducted immunity/susceptibility testing
4. To Study Radiated immunity/susceptibility testing
5. To Study Filtering
6. To Study Shielding
7. To Study PCB design for EMC
8. To Study Grounding and bonding
9. To Study Cable selection and routing
10. To Study CE marking

ETC/ECE 8.4.11 INTRODUCTION TO DEEP NEURAL NETWORKS

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.11	Introduction to Deep Neural Networks	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to the basic concepts of applied mathematics needed to understand various paradigms in deep learning.
2. A solid understanding of the most important general principles of machine learning.
3. The knowledge of modern deep learning technologies and approaches.
4. The basic understanding of recurrent neural network for the processing of temporal sequences.

Course Outcomes:

The student after undergoing this course will be able to:

1. Apply the concepts mathematics in the context of artificial intelligence.
2. Apply optimization and training methodologies for deep machine learning.
3. Determine hyper parameters for learning algorithms.
4. Implement deep neural networks for given applications.
5. Demonstrate the use of convolutional and recurrent neural networks for optimization of feed forward deep network models.

UNIT - 1

(12 hours)

Introduction to Deep Learning, Applications.

Applied Math and Machine Learning Basics: Linear Algebra: Scalars, Vectors, Matrices and Tensors, Multiplying Matrices and Vectors, Identity and Inverse Matrices, Linear Dependence and Span, Norms, Special Kinds of Matrices and Vectors, Eigen-decomposition, Singular Value Decomposition, The Moore-Penrose Pseudoinverse, The Trace Operator, The Determinant, Example: Principal Components Analysis.

Numerical Computation: Overflow and Underflow, Poor Conditioning, Gradient-Based Optimization, Constrained Optimization, Example: Linear Least Squares.

UNIT - 2

(12 hours)

Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent.

Deep Networks: Modern Practices: Deep Feedforward Networks, Example: Learning XOR, Back-Propagation and Other Differentiation Algorithms.

UNIT - 3

(12 hours)

Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates.

Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised.

UNIT - 4

(12 hours)

Sequence Modeling: Recurrent and Recursive Nets, Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks

The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs, Optimization for Long-Term Dependencies, Explicit Memory.

Recommended Readings:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville; Deep Learning; MIT Press
2. Daniel Granger; Deep Learning Neural Networks Design and Case Studies; World Scientific
3. Li Deng, Dong Yu; Deep Learning Methods and Applications; Microsoft Research
4. Nikhil Buduma, Nicholas Locascio; Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms; O'Reilly Media
5. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy; Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case ; MIT Press
6. Josh Patterson, Adam Gibson; Deep Learning: A Practitioner's; O'Reilly Media

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Supervised Learning Algorithms
 2. Unsupervised Learning Algorithms
 3. Feedforward back propagation Networks
 4. Deep Feedforward Networks
 5. Optimization for Training Deep Models
 6. Algorithms with Adaptive Learning rates
 7. Convolutional Networks
 8. Bidirectional Recurrent Neural Networks
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9. Deep Recurrent Neural Networks

10. Recursive Neural Networks

ETC/ECE 8.4.12 MEDICAL IMAGING

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.12	Medical imaging	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An introduction to X-ray and computer tomography imaging.
2. An introduction to Ultrasound techniques for medical imaging.
3. An understanding of nuclear medicine.
4. An introduction to nuclear imaging techniques and safety considerations thereof.

Course Outcomes:

The student after undergoing this course will be able to:

1. Describe interaction of radiation and matter and medical imaging informatics.
2. Demonstrate knowledge of X-ray physics, related math and the precautions while working with X-rays.
3. Explain working of ultrasound techniques.
4. Explain Magnetic resonance imaging technique and its application.
5. Describe different nuclear imaging techniques and its effects.
6. Define safety parameters and methods for radiation protection in diagnostic X-ray imaging and in nuclear medicine.

UNIT - 1

(12 hours)

Introduction to medical imaging, Interaction of radiation and matter, Image quality, medical imaging informatics.

Diagnostic Radiology: X-ray Production, X-ray tubes and X-ray generators, Radiography, Mammography.

UNIT - 2

(12 hours)

Computed Tomography, X-ray Dosimetry in projection imaging and computed tomography.

Magnetic Resonance Basics: Magnetic field, Nuclear magnetic characteristics, tissue contrast, image acquisition.

Ultrasound: Ultrasound transducers, ultrasound beam properties, image data acquisition, Doppler ultrasound, ultrasound image quality and artefacts.

UNIT - 3

(12 hours)

Nuclear Medicine: Radioactivity and nuclear transformation, Radionuclide Production, Radiopharmaceuticals and internal dosimetry.
Radiation detection and measurement, Nuclear imaging – Scintillation Camera, Emission Tomography.

UNIT - 4

(12 hours)

Radiation Biology: Interaction of radiation with tissue, Molecular and cellular response to radiation, Radiation effects.

Radiation Protection: Sources of Exposure to ionizing radiation, Personnel Dosimetry, radiation detection equipment in radiation safety, fundamental principles and methods of exposure control, structural shielding of imaging facilities, radiation protection in diagnostic and interventional X-ray imaging, Radiation protection in nuclear medicine, prevention of errors, management of radiation safety program.

Recommended Readings:

1. Jerrold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt, Jr. John M. Boone; The Essential Physics of Medical Imaging, 3rd Edition; Lippincott Williams and Wilkins
2. Nadine Barrie Smith, Andrew Webb; Introduction to Medical Imaging-Physics, Engineering and clinical application; Cambridge Text in Biomedical Engineering
3. Paul Suetens; Fundamentals of Medical Imaging, 2nd Edition, Cambridge University Press
4. J. G. Webster; Medical Instrumentation – Application & Design; John Wiley & Sons
5. Kirk Shung, Michael B, Smith, Benjamin M W Tsui; Principles of medical imaging; Academic press
6. Zhong Hicho, Manbir Singh; Fundamentals of Medical imaging; John Wiley
7. Peter Josefell, Edward Sudney; Nuclear Medicine introductory Text; William Blackwell Scientific Publishers London
8. G.T. Herman; Imaging reconstruction from projections - Implementation and applications; Topics in Applied Physics vol.32 Springer Verlag

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Study of X ray tubes
2. Study of X ray Generators
3. X ray imaging
4. X ray image acquisition
5. X ray image enhancement
6. Ultrasound transducers
7. Doppler ultrasound
8. Ultrasound image acquisition
9. Ultrasound image enhancement
10. Study of nuclear imaging
11. Nuclear imaging image acquisition
12. Nuclear imaging image enhancement

ETC/ECE 8.4.13 STATISTICAL THEORY OF COMMUNICATION

Subject Code	Name of the Subject	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Th Duration (Hrs)	Marks					
						Th	S	TW	O	P	Total
ETC/ECE 8.4.13	Statistical Theory Of Communication	3	1	2	3	100	25	--	25	--	150

Course Objectives:

The subject aims to provide the student with:

1. An understanding of coding methods in communication.
2. An understanding of communication channel and measurements of channel parameters.
3. An understanding of noises and noise measurement in communication.
4. An understanding of Radar system.

Course Outcomes:

The student after undergoing this course will be able to:

1. Analyze the coding methods.
2. Calculate channel capacity for communication channel.
3. Analyze various noises in the communication system.
4. Estimate unknown parameters in communication systems.

UNIT - 1

(12 hours)

Information Measure: Fundamental problem of communication. Definition and properties of discrete entropy, Joint and conditional entropies. Entropy in the continuous case. Noiseless coding; the problem of unique decipherability, instantaneous codes, Kraft-McMillan inequality. The noiseless coding theorem. Construction of optimal codes (Huffman's method).

UNIT - 2

(12 hours)

Noisy Coding. The discrete memory less channel. Mutual information and channel capacity. Classification of channels. Calculation of channel capacity. Decoding schemes. Shannon's fundamental theorem. Capacity of a band limited Gaussian channel.

UNIT - 3

(12 hours)

Optimum Linear systems. Digital communication in presence of additive white Gaussian Noise. The correlation Receiver. Matched Filter for Additive Non-White Gaussian Noise: The pre-whitening approach. Linear Estimation using least mean square error criterion: Wiener filter, testing of statistical hypothesis. Likelihood ratio tests Bayes, Neyman-

Pearson and mini-max test, probability of error. Receiver operating characteristics, optimum reception of known binary signals in Gaussian noise.

UNIT - 4

(12 hours)

Parameter Estimation: Estimation of Unknown Parameters, Random and Deterministic; ML, MSE and MAP estimates. Applications to RADAR: Block Diagram of a pulsed RADAR system, The RADAR Equation, Detection of steady point targets, estimation of the range and velocity of steady point targets.

Recommended Readings:

1. J. B. Thomas; Statistical Theory of Communication; Wiley
2. M. B. Srinath, P. K. Rajasekaran; An Introduction to Statistical Signal Processing with Applications; Wiley
3. R.B. Ash; Information Theory; Wiley
4. D. J. Sakrison; Communication Theory; Wiley
5. H. L. Vantrees; Detection, Estimation and modulation Theory; Wiley

List of Experiments:

(At least 8 experiments should be conducted from the list of experiments.)

1. Signal Sampling and reconstruction
2. Time Division Multiplexing
3. AM Modulator and Demodulator
4. FM Modulator and Demodulator
5. Pulse Code Modulation and Demodulation
6. Delta Modulation and Demodulation
7. Line coding schemes
8. FSK, PSK and DPSK schemes (Simulation)
9. Error control coding schemes - Linear Block Codes (Simulation)
10. Communication link simulation
11. Equalization – Zero Forcing & LMS algorithms(simulation)