# 3rd Semester B Tech ECE
# Syllabus

| **Subject: Electronics-I (Code: ECT201)** | **Year & Semester:** B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester | | **Total Course Credit: 4** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **3** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | End-Term | | |
| | 30 Marks | 10 | 60 Marks | | |

**Objectives:** Familiarize with the basic semiconductor devices and to know about the working and performance of semiconductor devices like diodes, BJTs and FETs. To understand DC analysis and AC models of semiconductor devices.

**Course Outcomes:**

**CO1** Familiarization with basic semiconductors
**CO2** Understanding the behavior of different types of diodes at circuit level
**CO3** Analyze and study the behavior of different types of transistors
**CO4** Analysis of low frequency and high frequency amplifiers

**Details of the Syllabus:**

| **S. No.** | **Particulars** |
|---|---|
| 1 | **Introduction to Semiconductors:** Intrinsic and extrinsic semiconductors transport mechanism of charge carriers, electric properties, Hall effect etc |
| 2 | **P-N junction diode: Current components in p-n junction,** Characteristics-piece wise linear approximation, Temperature dependence, Diode capacitance, and switching times, diode circuits' half wave, full wave rectifiers, clipping clamping circuits etc. Circuit operations and applications of Zener, avalanche, Schottky, Photo and tunnel diodes. |
| 3 | **BJT: Operation and characteristics,** Ebers- Mollmodel, CE,CB and CC configuration input, output characteristics and graphical analysis of basic amplifier circuits, Biasing and Bias stability, Low frequency, h-parameter model, Analysis and Design of transistor amplifier circuits using h-parameters. High frequency hybrid–pi model, analysis and design of transistor amplifier circuits at high frequencies. Multistage amplifiers, phototransistors, Transistor as a switch |
| 4 | **JFET's Operationand characteristics,** model Application at low and high frequency, amplifiers, Switching circuits MOSFET types, Operation and characteristics |
| 5 | **Introduction to IGBT.** |

**Recommended Books:**

| **S.No** | **Name of Book** | **Author** |
|---|---|---|
| 1. | Fundamentals of Microelectronics | Behzad Razavi |
| 2. | Analysis and Design of Analog Integrated Circuits | Gray, Hurst, Lewis, Meyar |
| 3. | Electronic Devices and Circuits | Millman, Halkias, and SatyabrataJ it |
| 4. | Analog Electronics | Maheshwari and Anand |
| 5. | Electronic Devices & Circuits | Allan Mottershed |
| 6. | Microelectronics | Sedra & Smith |

| | | | | |
|---|---|---|---|---|
| **Subject:** Network Analysis (Code: ECT202) | **Year & Semester:** B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester | **Total Course Credit: 4** | | |
| | | **L** | **T** | **P** |
| | | **3** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | | End Term |
| | 30 Marks | 10 Marks | | 60 |

**Objectives:** To introduce students with the basic concepts of Electric Circuit theory and familiarize them how to analyze the circuits to get transits as well as steady state response of the system with emphasis on analysis in frequency domain using various techniques.

**Course Outcomes:**

**CO1** Comprehensive understanding of difference and network theorems
**CO2** Analysis of transient and steady state response of circuits
**CO3** Analysis of frequency response of circuits
**CO4** Analysis of 2-port network and filters

**Details of the Syllabus:**

| S. No. | Particulars |
|---|---|
| 1 | **Development of the circuit Concept:** Charge and energy, capacitance, inductance and resistance parameters in the light of field and circuit concepts, approximate realization of a physical system as a circuit. |
| 2 | **Conventions for describing networks:** Reference directions for currents and voltages, conventions for magnetically coupled circuits, Circuit topology, KVL and KCL equations, Source transformation, Dual networks. |
| 3 | **First order differential equation:** Differential equations as applied in solving networks, Application of initial conditions, evaluating initial conditions in networks. |
| 4 | **Laplace Transformations:** Solution of Network problems with Laplace transformation, Heavisides expansion theorem. |
| 5 | **Wave form analysis and synthesis:** The unit step, ramp and impulse functions and their Laplace transforms, Initial and final value theorems, convolution integral, convolution as summation. |
| 6 | **Network theorems and impedance functions:** Complex frequency, transform impedance and transform circuits, series and parallel combinations of elements, Fosters reactance theorem and reciprocity theorem. |
| 7 | **Network Functions- Poles and Zeros**: Ports or terminal pairs, Network functions for one port and two port networks (ladder and general networks), Poles and Zeros of network functions, Restriction on pole and zero locations for driving point and transfer functions. Time domain behavior from pole zero plot. |
| 8 | **Two port parameters:** Relationship of two port parameters, Admittance, impedance, transmission and hybrid parameters, Relationship between parameter sets, Parallel connection of two port Networks, Characteristics impedance of two port networks. |
| 9 | **Filters** : Filter fundamentals – pass and stop band, filter classification, constant K & m derived filters, Behavior of characteristic impedance over pass & stop bands, design of filters. |

**Recommended Books:**

| **S. No.** | **Name of the Book** | Author |
|---|---|---|
| 1 | Network Analysis | M. E. Van Valkenberg |
| 2 | Network Analysis and Synthesis | F. F. Kuo |
| 3 | Network Analysis and Synthesis | K. M. Soni |
| 4 | Network and Systems | Roy Choudhury |

| | | | | |
|---|---|---|---|---|
| **Subject:** Signals and Systems (Code: ECT203) | **Year & Semester:** B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester | **Total Course Credit: 4** | | |
| | | **L** | **T** | **P** |
| | | **3** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | | End Term |
| | 30 | 60 Marks | | 60 |

**Objectives:** To acquire knowledge and become familiar with various types of signals, their use in various types of systems with emphasis in time domain.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Generate and characterize various continuous and discrete time signals and perform basic operations on signals. |
| **CO2** | Classify systems based on their properties and determine the response of LTI systems using convolution. |
| **CO3** | Analyze the spectral characteristics of continuous-time periodic and aperiodic signals using Fourier analysis. |
| **CO4** | Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems. |

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1 | **Introduction to Signals & Systems:** Definition of a signal & System, Classification of Signals, Basic operations on Signals, Elementary Signals, Systems viewed as interconnection of operations, Properties of Systems, Sampling theorem, Graphical & Analytical proof of Band-limited signals, Impulse Sampling, Aliasing |
| 2 | **Linear Time Invariant (LTI) Systems:** Time-Domain representation &Characterization of LTI systems, Impulse response representation, Convolution integral & Convolution sum, properties of LTI systems, Stability criteria for LTI systems, Elements of Continuous time & Discrete-time LTI systems. |
| 3 | **Fourier Representation of Signals:** Fourier representation of Signals, Continuous-time Fourier series and their properties, Application of Fourier series to LTI systems, Fourier Transform &its properties, Applications of Fourier Transform to LTI systems, Discrete-time Fourier Transform & its properties. Circular Convolution, Relationship to other transforms. |
| 4 | **Laplace Transform:** Introduction &Definition, Region-of- convergence, Properties of Laplace transform, Inverse Laplace Transform, Applications of Laplace Transform in analysis of LTI systems, Unilateral Laplace transform & its applications to solved differential equations, Analysis of Electric circuits. |
| 5 | **Z-Transform:** The Z -Transform, Region-of-convergence, Properties of Z-Transform, Inverse Z Transform, Z-Transform Analysis of Discrete-time LTI systems, Unilateral Z-transform & its applications to LTI systems described by difference equations. |

**Recommended Books:**

| S. No. | Name of the Book | Author |
|---|---|---|
| 1 | Signals &Systems | Haykins |
| 2 | Signals &Systems | Ziemer |
| 3 | Signals & Systems | Sanjay Sharma |
| 4 | Signals Analysis | A Papoulis |
| 5 | Schaum's Series Signals &Systems | HSU |

| | | | | |
|---|---|---|---|---|
| **Subject:** Data Structures (Code: CST205) | **Year & Semester:** B. Tech. Electronics and Communication Engineering 2nd Year & 3rd Semester | **Total Course Credit: 3** | | |
| | | **L** | **T** | **P** |
| | | **2** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | | End Term |
| | 30 Marks | 10 Marks | | 60 |

**Objectives:** To understand efficient storage mechanisms of data for an easy access, design and implementation of various basic and advanced data structures**.**

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Understand the basic concepts of data, structures and pointers. |
| **CO2** | Understand and implement basic data structures such as arrays, linked lists, stacks and queues and to assess how the choice of data structures and algorithm design methods impacts the performance of programs. |
| **CO3** | Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data and recursion. |
| **CO4** | Implementing hash table and understanding different hashing techniques, Solve problems involving graphs, trees and heaps. |

**Details of the syllabus:**

| S. No. | Particulars |
|---|---|
| 1 | **Introduction:** Basic concept of data, structures and pointers. |
| 2 | **Arrays:** Representation, implementation, polynomial representation. Limitations. |
| 3 | **Strings:** Representation, String operations, Implementing String. h library functions. |
| 4 | **Linked List:** Static and dynamic implementation. Single, double, circular, multiple linked lists. |
| 5 | **Stacks:** Recursion and Stacks. Static and dynamic implementation. Expression evaluation. Infix, postfix expressions, multiple stacks. |
| 6 | **Queues:** Static and dynamic implementation, circular queues, and implementation. |
| 7 | **Hash Tables:** Hash tables implementation. Hashing techniques, single, double. |
| 8 | **Storage Management:** Memory Management techniques, garbage collection. |
| 9 | **Trees:** Binary trees, binary search trees, static and dynamic implementation. Tree operations, insert, delete, and search. |
| 10 | **Heaps:** Implementation, sorting etc. |
| 11 | **Sorting and Searching:** Different sorting techniques. Insertion sort, selection sort, bubble sort, radix sort, quick sort, merge sort, heap sort. |
| 12 | **Graphs:** Representation of graphs, BFS, DFS sort. Graph Algorithms. |

**Recommended Books**

| S. No. | Name of the Book | Author |
|---|---|---|
| 1 | Data Structures | Rajni Jindal |
| 2 | Data Structures | Schaum's Series |
| 3 | Data Structures | Knuth |
| 4 | Data Structures | Farouzan |
| 5 | Data Structures using C and C++ | Langsam, A |

| **Subject:** Mathematics-III (Code: MAT204) | **Year & Semester:** B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester | | **Total Course Credit: 4** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **3** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | End Term | | |
| | 30 Marks | 10 Marks | 60 | | |

**Objectives:** To understand various transformation techniques and their use to solve boundary value problems, and various linear differential equations.

**Course Outcomes:** At the end of the course, the student will be able to:

| | |
|---|---|
| CO1 | Evaluate Laplace and Inverse Laplace transforms of various functions and related problems. |
| CO2 | Evaluate Fourier and Inverse Fourier transforms of various functions and related problems. |
| CO3 | Apply the methods of Laplace and Fourier transforms in solving ODE, PDE and Integral equations. |
| CO4 | Evaluate Z-transforms and Inverse Z- transforms of various functions and apply these concepts to solve difference equations. |

**Details of Course**

| **Unit** | **Particulars** |
|---|---|
| I | **Laplace Transforms:** Laplace transform, Condition for the existence of Laplace transform, Laplace transform of some elementary functions, Properties of Laplace transform, Differentiation and Integration of Laplace transform. Laplace transforms of periodic functions and other special functions, Unit Impulse function, Dirac-delta function and its Laplace transform, Heaviside's expansion theorem, Inverse Laplace transform, Initial and Final value theorems, Convolution theorem and properties of Convolution, Evaluation of definite integrals by Laplace transforms, Use of Laplace transforms in the solution of linear differential equation. |
| II | **Fourier Transforms:** Definition of Fourier transform, Fourier Integral Theorem, Properties of Fourier transform, Fourier sine and cosine, Convolution Theorem, Parseval's Identity for Fourier transform, Solution of Integral equations, Evaluation of definite integrals using Fourier transform, Applications of Fourier transforms to Ordinary and Partial differential equations. |
| III | **Z-Tranforms:** Definition, Linearity property, Z- transform of elementary functions, Shifting theorems, Initial and Final value theorems, Convolution theorem, Inversion of Z- Transforms, Use of Z- transforms in solving difference equations. |

**Recommended Books:**

| | |
|---|---|
| **Text Books** | 1. L. Debnath and D. Bhatta,*Integral Transforms and their Applications*, 2ndEdition, CRC press, (2007).<br>2. M. R. Spiegel, *Schaum's Outlines Laplace Transforms*, Tata Mc-Graw Hill Edition, (2005). |
| **Reference Books** | 1. R.K Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008).<br>2. I.N. Sneddon, *The use of Integral Transforms*, 2nd Edition, Mc-Graw Hill Pub.,(1972). |

| **Subject: Electronics Engineering Materials (Code: MMT210)** | **Year & Semester: B. Tech. Electronics and Communication Engineering 2nd Year & 3rd Semester** | | **Total Course Credit: 4** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **3** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | End Term | | |
| | 30 Marks | 10 | 60 Marks | | |

**Objectives:** To familiarize with the basic principles related to the physics of materials relevant to electrical, electronic, magnetic and optical properties.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | To understand the correlation of material properties with crystal structure, composition and nature of bonding |
| **CO2** | Understanding the growth of semiconductor materials and semiconductor properties |
| **CO3** | Understanding about electronic, magnetic , dielectric and optical properties of materials and their applications |
| **CO4** | Understanding the state of the art new materials for electronic applications |

**Details of the syllabus:**

| **S. No.** | **Particulars** |
|---|---|
| 1 | **Crystal Structure:** Crystalline state, Bravais lattices, Miller indices, reciprocal lattice, common crystal structures, interference phenomenon, Bragg's diffraction, crystal imperfections. |
| 2 | **Crystal Growth**: single crystal growth techniques, zone refining technique (specifically for semiconductors) |
| 3 | **Semiconductor materials:** Their properties and applications, Binary, Ternary and Quaternary semiconductors, Physical parameters of semiconductors. |
| 4 | **Magnetism:**Magneticpropertiesofmaterials,diamagnetism,para-magnetism,a n d ferromagnetism, Blackwell, domain dimensions, anti-ferromagnetism, and ferromagnetism, ferrites, Magnetic Materials: Fe, Si, Ni, Co, Hard magnetic materials. |
| 5 | **Dielectric materials:** Electric &optical properties, polarization in static and alternating field, piezoelectricity, polarizability and dielectric constant, optical transition in solids, absorption and emission of radiation. Ferroelectric materials |
| 6 | Materials for resistors, capacitors and inductors, properties and application of plastic materials. |
| 7 | Low Temperature and High Temperature Materials |
| 8 | Superconductivity and Superconductors |
| 9 | Introduction to material characterization techniques |

**Recommended Books**

| **S. No.** | **Name of the Book** | **Author** |
|---|---|---|
| 1 | Introduction to Solid State physics | Kittle |
| 2 | Solid state Physics | Dekker |
| 3 | Physical Met. Principles | Reedhill |
| 4 | Material Science and Engineering | Raghavan |
| 5 | Electronic Processes in Materials | Azaroff |

| **Subject: Data Structures Laboratory (Code: CSL 206)** | **Year & Semester: B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester** | **Total Course Credit: 1** | | |
|---|---|---|---|---|
| | | **L** | **T** | **P** |
| | | **0** | **0** | **2** |
| **Evaluation Policy** | Mid-Term/Class Assessment | Final-Term | | |
| | (40 Marks) | (60 Marks) | | |

**Objectives:** To develop programs for: Understanding Structures and Pointers, Implementation of Stacks and Queues using arrays and link list Implementation of sorting algorithms & hash tables

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Be able to design and analyze the time and space efficiency of the data structure |
| **CO2** | Understand and apply different data structure such as stacks, queues, trees, etc. to solve varied computing problems |
| **CO3** | Different searching and sorting techniques; and their applications |
| **CO4** | Practical knowledge on the applications of data structures, and to solve a real world problem |

**Details of the syllabus:**

| **S. No.** | **Particulars** |
|---|---|
| 1 | Basic concepts of data, linear lists, strings, arrays and orthogonal lists, representation of trees & graphs, storage systems, Arrays, Recursion, Stacks, Queues, Linked lists, Binary trees, General Trees, Tree Traversal, Symbol Table and Searching Techniques, Sorting Techniques, graphs. |
| 2 | Implement singly and doubly linked lists. |
| 3 | Represent a polynomial as a linked list and write functions for polynomial addition. |
| 4 | Implement stack and use it to convert infix to postfix expression |
| 5 | Implement array-based circular queue and use it to simulate a producer consumer problem. |
| 6 | Implement an expression tree. Produce its pre-order, in-order, and post-order traversals. |
| 7 | Implement binary search tree. |
| 8 | Implement priority queue using heaps |
| 9 | Implement hashing techniques |
| 10 | Implement various sorting techniques as taught in class. |
| 11 | Implement Dijkstra's algorithm using priority queues |
| 12 | Implement Prim's and Kruskal's algorithms |

| | | | | |
|---|---|---|---|---|
| **Subject:** Electronics Laboratory (Code: ECL204) | **Year & Semester:** B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester | **Total Course Credit: 1** | | |
| | | **L** | **T** | **P** |
| | | **0** | **0** | **2** |
| **Evaluation Policy** | Mid-Term/Class Assessment | Final-Term | | |
| | (40 Marks) | (60 Marks) | | |

**Objectives:** To acquire knowledge and become familiar with the different characterization techniques to analyze, synthesize basic electronic networks to get desired output.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Familiarization and working of different electronic equipment |
| **CO2** | Choose testing and experimental procedures on different types of electronic circuit and analyze their operation under different operating conditions |
| **CO3** | Identify relevant information to supplement the Electronics I course |
| **CO4** | Experimental characterization of diodes , BJT, and FETs |

**Details of the syllabus:**

| S. No. | Particulars |
|---|---|
| 1 | Study of CRO-Measurement of Voltage, frequency and Phase of a given waveform |
| 2 | To obtain diode characteristics. Half wave and a full wave rectifier and to study their performance. Clipping and Clamping circuits |
| 3 | Comparison of Zener diode and Avalanche diode characteristics and to use Zener diode as a voltage regulator. |
| 4 | To obtain transistor characteristics in the following configurations.<br>e) Common base<br>f) Common emitter |
| 5 | To assemble a CE amplifier and observe its performance |
| 6 | To obtain frequency response of an RC coupled CE amplifier |
| 7 | To obtain JFET characteristics and to observe performance of a source follower |
| 8 | JFET as a voltage variable resistor |
| 9 | Transfer and Output Characteristics of a MOSFET |

# 4th Semester B Tech ECE
# Syllabus

| **Subject:** Electronics II (Code: ECT250) | **Year & Semester: B**. Tech Electronics & Communication Engineering 2nd Year & 4thSemester | | **Total Course Credits:4** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | 3 | 1 | 0 |
| **Evaluation Policy** | **Mid-term** | **Class Assessment** | **End Term** | | |
| | 30 | 10 | 60 | | |

**Objectives:** To make students aware about the effects of feedback in electronic amplifiers, to analyze the amplifiers under different feedback configuration, to design different sinusoidal oscillators; To understand operational amplifier basics and its application in electronics, to design various wave shaping circuits, to understand power amplifiers and design power supplies.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Develop the concept of feedback analysis of different feedback topologies |
| **CO2** | Analysis and design of sinusoidal oscillators and multi vibrators |
| **CO3** | Understanding the basic concept of power amplifiers and IC regulated power supplies |
| **CO4** | Understanding basics of op-amps, its linear and non-linear applications and circuits of basic gates using various logic families |

**Details of the syllabus:**

| **S. No** | **Particulars** |
|---|---|
| 1 | **Feedback Basics :** Negative feedback, Effect of negative feedback on the performance of amplifiers e.g. on Gain, Bandwidth. Types of feedback amplifiers, current shunt, current series, voltage shunt, and voltage series feedback. Analysis of feedback amplifiers circuits |
| 2 | **Sinusoidal Oscillators:** Basic operations, Positive feedback, analysis of general oscillator circuit, Barkhausen's criteria, various types of oscillator circuits and their analysis, Design of practical oscillator circuits. |
| 3 | **Power Amplifiers and Power Supplies :** Classification of power amplifiers, Class A, Class B, Class AB and Class C power amplifiers; analysis and design. Power supplies and IC regulators |
| 4 | **Operational Amplifiers:** Operational amplifiers stages, Differential amplifier, CMRR, Cascade amplifier, Ideal and practical operational amplifier characteristics and properties OP amp applications, inverting and non inverting amplifiers, difference amplifier, summer differentiator and integrator, rectifiers etc. OP-AMP in analog computation. Frequency response, Gain Bandwidth product, Signal to noise ratio Active Filters |
| 5 | **Multivibrators and Wave Form Generators:** Bi-stable, Monostable and astable multivibrator circuits, and their analysis. Wave form generators, triangular and square wave generators. |
| 6 | **Logic families:** DTL, TTL, ECL, RTL |

**Recommended Books:**

| | | |
|---|---|---|
| 1 | Fundamentals of Microelectronics | Behzad Razavi |
| 2 | Analysis and Design of Analog Integrated Circuits | Gray, Hurst, Lewis, Meyar |
| 3 | Electronic Devices and Circuits | Millman, Halkias, and SatyabrataJit |
| 4 | Analog Electronics | Maheshwari and Anand |
| 5 | Electronic Devices & Circuits | Allan Mottershed |
| 6 | Microelectronics | Sedra & Smith |

| **Subject: Digital Electronics and Logic Design (Code: ECT251)** | **Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester** | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **2** | **1** | **0** |
| Evaluation Policy | Mid Term | Class Assessment | End Term | | |
| | 30 | 10 | 60 | | |

**Objectives:** To study number systems, simplification and implementation of digital functions,
design & analysis of various combinational and sequential circuits, memory organization & its implementations.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | To represent numbers in different number systems, binary codes and to perform their conversions and arithmetic operations. |
| **CO2** | To understand the Boolean algebra/theorems, K-Map and Q-M method and minimization of logic function using them, design and analysis of various combinational circuits. |
| **CO3** | To understand lathes and flip flops and designing various sequential circuits using various flip flops. |
| **CO4** | To understand basic concept of PLA, PAL, ADC, DAC, IEEE standards and notations |

**Details of the syllabus:**

| **S. No.** | **Particulars** |
|---|---|
| 1 | Review of Binary, octal and hexadecimal number systems. Various types of codes |
| 2 | Boolean algebra and Boolean theorems |
| 3 | Logic gates and implementation of Boolean functions with different types of logic gates. Circuit equivalence |
| 4 | Simplification techniques and minimization by map methods. Tabular method |
| 5 | Combination logic and arithmetic circuits. Encoders and Decoders, Multiplexes and Demultiplexes |
| 6 | Sequential circuits– statediagrams and statetables, design and analysis of flip flops, registers, counters, Synchronous and Asynchronous operation of sequential circuits. State Machines, Analysis and Design using State Machines |
| 7 | Analog to Digital converter, Digital to Analog converter |
| 8 | Latches and memory organizations. ROM's, EPROM's and RAM's Dynamic and Static |
| 9 | Introduction to PLA's, FPGA |
| 10 | IEEE standards and notations. |

**Recommended Books**

| | | |
|---|---|---|
| 1 | Digital System Design An Integrated Approach | Uyemura |
| 2 | Digital Logic & Computer Design | M Morris Mano |
| 3 | Digital Electronics | Gupta &Singhal |
| 4 | Digital principles and applications | A. P.Malvino |
| 5 | Switching Circuits | Marcus |

| **Subject:** Communication Systems-I (Code: ECT252) | **Year & Semester:** B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester | | **Total Course Credit:3** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **2** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | End Term | | |
| | (30 Marks) | (10 Marks) | 60 | | |

**Objectives:** To analyze various analog modulation & demodulation schemes, to understand operation of AM & FM radio receivers, to perform noise analysis of AM & FM systems, to understand the basics of random process.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Understanding of basic principles of communication system and Fourier analysis of different signals. |
| **CO2** | To understand and analyze various analog modulation and demodulation schemes |
| **CO3** | To understand the random processes and different sources, classification of noise effecting the communication system. |
| **CO4** | To understand various reception techniques and the performance analysis of different radio receivers in presence of Noise. |

**Details of the syllabus:**

| **S. No** | **Particulars** |
|---|---|
| 1 | **Amplitude Modulation**:<br>Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations, Frequency discriminator, Demodulation of AM, Diodedetector, Monodyne, Homodyne and Super heterodyne receiver |
| 2 | **Angle Modulation:**<br>Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Spectral characteristics of angle modulated signals, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems, FM Receiver and Transmitter |
| 3 | **Introduction to Random Process**<br>Random Process, Mean Function, Autocorrelation function, Stationary Process , Wide Sense Stationary Process, White Gaussian Noise (WGN), Power Spectral Density of WGN (Basic Definition), Random process through LTI (Linear Time Invariant) System. |
| 4 | **Noise Analysis:** Signal to Noise Ratio, Noise Figure, Performance of AM &FM Systems in presence of noise, Pre-emphasis and De-emphasis, Threshold effect in AM &FM Demodulation |

**Recommended Books**

| | | |
|---|---|---|
| 1 | Principles of Communication Systems | Taub &schling |
| 2 | Taub's Principles of Communication Systems | Taub, schling & G Saha |
| 3 | Communication systems | Simon Haykins |
| 4 | Electronic Communication Systems | G. Kennedy |
| 5 | Introduction to Communication Science and Systems | John R. Pierce and Edward C. Posner |
| 6 | Probability, Random Variables And Random Signal Principles | Peebles |
| 7 | Introduction to Random Signals and Noise | Wim C. Van Etten |

| **Subject: Electrical Machines (Code: EET255)** | **Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester** | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **2** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | End Term | | |
| | (30 Marks) | 10 | 60 | | |

**Objectives:** The objective of the course is to describe the operating principles, characteristics & applications of transformers and rotating electric machines

**Course Outcomes:**

| | |
|---|---|
| **CO1** | To study transformer construction, operation, various tests, find efficiency & voltage regulation. |
| **CO2** | Study about DC machines, operation, performance, applications, recent advancements. |
| **CO3** | To study induction motor operation, find efficiency & speed regulation |
| **CO4** | Study of synchronous machine and its applications. |

**Details of the syllabus:**

| **S. No.** | **Particulars** |
|---|---|
| 1 | **Transformers:** Operating principle, classification, construction, EMF equation, phasor diagrams, equivalent circuit model, losses &efficiency, voltage regulation, frequency response, polarity test, autotransformers, three-phase transformer connections, impedance matching, isolation &instrument transformers. |
| 2 | **DCMachines:** Operating principle, generator& motor action, construction, types of excitation, EMF & torque equations, power stages & efficiency. Commutation & Armature Reaction, characteristics &application of DC generators, starting &speed control of DC motors, characteristics &applications of DC motors, electric braking. |
| 3 | **Induction Machines:** Three-phase induction motors. Principle of operation, construction, types. Rotating magnetic field, EMF equation of an AC Machine, torque developed in an induction motor, equivalent circuit model, torque-speed characteristics, starting &speed control. Single phase induction motors, starting, application |
| 4 | **Synchronous Machines:** Construction, types &operating principle of synchronous generator, AC armature windings, equivalent circuit, phasor diagrams, voltage regulation, parallel operation, synchronization, Power Angle characteristics, and effect of field excitation change. Synchronous Motor, principle, starting, hunting, damper windings |
| 5 | **Special Purpose Motors:** Stepper Motor, Universal Motor, Shaded-pole Motor |

**Recommended Books**

| | | |
|---|---|---|
| 1 | Electric Machinery | Fitzgerald,Kingslay,Umans |
| 2 | Electric Machinery Fundamentals | Chapman |
| 3 | Electric Machines | Nagrath and Kothari |
| 4 | Electric Machinery and Transformer | Guru, Hiziroglu |

| | | |
|---|---|---|
| 5 | Electric Machinery | P.S.Bimbhra |
| 6 | Basic Electric Machines | Vincent Deltoro |

| **Subject: Control System (Code: EET256)** | **Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester** | | **Total Course Credit:4** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **3** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | End term | | |
| | (30 Marks) | 10 | (60 Marks) | | |

**Objectives:** The objective of the course is to introduce the students to modeling, analysis and design of control systems which are an integral part of modern society and have widespread application in science, engineering, and industry.

**Course Outcomes:**

| | |
|---|---|
| CO1 | To determine and analyze the time response of first and second order systems to various standard test inputs. |
| CO2 | Investigate, evaluate and analyze the stability of control systems, compare and contrast absolute and relative stability. |
| CO3 | Study and design of PID controllers, lead-lag Compensators and modeling of dynamic systems in state space. |
| CO4 | To determine and analyze the time response of first and second order systems to various standard test inputs. |

**Details of the syllabus:**

| S No | **Particulars** |
|---|---|
| 1 | **Introduction to continuous control systems:** Definition of a control system, open-loop, closed loop (automatic and manual) control |
| 2 | **Mathematical modeling:** Transfer functions, block diagrams, signal flow graphs |
| 3 | **First and second order system:** Example of first and second order systems, responses of these systems to step, ramp, parabolic and sinusoidal inputs, transient, steady state and error analysis |
| 4 | **Stability studies:** Definition of stability, stability and pole locations, stability and Routh Table, stability and frequency response bode plot, polar plot, root locus. |
| 5 | **Study of PID controllers, lead-lag Compensators** Proportional, Integral, Derivative (P.I.D) control. Compensator design Lead – lag compensators, Modeling of dynamic systems in state space (Introduction). |

Suggested Books

| | | |
|---|---|---|
| 1 | Modern Control Engineering | K. Ogatta |
| 2 | Automatic Control Systems | B. C. Kuo |
| 3 | Control System Engineering | Norman S Nise |
| 4 | Control Systems | M Gopal |
| 5 | Design of Feedback Control Systems | Stefani |
| 6 | Feedback control of dynamic systems | Franklin and Powel |
| 7 | Control systems, | A. Anand Kumar |

| **Subject: Mathematics IV (Code: MAT254)** | **Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester** | | **Total Course Credit:4** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **3** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | End term | | |
| | (30 Marks) | (10 Marks) | (60 Marks) | | |

**Objectives:** To understand Probability theory with applications to engineering problems such as the reliability of circuits and systems to statistical methods for hypothesis testing, decision making under uncertainty, and parameter estimation.

**Course Outcomes**: At the end of the course, a student should be able to:

| | |
|---|---|
| **CO1** | Be acquainted with basic concepts of random variables, probability distribution. |
| **CO2** | Apply the concepts of different distributions and joint probability distribution on various platforms. |
| **CO3** | Be acquainted with concepts like correlation coefficient, Transformation of random variables, Regression Analysis and their applications |
| **CO4** | Compute point estimation of parameters, explain sampling distributions, and understand the central limit theorem. |
| **CO5** | Construct confidence intervals on parameters for a single sample, and perform hypothesis testing. |

**Details of the syllabus**

| **S No** | **Particulars** |
|---|---|
| **1** | **Random variables: (12 Hours):**Discrete and Continuous Random variables, Distribution functions, Expectation and Variance of Probability distribution, and Moment Generating function, Moments and properties.<br>Discrete distributions: Binomial, Poisson and Geometric distributions and their applications. Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution and their applications. |
| | **Two-Dimensional Random Variables (15 Hours)**<br>Bivariate Random Variables, Joint Distribution Functions (Discrete and Continuous),<br>Marginal and Conditional Distributions, Covariance and Correlation Coefficient, Transformation of random variables. Regression Analysis, Linear and Non linear Regression, Multiple regression, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves. |
| **3** | **Sampling Theory (14 Hours)**<br>Population and Sample, Statistical inference, Sampling with and without replacement, Random samples, Population parameters, Sample statics, Sampling distributions, Sample mean, Sampling distribution of means, Sample variances, Sampling distribution of variances, Case where population variances is unknown, Unbiased estimates and efficient estimates, point estimate and Interval Estimates, Confidence Interval estimates of population parameters. |

**Text Books:**

5. Neil A. Weiss, *Introductory Statistics*, 9th Edition. Pearson, (2012).
6. Johnson, Miller and Freund, *Probability and Statistics for Engineers*, Pearson Education, 8th Edition, (2015).
7. S. C. Gupta, *Fundamentals of Statistics*, 7th Edition, Himalaya Publications (2018).
8. S. Ross, *A First Course in Probability*, 6th Edition, Pearson Education India, (2002).
9. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to Mathematical Statistics*, 2nd Edition, Prentice hall, (2007).

**Reference Books:**

3. R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008).
4. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 35th Edition, (2000).
5. V.K. Rohatgi and A. K. Md. Ehsanes Saleh, *An Introduction to Probability and Mathematical Statistics,* 2nd Edition, John Wiley and sons, (2008).
6. Hwei P. Hsu, *Schaum's Outline of Theory and Problems of Probability, Random Variables, and Random Processes*, 4th Edition Tata Mc-Graw Hill (2019).

| | | | | |
|---|---|---|---|---|
| **Subject:** Electronics II Laboratory (Code: ECL253) | **Year & Semester:** B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester | **Total Course Credit: 1** | | |
| | | **L** | **T** | **P** |
| | | **0** | **0** | **2** |
| **Evaluation Policy** | Mid-Term/Class Assessment (40 Marks) | Final-Term (60 Marks) | | |

**Objectives:** To acquire knowledge and become familiar with the different characterization techniques to analyze, and synthesize electronic feedback networks, operational amplifiers, and power amplifiers.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Identify relevant information to supplement the Electronics II course |
| **CO2** | Experimental characterization of negative and positive feedback circuits |
| **CO3** | Experimental characterization and study of different applications of OPAMP's and 555 timer chip |
| **CO4** | Experimental Analysis of different topologies of Power Amplifiers |

**Details of the syllabus:**

| S. No. | Particulars |
|---|---|
| 1 | Feedback<br>c. To assemble current series feedback amplifier and study its performance.<br>d. To assemble a voltage shunt feedback amplifier and study its performance. |
| 2 | To assemble an RC phase shift oscillator. |
| 3 | To assemble a differential amplifier and obtain its CMRR. |
| 4 | To study different applications of OPAMPS.<br>i. OP-AMP as an inverting amplifier.<br>j. OPAMP as a non-inverting amplifier<br>k. OPAMP as an integrator<br>l. OPAMP as a differentiator |
| 5 | To measurethe following parameters of a typical OP-AMP.<br>i. I/PImpedance<br>j. O/PImpedance<br>k. Slewrate<br>l. CMRR |
| 6 | Obtain frequency response of an OP-AMP & hence find its bandwidth. |
| 7 | Study performance of multivibrator circuits using 555 chip in following modes:<br>**e.** Bistable<br>**f.** Astable<br>**g.** Monostable<br>**h.** Useof555 chip as a timer circuit |
| 8 | To assemble a Schmitt trigger Circuit and to obtain its characteristics and to use it as squaring circuit. |
| 9 | To assemble a Class A Power amplifier and to determine its power gain |
| 10 | To study the performance of a voltage regulator IC Chip. |

| **Subject:** Digital Electronics & Logic Design Lab (Code: ECL254) | **Year & Semester:** B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester | **Total Course Credit: 1** | | |
|---|---|---|---|---|
| | | **L** | **T** | **P** |
| | | **0** | **0** | **2** |
| **Evaluation Policy** | Mid-Term/Class Assessment (40 Marks) | Final-Term (60 Marks) | | |

**Objectives:** To acquire knowledge and become familiar with the different characterization techniques to analyze, and synthesize the digital logic, combinational and sequential circuits.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Identify relevant information to supplement the Digital Electronics & logic Design course |
| **CO2** | Develop competence in Combinational Logic Problem identification and solution |
| **CO3** | Develop design capability in the field of combinatorial logic using gates and blocks |
| **CO4** | Analysis and design of synchronous and asynchronous sequential circuits |

**Details of the syllabus:**

| **S. No.** | **Particulars** |
|---|---|
| 1 | To verify the truth table of following logic gates:<br>a. AND OR and NOT<br>b. NAND, NOR, XOR and XNOR<br>c. To realize the above gates using discrete active and passive components. |
| 2 | To implement XOR and XNOR using universal logic gates. |
| 3 | **a.** To verify DeMorgans law using logic gates.<br>**b.** To implement typical Boolean expressions and check their equality. |
| 4 | To design and realize:-<br>**a.** Half adder and verify its truth table.<br>**b.** Full adder and verifyits truth table.<br>**c.** Half subtractor and verify its truth table<br>**d.** Full subtractor and verify its truth table. |
| 5 | To design a multiplexer/demultiplexer using two input NAND gates |
| 6 | To designa4 bit binary to decimal converter. |
| 7 | To designamodulo-10 counter. |
| 8 | Given a frequency f obtain the waveforms with frequencies f/2,f/5&f/10 |
| 9 | Design and realize the following flip flops using logic gates.<br>**a.** RS flip flop<br>**b.** JK flip flop<br>**c.** D flip flop<br>**d.** T flip flop |
| 10 | Use PLL as:<br>**a.** Frequency multiplier.<br>**b.** Frequency demodulator. |

| **Subject: Communication Systems I Lab (Code: ECL257)** | **Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester** | **Total Course Credit:1** | | |
|---|---|---|---|---|
| | | **L** | **T** | **P** |
| | | **0** | **0** | **2** |
| **Evaluation Policy** | Mid-Term/Class Assessment | Final-Term | | |
| | (40 Marks) | (60 Marks) | | |

**Objectives:** Familiarize the students with analog communication systems. Integration of communication systems theory with experimental characterization techniques.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Familiarization and working of different electronic equipment used in communication systems |
| **CO2** | Choose testing and experimental procedures on different types of communication circuits and systems; and analyze their operation under different operating conditions |
| **CO3** | Design analog modulation circuits as amplitude and frequency modulation for different topologies |
| **CO4** | Analysis and Design of communication receivers under different noise conditions. |

**Details of the syllabus:**

| **S. No** | **Particulars** |
|---|---|
| 1 | Linear Systems Characteristics |
| 2 | Spectrum Analysis |
| 3 | Generation and detection of DSB_SC amplitude modulated signals. |
| 4 | Generation and detection of DSB_C amplitude modulated signals. |
| 5 | Generation and detection of frequency modulated signals. |
| 6 | To measure sensitivity, selectivity, and fidelity of a radio receiver. |
| 7 | To measure the noise figure of the following systems:<br>a. A.M. System<br>b. F.M. System |
| 8 | Zero crossing and PLL receivers of FM signals |

| **Subject: Electrical Machines Laboratory (Code: EEL257)** | **Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester** | **Total Course Credit: 1** | | |
|---|---|---|---|---|
| | | **L** | **T** | **P** |
| | | **0** | **0** | **2** |
| **Evaluation Policy** | Mid-Term/Class Assessment | Final-Term | | |
| | (40 Marks) | (60 Marks) | | |

**Objectives:** To prepare the students to have a basic knowledge of transformers and different types of motors with applications specifically in low power Electronics

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Familiarization and working of different equipment used in Electrical Machinery |
| **CO2** | Ability to conduct and analyze experiments on transformers |
| **CO3** | Acquire knowledge about the constructional details and principle of operation of dc and ac machines |
| **CO4** | Undertake the testing and develop application capabilities for different types of electrical machines. |

**Details of the syllabus:**

| **S. No** | **Particulars** |
|---|---|
| 1 | To perform open circuit, short circuit, and polarity tests on a single-phase transformer |
| 2 | To determine the efficiency and voltage regulation of a single phase transformer |
| 3 | To study three phase connections on a bank of three single phase transformers<br>To plot the saturation curve of a dc machine |
| 4 | To plot the external characteristics of a separately excited dc generator |
| 5 | To plot the external characteristic of a dc shunt generator and compare the characteristics with that of a separately excited generator |
| 6 | To determine the Torque/ speed characteristics of a 3-ϕInduction motor |
| 7 | To determine the speed characteristics of a Schrage motor |
| 8 | To determine the speed / Torque characteristics of an AC series motor (Universal motor) |
| 9 | To determine the equivalent circuit parameters of a 1-ϕInduction motor by (i) No load test (ii) Blocked rotor test |
| 10 | To obtain the OCC and SCC of a synchronous machine by Synchronous impedance method |

# 5th Semester B Tech ECE
# Syllabus

| **Subject:** Microprocessors (Code:ECT301) | **Year & Semester:** B. Tech Electronics & Communication Engineering<br>3rd Year & 5th Semester | | **Total Course Credit: 4** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 3 | 1 | - |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To study the basics of microprocessors, programming the microprocessor for different
control operations and interfacing it with peripherals. To understand the fundamentals of microcontrollers and using it in the areas of process control, robotics etc.

**Course Outcomes (COs):**

Upon successful completion of the course, student should be able to:

**CO1:** To introduce 8085 architecture and programming in assembly language.

**CO2:** To introduce basic concepts of interfacing memory and peripheral devices to a microprocessor.

**CO3:** To design real life applications of process control through microprocessors.

**CO4:** To introduce advanced versions of Microprocessors and peripheral chips like 8255

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **Microcomputer Structure and Operations:** Basic Microcomputer Elements, Typical Microcomputer Structure, CPU, Memory System, Input Output. |
| 2. | **Microprocessors and Memory:** Typical 8, 16 and 32 bit Microprocessors, 8085 Microprocessor Specification, Memory Technologies. |
| 3. | **Assembly Language Programming I:** Programming Model of 8085, Registers, Fetch, Execute, Operation of CPU, Instruction Set. |
| 4. | **Assembly Language Programming II:** Addressing Modes, Basic Operations, Microprocessor Arithmetic, Program Flow Control Using Looping and Branching. |
| 5. | **Assembly Language Programming III:** Stack, Subroutines, Interrupts, Resets. |
| 6. | **Bus System I:** System Bus Structure, Bus Operations, Cycle by Cycle Operations, Timing and Control, Priority Management, Address Decoding. |
| 7. | **Microprocessors Interfacing I:** Interfacing concepts, Parallel Input Output, Memory Interfacing, Direct Memory Access**.** |
| 8. | **Microprocessors Interfacing II:** The Serial Subsystems**.** |
| 9. | **Microprocessor Interfacing III:** Programmable, Peripheral Interface, Analog Converter Subsystem. |
| 10. | **Introduction to INTEL 8086:** Basic features. |
| 11. | **Micro controller:** 8051, 68HC11**.** |
| 12. | **Application Examples:** Process Control, Robotics, CAI, Medical physics. |
| 13. | **Latest Developments in Microprocessor Technology.** |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | Microprocessor Architecture, programming and application | Ramesh Goankar |
| 2 | Microprocessor and Applications | Leventhal |
| 3. | Microprocessors | Mathur |

| | | | | | |
|---|---|---|---|---|---|
| **Subject:** VLSI Design (Code:ECT302) | **Year & Semester:** B. Tech Electronics & Communication Engineering 3rd Year & 5th Semester | | **Total Course Credit: 4** | | |
| | | | L | T | P |
| | | | 3 | 1 | - |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To understand mosfet mechanism as a building block of digital circuits, technology to manufacture them and operation of various logic families.

**Course Outcomes:** Upon course completion ,the students should familiarize with the following:

**CO1:** Understand the physics of MOSFET and its operation as a switch and inverter.
**CO2:** Acquire knowledge about the fabrication processes for MOS devices.
**CO3:** Design of universal logic gates, compound gates, multiplexers, RAM cell based on CMOS technology and transmission gates.
**CO4:** Understanding of CMOS logic structures, switching characteristics, transistor sizing and layout.

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **Review of MOSFET**: Constructional & Operational features of MOSFET, I-V Equation, 2ND Order Effects, MOS Capacitor, C-V Characteristics, MOSFET Switch, Transmission gate, CMOS Inverter ( Pull-up & Pull-down ), Inverter Static Characteristics, ßn/ ßp Ratio, ?n/ ?p Rtaio, Noise Margin, Switching characteristics of Inverter (Fall Time, Rise Time, Delay Time), Dynamic Characteristics, Power Dissipation |
| 2. | **VLSI Technology:** Wafer Processing, Oxidation, Epitaxy, Deposition, Ion-Implantation & Diffusion, The Silicon gate Process, n-well CMOS Process, p-well Process, Twin-Tub Process, Silicon On Insulator. |
| 3. | **CMOS Logic Design (Gates):** CMOS Logic Gate Design (NAND & NOR Logic), Switching Characteristics (Delay Time, Power, Fan-in, Fan-out ), Transistor Sizing, The Compound Gates. |
| 4. | **CMOS Logic Structures:** CMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, C2MOS Logic, BiCMOS Logic, NP Domino Logic. |
| 5. | **Layout**: Design Rules/Floor planning, Simple Layout Examples**.** |
| 6. | **CMOS Logic Design (Circuits):** Multiplexers, MUX Implementation in CMOS & Transmission Gate , RAM Cell Implementation, Implementation of Flip-Flop, Register/Counter |

**Recommended Books:**

| S.No | Name of Book | Author |
|---|---|---|
| 1 | CMOS VLSI Design: A Systems Perspective | N. Weste & K.Eshraghian |
| 2 | CMOS VLSI Design: A Circuits & Systems Perspective | N. Weste, D. Harris & A. Bannerjee |
| 3 | Digital Integrated Circuits: A Design Perspective | Rabaey |

| **Subject:** Digital communication (Code:ECT303) | **Year & Semester:** B. Tech Electronics & Communication Engineering 3rd Year & 5th Semester | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** The objective of this course is to provide the student the understanding of fundamental concepts of digital communication starting from sampling theorem to the digital modulation techniques like BPSK, QPSK, M-PSK, M-QAM. In this course the student is supposed to understand the design of digital modulator and demodulator and also to analyze the performance in the presence of noise. Lectures should be supplemented with the hands on sessions of simulation using modern simulation tools like MATLAB/Octave/Scilab. The student should also get the exposure of recent trends in the field of digital communication like understanding of next generation systems like 5G/6G, LTE, WiFi etc.

**Course Outcomes**: Upon completion of the course, student should be able to:

- **CO1:** To understand how analog signal are converted to digital ones via sampling, quantization and various pulse coded modulation techniques
- **CO2:** To be able to represent signals as vectors in vector space and understand various digital modulation schemes, their modulator and demodulators.
- **CO3:** To analyze and simulate error performance of various digital modulation schemes in the presence of noise
- **CO4:** To get exposure of recent trends in the field of Digital Communication.

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **Analog to Digital Conversion**: Sampling Theorem, Anti-Aliasing Filters, Pulse Amplitude Modulation (PAM), Quantization, Non-Uniform Quantization, Pulse Coded Modulation (PCM), Delta Modulation, Delta-Sigma Modulation, Differential Pulse Code Modulation**.** |
| 2. | **Digital Modulation Techniques:** Binary Phase Shift Keying (BPSK), Phase Shift Keying (PSK), Frequency Shift Keying (FSK), M-ary Digital Modulation Scheme, M-Quadrature Amplitude Modulation (M-QAM), Signal Space diagram of various modulation schemes |
| 3. | **Noise in Digital Communication Systems:** Bit Error Rate (BER), Q-Function, Optimum Detection of BPSK, QPSK, M-PSK, M-QAM, FSK in presence of Additive White Gaussian Noise (AWGN), Simulation of BER of various digital modulation schemes**.** |
| 4. | **Recent Trends in Digital Communication:** Digital Modulation used in IoTs, Receiver design of modern digital communication system, Other recent trends in digital communication. |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | An Introduction To Analog And Digital Communications. India, Wiley India Pvt. Limited, 2009. | Haykin, Simon |
| 2. | Modern Digital and Analog Communication Systems. United States: Oxford University Press. | Lathi, B. P., Ding, Z. (2010 |

**References:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | Digital Communication Systems. United Kingdom, Wiley, 2014. | Haykin, Simon |
| 2. | Digital Communications. United States, McGraw-Hill, 2008. | Proakis, John G.& Salehi Masoud |
| 3. | Selected papers from relevant IEEE Journals and other reputed journals/conference papers related to Information Digital Communication. | |

| **Subject:** Applied Electromagnetic Fields and Waves (Code: ECT304) | **Year & Semester:** B. Tech Electronics and Communication Engineering 3rd Year & 5th Semester | | Total Course Credits: 4 | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 3 | 1 | 0 |
| Evaluation Policy | Mid Term | Class Assessment | End Term | | |
| | 30 | 10 | 60 | | |

**Objectives:** To understand EMF in theory and practice, laws governing propagation of EMF in dielectric, transmission lines, standing wave ratios and impedance issues.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | To understand the interaction between electric and magnetic fields |
| **CO2** | To understand the basic theory behind Maxwell's equations and electromagnetic waves |
| **CO3** | To learn the Propagation behavior of Electromagnetic waves in lossless and lossy media |
| **CO4** | To study the behavior of electromagnetic waves at discontinuities of media |

**Details of the Syllabus:**

| S No | Particulars |
|---|---|
| 1 | **Review of coordinate systems and Vectors**: Cartesian, cylindrical and spherical coordinate systems, Vector operations; Vector calculus; gradient, divergence and curl of a vector function, gradient theorem, divergence theorem and Stokes theorem. Some important identities of vector calculus |
| 2 | **Static Electric Field:** Coulomb's law; Electric field and Electric field intensity due to point charge and summation of point charges; Electric scalar potential; Equi-potential surfaces and their properties; Relation between electric potential and electric field intensity; Electric dipole and Electric field due to a dipole; Electric flux and electric flux density; Electric flux over a closed surface: Gauss law, Poisson and Laplace equations Electric field due to linear, surface, spherical and cylindrical charge distributions. Induced charges; Dielectrics and permittivity; Electric field in a dielectric; boundary conditions; Parallel plate capacitor; Dielectric strength; Energy in a capacitor; Capacitance of Co-axial transmission line, two wire transmission line and Single wire transmission line |
| 3 | **Electric Charge in motion:** Electric current density; Ohm's Law in point form, Resistivity and conductivity of a medium; Conductor and Insulator; Divergence of J and continuity of current; Current and field at conductor-Insulator boundary; |
| 4 | **Magnetic effects of current:** Effect of current on magnet; Effect of magnet on current carrying conductor; Magnetic field due to a current carrying conductor; BiotSavart Law; Magnetic field due to a infinite linear conductor; Force between two linear parallel conductors; Ampere's law, Faradays' law of induction, self and mutual inductance, inductance of two wire transmission line, single wire and coaxial cable, displacement currents, Magnetic vector potential |

| | |
|---|---|
| 5 | **Maxwell equations and wave equations:** Maxwell's Equations general form, Maxwell equations for free space, Boundary conditions, Wave equation and its solution. Transverse Electromagnetic Waves, Poynting vector, intrinsic impedance of medium, Phase and group velocity, Plane waves in lossless and lossy media. |
| 6 | Polarization, reflection and refraction of waves: Polarization of electromagnetic waves and different cases, Normal and oblique incidence at plane conducting boundary, Normal and oblique incidence at plane dielectric boundary. |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | Electromagnetic Waves & radiating systems, PHI | Jordan E and Balman K |
| 2. | Field and Wave Electromagnetics, Addison Wesley | David K Cheng |
| 3. | Electromagnetics, Mc Graw Hill | Krauss |
| 4. | Introduction to Electrodynamics, PHI | Griffiths |

| **Subject:** Information Theory & Coding (Code:ECT305) | **Year & Semester:** B. Tech Electronics & Communication Engineering<br>3rd Year & 5th Semester | | **Total Course Credit:3** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | - |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** The objective of this course is to understand the notion of information and measures of information. The fundamental quantities of information measure are Entropy and mutual information. The student should understand the notion of source coding for compression and be able to prove that entropy is the fundamental limit for compression. Also student should be able to understand to notion of channel coding for combating errors and prove that mutual information is the upper limit of maximum achievable rate under probability of error constraint. Also in this course the student is expected to learn about various practical source coding and channel coding techniques like Huffman Coding, Shannon-Fano Coding, Linear Block coding, Cyclic codes, Convolutional coding. The student will also be provided the exposure of recent trends in information and coding theory including: Coding for 5G/6G, Information theory and Machine Learning, Polar Coding, LDPC Coding. In this course the instructor is supposed to supplement lectures with demonstrations in MATLAB/Octave/Scilab packages.

| | |
|---|---|
| **Course outcomes** | Upon successful completion of the course, the student should be able to : |
| **CO1** | To understand the source coding, various techniques for source coding and entropy as fundamental limit for compression. |
| **CO2** | To the channel coding, discrete memoryless channel, mutual information, random coding and notion of channel capacity. |
| **CO3** | To understand and demonstrate error control coding in particular Linear block codes, Cyclic Codes, Convolutional codes |
| **CO4** | To get exposure of recent trends in the field of information and coding theory. |

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| **1.** | **Source Coding:** Entropy and its properties, Relative Entropy, Instantaneous codes, Construction of instantaneous codes, Kraft's inequality, Source coding theorem. Construction of basic source codes – Shannon Fano coding, Shannon Fano Elias coding, Huffman coding. |
| **2.** | **Channel Coding:** Mutual information and its properties, information rate, channel capacity, Shannon's Channel Coding Theorem, Discrete channels – Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Differential Entropy, Capacity of AWGN Channel. |
| **3.** | **Error Control Codes:** Repetition Coding, Linear Block Codes, Cyclic Codes, Syndrome Decoding, Convolutional Codes, Viterbi Decoding. |

| | |
|---|---|
| **4.** | **Recent Trends in Information and Coding Theory:** Codes for 5G/6G: LDPC Codes, Polar Codes; Information theory for machine learning; Quantum Information and computing. |

**Recommended Books:**

| S. No | Name of Book | Author | Publisher & Edition |
|---|---|---|---|
| 1. | Elements of Information Theory | Thomas, Joy A., and Cover, Thomas M. | Wiley, 2012. |
| 2. | Digital Communication Systems | Haykin, Simon. | United Kingdom,Wiley |
| | | | |

**References:**

| S. No | Name | Author | Publisher & Edition |
|---|---|---|---|
| 1. | Digital Communications | Proakis, John G., and Salehi, Masoud | United States, McGraw-Hill, 2008. |
| 2. | Information theory: coding theorems for discrete memoryless systems. | Csiszar, Imre, and János Körner | Cambridge University Press, 2011 |
| 3. | Error control coding | Lin, Shu, and Daniel J. Costello | Pearson Education India, 2011. |
| 4. | Selected papers from IEEE Transactions on Information Theory and other reputed journals/conference papers related to Information Theory and Coding | | |

| **Subject: Mathematics-V (Code:MAT3xx)** | **Year & Semester:** B. Tech Electronics & Communication Engineering 3rd Year & 5th Semester | | **Total Course Credit:4** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 3 | 1 | 0 |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To study complex variables, their functions and theorems, special functions and wavelet transform.

**Course Outcomes:** Upon successful completion of the course, student should be able to:

**CO1:** Determine Analytic functions their Harmonic conjugates and Laplace equation.
**CO2:** Differentiate and Integrate complex functions and develop the concepts of elementary functions in complex domain.
**CO3:** Expand complex valued functions in terms of Taylor, Laurant series and Classify singularities of a complex function and calculation of residues.
**CO4:** Learn and Apply Bessel and Legendre functions. Apply the concept of wavelet transform as a two parameter transform and use the methods for generating new wavelets.

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **Complex Variables:** Analytic functions, Cauchy Riemann equations, complex integration, Cauchy's fundamental theorem, Cauchy's integral theorem, Cauchy's inequality and Liouville's theorem on integral function, Taylor's and Laurent's expansions, Zeroes and poles of analytic functions, Residues and contour integration. |
| 2. | **Special Functions:** Solution of series, Legendres functions, Rodriguess formula, generating functions for Legendres Polynomials and recurrence formulae. Bessel's functions, Recurrence formulae and Bessel's functions of integral order. |
| 3. | **Wavelet Transform:** Continuous wavelet transform, Basic properties of wavelet transform, Discrete wavelet transform, Orthonormal wavelets, multi Resolution analysis, Construction of Orthonormal wavelets, Daubchies wavelets and algorithms. Band limited wavelets, Balian low theorem. |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | Complex Variables & Applications | R. V. Churchill |
| 2. | Theory of Functions of Complex Variables | E. I. Copson |

| **Subject:** Microprocessors Lab. (Code:ECL306) | **Year & Semester:** B. Tech Electrical Engineering 3rd & 5th Year Semester | **Total Course Credit: 1** | | |
|---|---|---|---|---|
| | | L | T | P |
| | | 0 | 0 | 2 |
| **Evaluation Policy** | Internal Assessment (40 Marks) | End-Term (60 Marks) | | |

**Course Objective**: To develop programs using 8085 instruction set, understanding of usage of microprocessor as an automatic controller. To develop programs for interaction between microprocessor and peripherals, understand usage of PPI-8255.

**Course Outcomes (COs):**

Upon successful completion of the course, student should be able to:

**CO1:** Assess and solve basic binary arithmetic operations using the microprocessor.

**CO2:** Apply knowledge and demonstrate programming proficiency using various addressing modes and data transfer instructions of the target microprocessor.

**CO3:** Demonstrate use of conditional branch and loop instructions.

**CO4:** Demonstrate use of logical instructions and use of call instructions for implementing stacks and subroutines in a program.

**List of Experiments:**

| S. No. | Name of the experiment |
|---|---|
| **1.** | i) To develop a program to add two double byte numbers.<br>ii)To develop a subroutine to add two floating point quantities. |
| **2.** | i)To develop program to multiply two single byte unsigned numbers, giving a 16 bit product .<br>ii) To develop subroutine which will multiply two positive floating point numbers. |
| **3.** | To write program to evaluate P* Q+R*S where P,Q,R & S are 8 bit binary numbers. |
| **4.** | To write a program to divide a 4 byte number by another 4 byte number. |
| **5.** | To write a program to divide an 8 bit number by another 8 bit number upto a fractional quotient of 16 bit. |
| **6.** | Write a program for adding first N natural numbers and store the results in memory location X. |
| **7.** | Write a program which decrements a hex number stored in register C. The Program should half when the program register reads zero. |
| **8.** | Write a program to introduce a time delay of 100 ms using this program as a subroutine display numbers from 01H to OAH with the above calculated time delay between every twonumbers. |
| **9.** | N hex numbers are stored at consecutive memory locations starting from X. Find the largest number and store it at location Y. |
| **10.** | Interface a display circuit with the microprocessor either directly with the bus or by using I/O ports. Write a program by which the data stored in a RAM table is displayed. |

**11.** To design and interface a circuit to read data from an A/D converter, using the 8255 A in the memory

mapped I/O.

**12.** To design and interface a circuit to convert digital data into analog signal using the 8255 A in the memory mapped I/O.

**13.** To interface a keyboard with the microprocessor using 8279 chip and transfer the output to the printer.

**14.** To design a circuit to interface a memory chip with microprocessor with given memory map.

| **Subject:** VLSI Design Lab. (Code:ECL307) | **Year & Semester:** B. Tech Electrical Engineering 3rd & 5th Year Semester | **Total Course Credit: 1** | | |
|---|---|---|---|---|
| | | L | T | P |
| | | 0 | 0 | 2 |
| **Evaluation Policy** | Internal Assessment (40 Marks) | End-Term (60 Marks) | | |

**Course Objective**: To familiarize the students with the practical aspects of MOS device such as its working, characteristics, application, layout using tool based software.

**Course Outcomes:**

Upon completion of the course, student should be able to:

**CO1:** To understand the MOS model parameters using simulation and analysis of the MOS characteristics.
**CO2:** To understand CMOS based inverter using a tool and analysis of the related parameters.
**CO3:** To get familiarized with the operation of ring oscillators and the multiplexers .
**CO4:** To be able to implement the layout of CMOS based inverter and CMOS based gates for detailed analysis of their performances.

**List of Experiments:**

| **S. No.** | **Name of the experiment** |
|---|---|
| 1. | Familiarization with MOS model parameters in a circuit simulation software |
| 2. | To Plot the transfer characteristics and output characteristics of a MOSFET |
| 3. | Simulation of CMOS Inverter with different loads. |
| 4. | Simulation of CMOS Inverter for different parameters $K_n$, $K_p$ as a design variable . |
| 5. | Study of the switching characteristics of CMOS Inverter and find out noise margins. |
| 6. | To design and plot the output characteristics of a 3-inverter ring oscillator. |
| 7. | Study of the switching characteristics of 2-input CMOS NAND/NOR gate. |
| 8. | Layout design of a CMOS Inverter using a layout design tool. |
| 9. | Layout design of a 2-input CMOS NAND/NOR gate using a layout design tool and their comparison. |
| 10. | To design and plot the characteristics of a 4x1 digital multiplexer using pass transistor logic. |

| **Subject:** Digital Communication Lab. (Code:ECL308) | **Year & Semester:** B. Tech Electrical Engineering 3rd & 5th Year Semester | **Total Course Credit: 1** | | |
|---|---|---|---|---|
| | | L | T | P |
| | | 0 | 0 | 2 |
| **Evaluation Policy** | Internal Assessment (40 Marks) | End-Term (60 Marks) | | |

**Course Objective**:

To familiarize the students with the fundamental concepts on TDM, Pulse modulations, digital modulation techniques, source coding techniques and Error-control coding techniques.

**Course Outcomes:**

Upon completion of the course, student should be able to:

- **CO1:** To understand how analog signal are converted to digital ones via sampling, quantization and various pulse coded modulation techniques.
- **CO2:** To be able to represent signals as vectors in vector space and understand various digital modulation schemes, their modulator and demodulators.
- **CO3:** To analyze and simulate error performance of various digital modulation schemes in the presence of noise.
- **CO4:** To get exposure of recent trends in the field of Digital Communication

**List of Experiments:**

| **S. No.** | **Name of the experiment** |
|---|---|
| 1. | To study the sampling theorem and to plot waveforms for different sampling rates. |
| 2. | To analyze a Pulse amplitude modulation (PAM), Pulse width modulation (PWM) and Pulse position modulation (PPM) modulation system and interpret the modulated and demodulated waveforms. |
| 3. | To analyze a PCM system and interpret the modulated and demodulated waveforms. |
| 4. | To analyze a Delta modulation system and interpret the modulated and demodulated waveforms. |
| 5. | To analyze Amplitude Shift Keying (ASK) modulation system and interpret the modulated and demodulated waveforms. |
| 6. | To analyze a Frequency Shift Keying (FSK) modulation system and interpret the modulated and demodulated waveforms. |
| 7. | To analyze a Binary Phase Shift Keying (BPSK) modulation system and interpret the modulated and demodulated waveforms |
| 8. | To demonstrate Time Division Multiplexing and de-multiplexing process. |

# 6th Semester B Tech ECE,

# Syllabus

| **Subject:** Antenna and Wave Propagation (Code: ECT350) | **Year & Semester:** B. Tech Electronics and Communication Engineering 3rd Year & 6th Semester | | Total Course Credits: 4 | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 3 | 1 | 0 |
| Evaluation Policy | Mid Term | Class Assessment | End Term | | |
| | 30 | 10 | 60 | | |

**Objectives:** To understand Propagation of waves in guided and unguided media and Basic theory behind the Antenna theory.

**Course Outcomes:**
**CO1:** To understand Propagation of Waves through Transmission lines
**CO2:** To understand the Propagation of waves through unguided media particularly the free space and atmosphere.
**CO3:** To understand the antenna basics and theory behind EM radiations
**CO4:** To have an understanding of different types of antennas and their operations.

**Details of the Syllabus:**

| S No | Particulars |
|---|---|
| 1 | Transmission Lines: Transmission Line equations and solutions, Characteristic impedance and propagation constant, Reflection and transmission coefficients, SWR, Open and short circuit lines-their use as circuit elements at UHF, Line impedance and admittance , Smith Chart, Impedance Matching |
| 2 | Waveguides and Cavity Resonators: Transverse Electric and Transverse magnetic Waves, Wave propagation through rectangular and circular waveguides, Power transmission and attenuation in waveguides, Electromagnetic Resonators, Rectangular & Circular cavities |
| 3 | Strip Lines: Propagation Constant, Characteristic impedance and attenuation characteristics of strip lines and microstrips. |
| 4 | Propagation of Waves: Waves in free space, Attenuation, Absorption and polarization, effects of environment, Ground wave propagation, sky wave propagation, space wave propagation, Tropo-spherical propagation and Extra-terrestrial propagation |
| 5 | Radiation: Retarded Potential and Electromagnetic field, Radiation from a short current element, Half wave dipole, Radiation Resistance, Effect of ground on radiating elements |
| 6 | Antennas: Basic Antenna parameters, Radiation pattern, Directivity and Antenna Gain, Bandwidth and beam-width, Polarization, Folded dipole and applications. Antenna arrays, Parabolic reflector, Properties and feed mechanism, Horn Antenna, Loop Antenna. |

| | | |
|---|---|---|
| 1 | Electromagnetic Waves and radiating Systems PHI | Jordan and Balman |
| 2 | Antennas and Wave Propagation | Krauss |

| **Subject:** Electronic Devices (Code: ECT351) | **Year & Semester:** B. Tech Electronics and Communication Engineering 3rd Year & 6th Semester | | **Total Course Credits: 4** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **3** | **1** | **0** |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives: To understand free electron theory, band theory of electronic conduction, semiconductor physics and optical devices.**

**Course Outcomes:**

- **CO1** Understanding of free electron theory and band theory of electronic conduction.
- **CO2** Understanding of semiconductor physics, mechanism of charge carrier generation, transport and recombination phenomenon
- **CO3** Acquire knowledge of construction, basics of operation and performance analysis of the devices like pn-junction diodes, BJT, MOSFETs.
- **CO4** Understanding of the physics of optical devices and mechanisms like stimulated emission, photo-detection, photo-conduction.

**Details of the Syllabus:**

| **S. No.** | **Particulars** |
|---|---|
| 1. | **Overview of Free Electron Theory** |
| 2. | **Band Theory of Electronic Conduction:** Kroning Penny model, block wave Brillion zones, effective mass, density of states & energy discontinuity, electron and hole conduction. |
| 3. | **Semiconductor Physics:** Fermi Dirac distribution functions, Fermi energy and contact potential, electronic conductivity and means free time. Intrinsic and Extrinsic semiconductors, free carrier concentration and Fermi level, donor and acceptor states, derivation of fermi level, carrier concentration and mobility, scattering mechanisms, semiconductor materials and their energy band structures. |
| 4. | **Transport and Recombination Phenomenon.** |
| 5. | **Physics of:** Metal semiconductor contact, p-n junction diodes, bipolar junction transistor, thyristor, junction field effect transistor, metal insulator semiconductor structure, MOSFET. |
| 6. | **Optical Devices:** Junction, luminescence and energy band gap, spontaneous emission and carrier life time for band to band transition, stimulated emission, p-n junction laser, photo-detective and photo conductive devices. |

**Recommended Books:**

| | | |
|---|---|---|
| **1.** | Electronic Processes & Materials | Azaroff & Brophy |
| **2.** | Fundamentals of Solid-State Devices & Circuits | Barlev |
| **3.** | Solid State Electronic Devices | Ben G. Streetman |
| **4.** | Fundamentals of Semiconductor Theory | S. Wang |

| **Subject:** Computer Organization and Architecture (Code: ECT352) | **Year & Semester:** B. Tech Electronics and Communication Engineering 3rd Year & 6th Semester | | **Total Course Credits: 4** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **3** | **1** | **0** |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To study the basic structure and organization of computer and its modules, instruction execution, peripheral devices, memories and organization.

**Course Outcomes:**

- **CO1** To Discuss the basic concepts and structure of computers.
- **CO2** To Explain different types of Addressing Modes.
- **CO3** To Understand the theory and architecture of Central Processing Unit.
- **CO4** To understand the organization of Memory and Input/output units. Introduce the concepts of Pipelining and parallel processing.

**Details of the Syllabus:**

| **S. No.** | **Particulars** |
|---|---|
| 1. | Introduction to computer architecture and organization: Basic structure of computers, Operational concepts, performance. |
| 2. | Computer Organization and instruction cycle control: Machine Instructions & Programs, Memory location & Addresses, Instruction & Instruction Sequencing, addressing modes, Stacks & Queues, Subroutines, Additional Instructions and Encoding of Machine Instructions. |
| 3. | CPU organization: Fundamental concepts, Execution of a complete Instruction, Multiple Bus organization, Hardwired control, Microprogrammed control. |
| 4. | I/O devices and Organization: Accessing I/O devices, Interrupts, DMA, Buses, Interface Circuits, Standard I/O Interfaces & Computer peripherals. |
| 5. | Types of memories and memory organization: Basic Concepts, Semiconductor RAM Memories, ROM's Cache Memories, performance Considerations, Virtual Memories, Secondary Storage. |
| 6. | Arithmetic addition & Subtraction of Signed numbers, Design of fast adders, Multiplication of Positive numbers, Signed-Operand Multiplication, Fast Multiplication, Integer Division, Floating Point Numbers & Operations. |
| 7. | Introduction to Pipelining & Embedded Systems. |

**Recommended Books:**

| | | |
|---|---|---|
| 1. | Computer Organization & Architecture | M. Mano |
| 2. | Computer organization | Hamachar |

| **Subject:** Data Comm. & Networking (Code: ECT353) | **Year & Semester:** B. Tech Electronics and Communication Engineering 3rd Year & 6th Semester | | **Total Course Credits: 4** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **3** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | End-Term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To study the techniques of data communication, encoding and protocols, error detection, correction, multiplexing and understand network topologies, routing and switching techniques of data transmission.

**Course Outcomes:**

- **CO1** Understand fundamental principles of computer communication in data networks and the Internet.
- **CO2** Understand network topologies, multiplexing and various error detection and correction techniques.
- **CO3** Understand data encoding and recognize the different internetworking devices and their functions.
- **CO4** Understand the principles and the role of protocols in networking.

**Details of the Syllabus:**

| **S.No.** | **Particulars** |
|---|---|
| 1. | Data Transmission, data encoding, digital data communication technique |
| 2. | Error detecting and error correcting technique, nature of transmission errors, error detecting codes, error correcting codes, retransmission techniques. |
| 3. | Multiplexing and de-multiplexing techniques viz.., TDM, FDM. |
| 4. | Synchronous and asynchronous communications, carriers, bit and frame synchronization. |
| 5. | OSI reference model. |
| 6. | Introduction to transmission media and network topologies, MAN, LAN, WAN. |
| 7. | Circuit switching, message switching and packet switching, relative advantages and disadvantages. |
| 8. | Routing techniques, flooding static routing, centralized routing, distributed routing**.** |
| 9. | Multiple access scheme viz., TDMA, FDMA, ALOHA, CSMA techniques. |
| 10. | Integrated services, digital network, broadband ISDN. |
| 11. | Link level protocols. |

**Recommended Books**

| | | |
|---|---|---|
| 1. | Data Communications and Computer Networking | W. Stallings |
| 2. | Data Communications and Computer Networking | Behrouz Forouzan |

| **Subject:** Power Electronics (Code: EET3_----) | **Year & Semester:** B. Tech Electronics and Communication Engineering 3rd Year & 6th Semester | | **Total Course Credits: 4** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **3** | **1** | **0** |
| **Evaluation Policy** | Mid-Term | Class Assessment | End-Term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To understand the fundamentals of power devices like diodes, transistors, Thyristors, phase control circuits, converters etc.

**Course Outcomes:**

- **CO1** Explain the need for Power Electronics Devices and Circuits and their basic operation.
- **CO2** Analysis of driving and control and triggering circuits for Power Electronic converter.
- **CO3** Analysis of AC to DC converters (Single phase and three phases, controlled and uncontrolled), A.C Voltage controllers, DC to DC converters (choppers), and single-phase D.C to A.C converters (Inverters) in square wave mode.
- **CO4** Fourier analysis and knowledge of Power Quality issues associated with power electronic circuits.

**Details of Syllabus**

| **S.No.** | **Particulars** |
|---|---|
| **1.** | **An Introduction to Thyristor Engineering.** |
| **2.** | **Power Electronic Devices:** Heavy current and high voltage solid state devices, power diodes, power transistors, SCR's. Triacs Diacs and other Thyristors, Basic theory of operation and characteristics of SCR, Ratings, protection, series and parallel operation of SCRs. Driving circuits, GIO"s, IGBT,MOSFET. |
| **3.** | **Firing Circuits**: Line commutation of SCRs and forced commutation techniques. |
| **4.** | **Line Commutated Converters:** 2 pulse, 3 pulse, 6 pulse and higher pulse configurations. |
| **5.** | **AC Phase Control:** Integral cycle control**.** |
| **6.** | **Choppers:** Principle and basic chopper circuits. |
| **7.** | **Inverters:** Series parallel and bridge inverters and voltage control. |
| **8.** | **Application of Thyristor Technology to Electric Drives.** |
| **9.** | **Design of transformers, pulse transformer and design of inductors.** |

**Recommended Books**

| | | |
|---|---|---|
| **1.** | Power Electronics | Rashid |
| **2.** | Power Electronics | Ned Mohan |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Electronic Design & Automation Tools (Code: ECL354) | **Year & Semester:** B. Tech Electronics and Communication Engineering 3rd Year & 6th Semester | **Total Course Credit: 1** | | |
|---|---|---|---|---|
| | | **L** | **T** | **P** |
| | | **0** | **0** | **2** |
| **Evaluation Policy** | **Mid-Term/ Class Assessment** | **End-Term** | | |
| | 40 Marks | 60 Marks | | |

**Objectives: To study the design of various electronic circuits and systems using automatic simulation tools.**

**Course Outcomes:**

**CO1:** To develop the working knowledge of Vivado tool and any other electronic simulator available.
**CO2:** To develop the VHDL code for implementing the digital circuits.
**CO3:** To implement combinational or sequential circuits.
**CO4:** To test the hardware (FPGA Boards) using the implemented code.

**Details of Syllabus**

| **S.No.** | **Particulars** |
|---|---|
| **1.** | SPICE |
| **2.** | MATLAB |
| **3.** | ANSYS |
| **4.** | Any other electronic simulator available |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| | | | | |
|---|---|---|---|---|
| **Subject:** Industrial Training (Code: ECI355) | **Year & Semester:** B. Tech Electronics and Communication Engineering 3rd Year & 6th Semester | **Total Course Credit: 1** | | |
| | | **L** | **T** | **P** |
| | | **0** | **0** | **2** |
| **Evaluation Policy** | Mid-Term/ Class Assessment | End-Term | | |
| | | | | |

**Objectives:** Students are required to be a part of industrial organization and understand the implementation of technology there. The practical knowledge gained is to be presented in form of detailed report of work experience. The course will be evaluated on basis of viva and report.

**Course Outcomes:**

- **CO1** Acquaint themselves with the essential practical tasks emphasized in their Professional study.
- **CO2** Ability to identify, formulate & model problems & find engineering solutions based On a systems approach.
- **CO3** Learn professional ethics & economic aspects of industry.
- **CO4** Learn industrial settings, gaining hands-on experience in designing & manufacturing.

# Department of Electronics & Communication Engineering
# National Institute of Technology, Srinagar-190006

| **Subject:** Power Electronics Lab (Code: EEL 3x x ) | **Year & Semester:** B. Tech Electronics and Communication Engineering 3rd Year & 6th Semester | **Total Course Credit: 1** | | |
|---|---|---|---|---|
| | | **L** | **T** | **P** |
| | | **0** | **0** | **2** |
| **Evaluation Policy** | Mid-Term/ Class Assessment | End-Term | | |
| | 40 Marks | 60 Marks | | |

**Objectives:**
**Course Outcomes:**

**CO1**
**CO2**
**CO3**
**CO4**

**Details of Syllabus**

| S.No. | Particulars |
|---|---|
| 1. | To obtain V-I Characteristics of an SCR.<br>To obtain V-I Characteristics of a Triac. |
| 2. | To obtain the Static Emitter Characteristics of a UJT. |
| 3. | To study the Line-synchronized UJT Relaxation Oscillator as a triggering agent for a thyristor and plot load voltage Vs. firing angle. |
| 4. | To study various firing schemes of an SCR and draw the traces for various waveforms: Resistance Triggering Technique,<br>R-C Triggering Technique,<br>Linear Firing Scheme,<br>Inverse Cosine Firing Scheme. |
| 5. | To study a Single-Phase Half-Wave Converter and plot Source voltage, Load voltage and load current for R and R-L loads. |
| 6. | To study a Single-Phase Semi-Converter and plot Source voltage, Source current, Load voltage and load current for R, R-L and Motor Loads. |
| 7. | To study a Single-Phase Full-Converter and plot Source voltage, Source current, Load voltage and load current for R, R-L and Motor Loads. |
| 8. | To study a Three-Phase Semi-Converter and plot Source voltage, Source current, Load voltage and load current for R, R-L and Motor Loads. |
| 9. | To study a Three-Phase Full-Converter and plot Source voltage, Source current, Load voltage and load current for R, R-L and Motor Loads. |
| 10. | To study a Single-Phase Dual Converter on Motor Load. |
| 11. | To study a DC-DC Buck Converter (Step Down Chopper) for R, R-L and DC Motor Load and plot Load voltage Vs. Duty Ratio. |
| 12. | To study a Single-Phase Voltage Source Inverter on R and R-L Loads. |
| 13. | To study a Three-Phase Voltage Source Inverter on R and R-L Loads. |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

**Elective I**

| **Subject:** Multimedia Information Systems (Code: ECT- 356) | **Year & Semester:** B. Tech Electronics & Communication Engineering 3rd Year & 6th Semester | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **2** | **1** | **0** |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** The course is aimed to give students exposure to various audio, image and video standards so that the students gain enough skills to understand and handle multimedia systems.
**Course Outcomes (COs):** Upon successful completion of the course, student should be able to:
**CO1:** understand various digital audio standards and their utility in the practical systems.
**CO2:** comprehend various image data formats & their practical applications.
**CO3:** handle video systems used in practice.
**CO4:** understand various data compression standards used in practice.

**Details of the Syllabus:**

| S. No. | Particulars |
|---|---|
| 1 | Introduction: Multimedia systems: Components , Functional Requirements and Applications<br>Multimedia Data Acquisition and formats |
| 2 | Digital Audio: Sound digitization, Representation- Time Domain & Transform Domain Representation, Coding for Digital Audio - Pulse code modulation , Differential Coding Techniques |
| 3 | Graphics & Image Data: Graphics/ Image Data Types , Image Data Formats<br>Colour Models in Images -- RGB, CMY, CMYK |
| 4 | Fundamental of Video Processing: Types of Video Signals- Composite Video , S-video;<br>Analog and Digital Video Standards |
| 5 | Multimedia Data Compression:<br>Lossless Compression -- Run Length Coding, Variable Length Coding<br>Lossy Compression -- Discrete Cosine Transform , Wavelet Transform |

**Recommended Books:**

| S. No. | Name of Book | Author | Publisher |
|---|---|---|---|
| 1 | Fundamentals of Multimedia | Li, Ze-Nian, Drew, Mark, Liu, Jiangchuan | Pearson Education |
| 2 | Multimedia Systems and Design | Prabat K Andleigh and Kiran Thakrar | Pearson Education |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

<table>
<tr><td rowspan="2">Subject: Advanced Microprocessors (Code: ECT357)</td><td colspan="2" rowspan="2">Year & Semester: B. Tech Electronics and Communication Engineering<br>3rd Year & 6th Semester</td><td colspan="3">Total Course Credits: 3</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td rowspan="2">Evaluation Policy</td><td>Mid Term</td><td>Class Assessment</td><td colspan="3">End Term</td></tr>
<tr><td>30</td><td>10</td><td colspan="3">60</td></tr>
</table>

**Objectives:** To make students familiar about different types of Processor/Architectures and induce in them the sense of inquisitive thinking about design and implementation issues related to computer processors/architectures taking MIPS architecture as an example.

**Course Outcomes:**

**CO1:** Computer architectures, their significance and difference

**CO2:** Performance measures of processors and their evaluation

**CO3:** Design of data path for single cycle MIPS-32 implementation and introduction to multicycle implementation

**CO4:** Performance enhancement of the computer system using pipelining and memory management

**Syllabus Details:**

| S.No | Particulars |
|---|---|
| 1 | Familiarization and importance of CISC and RISC processors, their design issues. Hardware and Software interaction in Computers |
| 2 | Performance of Computers. Understanding and evaluation of CPU performance. Factors used for enhancement of performance. Performance bench marks |
| 3 | Introduction to MIPS-32 and MIPS-64 processors and their instruction formats/addressing modes.<br>Single Cycle Data Path implementation of MIPS-32 and introduction to multipath implementation. |
| 4 | Performance enhancement of MIPS-32 using pipelining. Pipeline Hazards and the resolution of Pipeline Hazards |
| 5 | Memory hierarchy and use of memory hierarchy for improvement of computer performance. Virtual memory importance and implementation in the computer system. |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** VLSI Technology (Code: ECT358) | **Year & Semester**: B. Tech Electronics and Communication Engineering 3rd Year & 6th Semester | | **Total Course Credits: 3** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | Mid Term | Class Assessment | End Term | | |
| | 30 | 10 | 60 | | |

**Objectives:** To introduce students with the basic concepts of VLSI and ULSI theory and technology. Profound understanding of the latest fabrication techniques, with emphasis on the ultra deep submicron technology and their issues and challenges

**Course Outcomes:**
**CO1:** Develop the concept of crystal growth and wafer preparation.
**CO2:** Develop the knowledge of various fabrication processes such as Epitaxy, Oxidation, Lithography and Etching.
**CO3:** Study the methodology of doping in detail and process of metallization.
**CO4:** Apply the concept of fabrication processes for process simulation, integration and understanding of different assembly and packing techniques.

**Details of Syllabus:**

| S. No. | Particulars |
|---|---|
| 1 | **Crystal Growth, Wafer Preparation, Epitaxy and Oxidation** Electronic Grade Silicon, Czochralski crystal growing, Silicon Shaping, processing consideration, Vapor phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators, Epitaxial Evaluation, Growth Mechanism and kinetics, Thin Oxides, Oxidation Techniques and Systems, Oxide properties, Redistribution of Dopants at interface, Oxidation of Poly Silicon, Oxidation induced Defects. |
| 2 | **Lithography and Relative Plasma Etching** Optical Lithography, Electron Lithography, X-Ray Lithography, Ion Lithography, Plasma properties, Feature Size control and Anisotropic Etch mechanism, Relative Plasma Etching techniques and Equipments |
| 3 | **Deposition, Diffusion, Ion Implantation and Metallization** Deposition process, Polysilicon, plasma assisted Deposition, Models of Diffusion in Solids, Flick's one dimensional Diffusion Equation – Atomic Diffusion Mechanism – Measurement techniques – Range theory- Implant equipment. Annealing Shallow junction – High energy implantation – Physical vapour deposition – Patterning. |
| 4 | **VLSI Process Integration and Process Simulation** Ion implantation – Diffusion and oxidation – Epitaxy – Lithography – Etching and Deposition- NMOS IC Technology – CMOS IC Technology – MOS Memory IC technology - Bipolar IC Technology – IC Fabrication. Introduction to process simulation |
| 5 | **Assembly Techniques and packaging of VLSI Devices** Analytical Beams – Beams Specimen interactions - Chemical methods – Package types – banking design consideration – VLSI assembly technology – Package fabrication technology. |

**Recommended Books:**

| | | |
|---|---|---|
| **1.** | VLSI Technology McGraw Hill | Sze |
| **2.** | ULSI Technology McGraw Hill | Chang and Sze |
| **3.** | Silicon VLSI Technology: Fundamentals, Practice, and Modeling Pearson | Plummer |
| **4** | VLSI Fabrication Principles: Silicon and Gallium Arsenide Wiley Student edition | S K Gandhi |

# Department of Electronics & Communication Engineering
# National Institute of Technology, Srinagar-190006

| **Subject:** Network Synthesis (Code: ECT359) | **Year & Semester:** B. Tech Electronics and Communication Engineering 3rd Year & 6th Semester | | Total Course Credits: 4 | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | Mid Term | Class Assessment | End Term | | |
| | 30 | 10 | 60 | | |

**Objectives:** To introduce students with the basic concepts of Electric Circuit design theory and familiarize them how to synthesis the circuits to get transits as well as steady state response of the proposed system with emphasis on synthesis in frequency domain using different techniques.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Comprehensive understanding of synthesizing techniques for circuits and systems |
| **CO2** | Understanding of causality, stability, and realizability theory; Hurwitz polynomial; Positive real functions |
| **CO3** | Synthesis procedure for driving point and transfer immittance functions for RLC circuits |
| **CO4** | Synthesis and filter design, transient response, magnitude and frequency normalization, frequency transformation |

**Details of the syllabus:**

| S. No | Particulars |
|---|---|
| 1 | **Introduction:** Frequency domain representation of networks, Laplace transforms of shifted functions, transient & steady response. Time domain behaviors from poles and zeros, Convolution Theorem. |
| 2 | ***Network Synthesis:*** *Network functions, Impedance & Admittance function, Transfer functions, Relationship between transfer and impulse response, poles and zeros and restrictions, Network function for two terminal pair network.* |
| 3 | ***Poles and Zeros:*** *Sinusoidal network in terms of poles & zeros. Real liability condition for impedance synthesis of RL & RC circuits, Network synthesis techniques for 2-terminal network, Foster and Cauer forms.* |
| 4 | ***Filters Synthesis:*** *Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T section, IT section, terminating half section, Pass bands and stop bands. Design of constant-K, m-derived filters, Composite filters.* |

**Suggested Books:**

| | | |
|---|---|---|
| **1.** | Network Synthesis | Van Valkenberg |
| **2.** | Network Synthesis | IVS Iyer |
| **3.** | Network Analysis & Synthesis | Franklin F Kou |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Python Programming (Code: CST 310) | **Year & Semester:** B. Tech Electronics & Communication Engineering 3rd Year & 5th Semester | | **Total Course Credit: 4** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | - |
| **Evaluation Policy** | Mid-Term | Class Assessment | End-Term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** (Maximum 25 Words): The course is designed to provide Basic knowledge of Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.

**Course Outcomes (COs):**

Upon successful completion of the course, student should be able to:

**CO1:** Understand Python syntax and semantics and self-assured in the use of Python flow control and functions.

**CO2:** Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.

**CO3:** Learn to approach real world problems as a programmer, including skills necessary to contribute to a production development team.

**CO4:** Gain functional knowledge of Python, SQL databases and the Django framework.

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **Introduction to Python:** What is Python and history of Python? Unique features of Python, Python-2 and Python-3 differences, Install Python and Environment Setup, First Python Program. Python Identifiers, Keywords and Indentation, Comments and document interlude in Python, Command line arguments, Getting User Input, Python Data Types, What are variables? |
| 2. | **Control Statements:** Python Core objects and Functions, Number and Maths , if-else, if-elif-else, while loop, for loop, break, continue, assert, pass, return. |
| 3. | **List, Ranges & Tuples in Python:** Introduction to Lists in Python, More about Lists, Understanding Iterators ; Generators, Comprehensions and Lambda Expressions, Understanding and using Ranges, More About Ranges, Ordered Sets with tuples |
| 4. | **Input and Output in Python:** Reading and writing text files, writing Text Files, Appending to Files and Challenge, Writing Binary Files Manually, Using Pickle to Write Binary Files |
| 5. | **Python built in function and Data Science Using Python:** Python user defined functions, Python packages functions, Defining and calling Function, The anonymous Functions, Loops and statement in Python, Python Modules & Packages. Introduction to numpy, Creating arrays, Indexing Arrays, Array Transposition, Universal Array Function, Array Processing, Array Input and Output |
| 6. | **Exceptions & Python Regular Expressions:** Errors in Python, Compile-Time Errors, Runtime Errors, Logical Errors, What is Exception? |

| | |
|---|---|
| | Handling an exception, try….except…else. What are regular expressions? The match Function, The search Function, Matching vs searching, Search and Replace, Extended Regular Expressions |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | "Python for Everybody: Exploring Data Using Python 3", 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.drchuck.com/pythonlearn/EN_us/pythonlearn.pdf ) (Chapters 1 – 13, 15) | Charles R. Severance |
| 2 | "Think Python: How to Think Like a Computer Scientist", 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 15, 16, 17) | Allen B. Downey |
| 3 | "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014 | Charles Dierbach, |
| 4 | "Data Structures and Algorithms in Python",1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978- 8126562176 | Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, |

# Department of Electronics & Communication Engineering
# National Institute of Technology, Srinagar-190006

| **Subject:** Numerical Analysis & Techniques (Code: MAT 603) | **Year & Semester:** B. Tech Electronics & Communication Engineering 3rd year & 6th Semester | | **Total Credit: 3** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **2** | **1** | **-** |
| **Evaluation Policy** | Mid-Term | Class Assessment | End-Term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** The objective of this subject is to make the students aware of the numerical methods for the solution of scientific problems which cannot be solved analytically.

**Course Outcomes (COs):**
Upon successful completion of the course, student should be able to:
**CO1:** Error estimate and Solve algebraic and transcendental equations using numerical techniques
**CO2:** Solution of Simultaneous Linear Algebraic Equations
**CO3:** Construction of Interpolating polynomial and finding intermediate value
**CO4:** Solve ordinary differential equations by numerical techniques
**CO5:** Apply Numerical techniques in Electronics & Communication Engineering problems

**Details of the syllabus:**

| S. No. | Particulars |
|---|---|
| 1. | **Errors in Numerical Calculations:(3 lectures)**<br>Floating- point form of numbers, Round-off, Algorithm, Stability, Programming errors, Errors of Numerical Results, Error propagation, Basic error principle, Loss of significant digits. |
| 2. | **Interpolation:(11 lectures)**<br>Difference Table and its usage. The difference operators Δ,▼ and the operator E. Interpolation Forward, Backward and Shift operators, Central differences , over-raging operator μ. Relations between the operators, their relations , Existence, Uniqueness of interpolating polynomial, Interpolation with equal intervals: Newton's advancing difference formula. Newton's backward difference formula.<br>Interpolation with unequal intervals. Newton's divided difference formula. Lagrange's interpolation formula. Gauss forward and backward interpolation formula |
| 3. | **Numerical solution of algebraic and Transcendental Equations: (4 lectures)**<br>Graphic Method, Regula-Fast method, Bolzano's Process of bisection of intervals, Newton-Raphson Method and its geometrical significance |
| 4. | **Numerical Integration: (4 lectures)**<br>Numerical Integration, General Quadrature Formula, Simpson's 1/3rd and 3/8th rules, Weddle's' rule, Trapezoidal rule. |
| 5. | **Numerical Solution of ordinary differential equations:(4 lectures)**<br>Numerical solution of ordinary differential equations, Picard's method. Taylor's series method, Euler's method, Runge Kutta Method |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | Numerical Methods for Scientists and Engineering, Wiley Eastern Ltd New age international publishers, 7th Edition, 2019, ISBN: 9789387477254, 9387477258.. | M.K. Jain, S. R. Iyengar & R.K. Jain |
| 2 | Introductory methods in Numerical Analysis, 5th Edition, Prentice Hall India learning Pvt Ltd, ISBN: 9788120345928, 9788120345928 | S.S. Sastry, |
| 3. | Elementary Numerical Analysis, , 3rd Edition, 2006, Wiley India Pvt Ltd, ISBN-13: 978-9754142747 | Kendall E. Atkinson, Han |
| 4 | Elementary Numerical Analysis An algorithmic approach, McGraw-Hill, 1980, **ISBN-13:** 978-0070124479 | S. D. Conte and C. de Boor |
| 5 | Mathematical Numerical Analysis, Oxford and IBH Publishers, 6th Edition, 2020, ISBN: 9788120417595, 9788120417595 | J.B. Scarborough |

# 7th Semester B Tech ECE
# Syllabus

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Embedded Systems (Code: ECT401) | **Year & Semester:** B. Tech Electronics & Communication Engineering 4th year 7th semester | | **Total Course Credits: 3** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | Mid-term | Class assessment | End-term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** Develop an understanding of the technologies behind the embedded computing systems. To introduce students to the design issues of embedded systems. Enable students to analyze and develop software programs for embedded systems.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Knowledge about Embedded systems and its architecture with basic of memory System and I/o Sub-system |
| **CO2** | To analyze various memory devices and their characteristics with component (Memory and I/O device) interfacing |
| **CO3** | To understand programming languages and basic compilation techniques |
| **CO4** | To understand features of operating system along with real-time memory management and network fundamentals |

**Details of Syllabus:**

| S.No | Particulars |
|---|---|
| **1.** | **Introduction:** Characteristics of Embedding Computing Applications, Concept of Real time Systems, Challenges in Embedded System Design. Design Process. |
| **2.** | **Embedded System Architecture:** Instruction Set Architecture - CISC and RISC instruction set architecture, Basic Embedded Processor/Microcontroller Architecture, Memory System Architecture, I/o Sub-system, Co-processors and Hardware Accelerators, Processor Performance Enhancement, CPU Power Consumption. |
| **3.** | **Designing Embedded Computing Platform:** Using CPU Bus, Memory Devices and their Characteristics – RAM, ROM, UVROM, EEPROM, Flash Memory, DRAM. I/O Devices. Component Interfacing - Memory Interfacing, I/O Device Interfacing, Interfacing Protocols. Designing with Processors. |
| **4.** | **Programming Embedded Systems:** Program Design, Programming Languages - Desired Language Characteristics, Use of High Level Languages, Programming and Run-time Environment, Basic Compilation Techniques, Analysis and Optimization of - Execution Time, Energy and Power, Program Size. |
| **5.** | **Operating System:** Basic Features of an Operating System, Kernel Features, Processes and Threads, Context Switching, Scheduling, Inter-process Communication, Real-time Memory Management, I/O, Evaluating and Optimizing Operating system performance, Power Optimization Strategies for Processes. |

| | |
|---|---|
| **6.** | **Network Fundamentals:** Layers and Protocols, Distributed Embedded Architectures, Elements of Protocol Design, High Level Protocol Design Languages, Network Based Design, Internet-Enabled Systems, Wireless Applications – Bluetooth. |

**Recommended Books:**

| **S. No.** | **Book Name** | **Author Name** |
|---|---|---|
| 1 | Embedded Systems: Architecture, Programming and Design | Raj Kumar |
| 2 | Embedded System Design- A unified Hardware/software Introduction | Frank Vahid, Tony Givargis |
| 3 | Programming Embedded Systems in C and C ++ | Michael Barr, O'Reilly |
| 4 | Real-Time Concepts for Embedded Systems | Q. Li and C. Yao |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Digital Signal Processing (Code: ECT402) | **Year & Semester:** B. Tech Electronics & Communication Engineering 4th year 7th semester | | **Total Course Credits: 3** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | Mid-term | Class assessment | End-term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To acquire knowledge and become familiar with various types of signals, 2D signals, different types of systems, filter design & to develop the concept of various mathematical tools like Fourier transform, z transform, finite modeling, etc.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Thorough understanding of the discrete time signals and systems and the system properties based on Fourier analysis, Z transform, FFT |
| **CO2** | To understand various algorithms and their computational complexities. |
| **CO3** | Design, implementation and analysis of IIR and FIR filters and their modeling effects in signal processing. |
| **CO4** | Understand the architecture of Digital Signal Processing |

**Details of Syllabus:**

| **S.No.** | **Particulars** |
|---|---|
| **1.** | **Introduction**:-Discrete time signals and systems frequency domain representation |
| **2.** | **Transforms**:-Z- transform, Discrete Fourier transform. Discrete correlation and correlator, Two dimensional signals and systems and their frequency domain representations. Discrete Hilbert transform. Fast Fourier transform |
| **3.** | **Algorithms**: - Computational consideration. Bluestein chirp – z transform Algorithm. |
| **4.** | **Filters: -** Digital filters. Representation, form realization. Design of digital filters, specification and design techniques. IIR and FIR digital filters. |
| **5.** | Finite modeling effect in digital signal processing applications. |
| **6.** | Introduction to DSP processors. |

**Recommended Books:**

| | | |
|---|---|---|
| **1.** | Digital Signal processing | Proakis |
| **2.** | Digital Signal Processing | Chittod |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Wireless Communication (Code: ECT403) | **Year & Semester:** B. Tech Electronics & Communication Engineering 4th year 7th semester | | **Total Course Credits: 3** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | Mid-term | Class assessment | End-term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To introduce basic cellular concepts & to develop the understanding of frequency reuse, cell splitting, shadowing, fading, GSM standards, mobility management,IS-95, GPRS, etc.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | To understand basic concepts of wireless communication, performance parameters, noise, spectrum and interference limitations. |
| **CO2** | To understand cellular communication principles and perform the analysis using the concepts of frequency reuse, handover and interference management. |
| **CO3** | To understand large scale and small scale channel propagation models and obtain quantitative results for link budget, BER analysis and different diversity techniques. |
| **CO4** | To learn various multiple access techniques, performance analysis issues and get exposure of recent trends in wireless communication. |

**Details of Syllabus:**

| S.No. | Particulars |
|---|---|
| **1.** | **Introduction:** Classification of wireless systems Types of Services, Requirements for the services, Performance parameters in wireless communications, Multipath propagation, Spectrum Limitations, Noise and Interference limited systems, Economic considerations, Standards |
| **2.** | **Propagation Channels:** Radio Propagation Mechanisms (Qualitative treatment), Propagation effects with mobile radio, Channel Classification, Link calculations, Narrowband and Wideband models. |
| **3.** | **Diversity**: Diversity modeling, BER performance Improvement with Diversity, Types of Diversity – Frequency, Time, Space |
| **4.** | **Cellular Communication:** Introduction to Cellular Communications, Frequency reuse, Basic theory of cell layout, Cellular Processes - Call Setup, Handover etc, |
| **5.** | **Multiple Access Schemes:** FDMA, TDMA, CDMA, and Random multiple accesses, Comparison, Performance Analysis issues, and Design. |
| **6.** | **Recent Trends:** UWB, MIMO, 4G & 5G, Cognitive Radio, Network on a chip. |

**Recommended Books:**

| | | |
|---|---|---|
| **1.** | Wireless Communications | Andreas F. Molisch. |
| **2.** | Wireless Communications Principles and Practice | Rappaport. |
| **3.** | Wireless Communications and Networks | Stallings. |

# Department of Electronics & Communication Engineering
# National Institute of Technology, Srinagar-190006

| **Subject:** Electronic Measurements & Instrumentation (Code: ECT404) | **Year & Semester:** B. Tech Electronics & Communication Engineering 4th year 7th semester | | **Total Course Credits: 4** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 3 | 1 | 0 |
| **Evaluation Policy** | Mid-term | Class assessment | End-term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To introduce the instrumentation system, to teach the construction, operation of various transducers, sensors, etc, to develop the concept of function generators, frequency counters, data acquisition systems, interfacing of micro controllers and basic GPIB techniques.

**Course Outcomes:**

**CO1:** To familiarize with measurement standards and systems with their responses

**CO2:** To get a detailed understanding of various analog meters

**CO3:** To introduce transducers, sensors and actuators used in measurements

**CO4:** To understand the working of wave generators, analyzers and digital meters and to get knowledge about data acquisition system and interfacing with microcontrollers

**Details of Syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **Measurement System and Standards:** Instrumentation System and its classification, Primary and secondary standards, Standards of various electrical quantities, IEEE standards, Static and Dynamic response, Errors, and accuracy of an instrumentation system. |
| 2. | **Measurement of Basic Parameters:** Galvanometer and its principle, Moving Coil, Moving iron meters, true rms meter, Bridge measurements, Q meters, Measurement of Voltage, Current, Power, Energy. Measurement of Resistance, Capacitance, Inductance. |
| 3. | **Transducers, Sensors, and Actuators:** Active and Passive, Transducers types: Resistive, Inductive, capacitive, Piezoelectric, Optical, Photo diodes; Measurement of Physical, Physiological, And chemical quantities: (Temperature, pH, Luminescence, Flow, Pressure, Torque, Speed, acceleration, Rotation, Stress, Strain, etc,), Sensors for hostile environments, Actuators: Relays, Solenoids, Stepper motors. |
| 4. | **Signal Generators and Analyzers:** Function generators, RF Signal Generator, Sweep Generator, Frequency synthesizer, Wave Analyzers for Audio and radio frequency waves. Measurement of harmonic distortion. Spectrum analysis, RF Power measurement. |
| 5. | **Digital Instrumentation:** Comparison of analog and digital techniques, Digital voltmeter, Digital multimeter, Frequency counter, Measurement of frequency and time interval, extension of frequency range, Measurement errors. |
| 6. | **Data Acquisition System:** Components of data acquisition system, Interfacing of transducers, Single Channel and Multi-channel system, Multiplexing, interfacing with micro controllers, IEEE 488 Bus, Automated data acquisition, |

| | |
|---|---|
| **7.** | **Advanced topics:** Virtual Instrumentation, Low level measurements and Noise rejection, GPIB based measurement techniques. Measurements using MEMS |
| **8.** | **Measurement System and Standards:** Instrumentation System and its classification, Primary and secondary standards, Standards of various electrical quantities, IEEE standards, Static and Dynamic response, Errors, and accuracy of an instrumentation system. |

**Recommended Books:**

| | | |
|---|---|---|
| **1.** | **Electronic Measurements** | **W Cooper** |
| **2.** | **Electrical & Electronic Measurements** | **A K Sawhney** |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Microwave Engineering (Code: ECT405) | **Year & Semester:** B. Tech Electronics & Communication Engineering 4th year 7th semester | | **Total Course Credits: 4** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 3 | 1 | 0 |
| **Evaluation Policy** | Mid-term | Class assessment | End-term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To understand basics of microwave communication, various active and passive devices, microwave amplifiers and oscillators.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | To have good idea about microwaves, microwave communication and wave propagation through waveguides. |
| **CO2** | To understand microwave cavities, scattering parameters and microwave passive devices |
| **CO3** | To be able to understand the working and construction of various Active microwave devices |
| **CO4** | To have in-depth understanding about high frequency semiconductor active devices and to be able to design microwave amplifiers and oscillator circuits |

**Details of Syllabus:**

| S.No. | Particulars |
|---|---|
| **1.** | **Introduction to Microwave Communication:** Need, Advantages and application of microwave signals. |
| **2.** | **Waveguides and Cavity Resonators**: Transverse Electric and Transverse magnetic Waves, Wave propagation through rectangular and circular waveguides, Power transmission and attenuation in waveguides, Electromagnetic Resonators, Rectangular & Circular cavities. |
| **3.** | **Microwave Passive Devices:** Scattering Matrix (S Parameter) representation of multi-port networks, Tees, Directional Coupler, Circulator and Isolator. |
| **4.** | **Microwave Active Devices:** Limitations of conventional vacuum tubes at microwave frequencies, Klystrons, Traveling wave tube, Magnetron, Microwave Detectors, Mixers-Single ended and Balanced. |
| **5.** | **High Frequency Devices:** PIN diode, Varactor diode, Tunnel diode, Read diode , IMPATT, TRAPATT and Gunn diode, Microwave Switches |
| **6.** | **Microwave Amplifiers and Oscillators:** Microwave Transistors-Bipolar and Field Effect Transistor Characteristics, Gain and Stability, Microwave Amplifier design, Gunn and transistor oscillators. |

**Recommended Books:**

| | | |
|---|---|---|
| **1.** | **Microwave Devices & Circuits, PHI** | **Liao, S. Y** |
| **2.** | **Microwave Engineering, John Wiley** | **David Pozar** |
| **3.** | **Foundations for Microwave Engineering** | **R E Collin** |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Pre-Project & Seminar (Code: ECP406) | **Year & Semester**: B. Tech Electronics & Communication Engineering 4th year 7th semester | **Total Course Credits: 2** | | |
|---|---|---|---|---|
| | | L | T | P |
| | | 0 | 0 | 2 |
| **Evaluation Policy** | Mid-term/Class assessment | End-Term | | |
| | 40 | 60 | | |

**Objectives:** The main objective of this course is to attain skills for literature survey, writing report, preparing presentations and aural presentation of Technical subjects.

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Review literature on a given advance topic related to the specific stream. |
| **CO2** | Summarize the concept of the chosen topic systematically after considerable study of the content from primary as well as secondary sources |
| **CO3** | Learn and present the structure and format of technical reports as per specified norms |
| **CO4** | Interpret graphs/results of various kinds and discuss the concept and conclusion in an open seminar |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Embedded Systems LAB (Code: ECL 407) | **Year & Semester:** B. Tech Electronics & Communication Engineering 4th year 7th semester | | **Total Course Credits: 1** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 0 | 0 | 2 |
| **Evaluation Policy** | Mid Term | End Term | | | |
| | 40 | 60 | | | |

**Objectives:** To introduce the basics programming of Microcontroller along with interfacing with different real time modules.

**Course Outcomes:**

**CO1** Knowledge about programming of Microcontroller.

**CO2** Interfacing of the Microcontroller with various modules like LED, Seven Segment Display, LCD, Keypad and ADC.

**CO3** Use of on chip modules like timers and interrupts.

**CO4** Implementation of serial communication using Microcontroller.

**List of Experiments (8051 Programming):**

1. Write a program for performing simple arithmetic operations.
2. Write a program for square waveform generation, with different frequencies and duty cycles.
3. Write a simple program for flashing LEDs using software delays.
4. Write a program for flashing LEDs using timers and interrupts.
5. Write a program for interfacing Seven Segment Display with 8051.
6. Write a program for interfacing LCD with 8051 and display message on LCD.
7. Write a program for interfacing Keypad with 8051 and display keypad input on LCD.
8. Write a program for serial communication through UART using polling and interrupt methods.
9. Write a program for interfacing ADC 0804 with 8051.
10. Write a program to interface sensor to I/O ports.

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| | | | | | |
|---|---|---|---|---|---|
| **Subject:** EDA Tools II Lab (Code: ECL 408) | **Year & Semester:** B. Tech Electronics & Communication Engineering 3rd Year & 7th Semester | | **Total Course Credit: 4** | | |
| | | | L | T | P |
| | | | 0 | 0 | 2 |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | | 10 Marks | 90 Marks | | |

**Objectives:** To understand the use of MATLAB and Verilog-A as languages for implementation of models for device and circuit simulation

**Course Outcomes (COs):**

Upon successful completion of the course, student should be able to:

**CO1:** Use MATLAB as a language for simulating device models
**CO2:** Use Verilog-A for device simulation
**CO3:** Implement a SPICE netlist using Verilog-A models
**CO4:** Get familiarity with Industry Standard Compact Models for Electronic Design Automation

**List of Experiments:**

| S. No. | Particulars |
|---|---|
| **1.** | Installation of MATLAB with the basic information of MATLAB workspace and working directory. |
| **2.** | Creating matrices and some simple matrix operations. |
| **3.** | Statistics and working with basic programs. |
| **4.** | MATLAB Programming language-looping and branching. |
| **5.** | Writing MATLAB functions. |
| **6.** | Graphics and Plotting- 2D graphs. |
| **7.** | Introduction to Verilog HDL Basics. |
| **8.** | Working with Verilog MODELING for SPICE |
| **9.** | Verilog Syntax, Data type, Fundamentals. |
| **10.** | Working with Verilog Structure. |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Microwave Engineering Lab (Code: ECL409) | **Year & Semester:** B. Tech Electronics & Communication Engineering 4th year 7th semester | **Total Course Credits: 1** | | |
|---|---|---|---|---|
| | | L | T | P |
| | | 0 | 0 | 2 |
| **Evaluation Policy** | **Mid-term/Class assessment** | **End-Term** | | |
| | 40 Marks | 60 Marks | | |

**Objectives:** The experimental setups are introduced to and performed by the students to enable them to give optimal performance in professional life.

**Course Outcomes:**

**CO1:** Explain and Perform the Reflex klystron Characteristics using Microwave bench set

**CO2:** Explain and Perform the Gunn diode Characteristics using Microwave bench setup

CO3: Measure the Frequency, attenuation, VSWR, Impedance using Klystron Bench Setup

CO4: Analyze various characteristics of microwave junctions and design of microwave communication links

**Details of Syllabus:**

| S.No. | Particulars |
|---|---|
| **1.** | To determine the characteristic impedance of lumped constant delay line. |
| **2.** | To study the voltage distribution along a lumped constant delay line in the cases when it is: (i) Open Circuited ii. Short Circuited (ii) iii. Terminated in Zo and hence determine attenuation constant, phase constant, propagation constant and wavelength. |
| **3.** | To study the method of measuring VSWR at the input of the component under test or unknown load when (i) VSWR<10 and (ii) VSWR>10 |
| **4.** | To set up an LOS link using microwave horn antennas and study the link performance under different obstructions. |
| **5.** | To study the method of evaluation of an unknown load impedance by measuring VSWR and the position of voltage minimum |
| **6.** | i. To study the characteristic of wave propagation in a waveguide by studying standing wave pattern and hence to plot W.B. diagram.<br>ii. To verify relationship between guide wavelength and free space wavelength |
| **7.** | To study the method of measurement of VSWR at the input of the component under test (say pyramidal horn) and hence to determine its input impedance. |
| **8.** | To measure the frequency of a microwave source. |
| **9.** | To study Gunn oscillator as a source of microwave power and hence to study.<br>i. I-V Characteristics<br>ii. Power frequency characteristics |
| **10.** | To measure main line and auxiliary line VSWR of a directional coupler |
| **11.** | To study the properties of E and H-plane waveguide tee junctions and to determine isolations, coupling coefficients and input VSWR. |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

**Elective II**

| **Subject:** Radar Systems (Code: ECT- 410) | **Year & Semester:** B. Tech Electronics & Communication Engineering 4th Year & 7th Semester | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **2** | **1** | **0** |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** The course is aimed to expose students to radar techniques for target detection in presence of noise and clutter. The course will enable students to gain insight into the emerging applications of radar technology.

**Course Outcomes :** Upon successful completion of the course, student should be able to:
**CO1:** understand the radar operation and its applications in practice.
**CO2 :** design a radar signal for a given problem.
**CO3:** choose a suitable detection method for detecting a target in presence of noise and clutter.
**CO4:** understand the tracking methods in a radar system.

**Details of the Syllabus:**

| **S. No.** | **Particulars** |
|---|---|
| 6. | Introduction to Radar Systems:<br>Radar Equation, Radar Cross section, Area and volume Targets |
| 7. | Radar Signals: Radar Signal Types and their LTI response,<br>Matched Filter Response for stationary and moving targets, Ambiguity function<br>Pulse compression of Radar Signals. Basic Concept and compression techniques. |
| 8. | Radar Detection: Basic Detection principles, Optimum decision rule, Detection criteria for different target models. |
| 9. | Radar measurements: Range, Doppler frequency and angle measurement.<br>Optimum Receiver Design, Radar Tracking |
| 10. | Emerging Trends in Radar technology:<br>3D Radar, Active Scanned Arrays for RADARs, Broadband Multifunction Radar, Distributed Aperture Radar Systems, Use of Light Detection and Ranging(LIDAR) sensors in Radar systems. |

**Recommended Books:**

| **S. No.** | **Name of Book** | **Author** | **Publisher** |
|---|---|---|---|
| 3. | Radar Principles | P.Z.Peebles | Wiley |
| 4. | Introduction to Radar Systems, (3/e) | Merrill I. Skolink | Tata MG Graw Hill |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** System Design (Code: ECT 411) | **Year & Semester:** B. Tech Electronics & Communication Engineering 3rd Year & 7th Semester | | **Total Course Credit: 4** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To learn basic techniques for the interfacing between system components, meta-stability, and techniques for handling them; to study Layout strategies at IC and board level for local and global signals

**Course Outcomes:** Upon successful completion of the course, student should be able to:

**CO1:** Understand the System partitioning techniques in different forms and Interfacing in linear and digital systems.
**CO2:** Design finite state machines, and implement state assignment strategies.
**CO3:** Carry out implementation of DSP algorithms, and comprehend signal integrity and high speed behavior of interconnects.
**CO4:** Get familiar with the Layout strategies at IC level.

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **Module I:** Basics of system hardware design. Hierarchical design using top-down and bottom-up methodology. |
| 2. | **Module II:** System partitioning techniques, interfacing between system components. Handling multiple clock domains, Synchronous and asynchronous design styles. Interface between synchronous and asynchronous blocks. Meta-stability and techniques for handling it. Interfacing linear and digital systems, data conversion circuits. |
| 3. | **Module III:** Design of finite state machines, state assignment strategies. Design and optimization of pipelined stages. Use of data flow graphs, Critical path analysis, retiming and scheduling strategies for performance enhancement. Implementation of DSP algorithms. Signal integrity and high speed behavior of interconnects: ringing, cross talk and ground bounce. |
| 4. | **Module IV:** Layout strategies at IC and board level for local and global signals. Power supply decoupling. |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | System Analysis & Design | V K Jain |
| 2. | Modern Systems Analysis and Design | Jeffrey A. Hoffer |
| 3. | System Analysis & Design | Silver and Silver Addison Wesley, last edition. |
| 4. | System Analysis & Design | Kenneth E. Kendall |

# Department of Electronics & Communication Engineering
# National Institute of Technology, Srinagar-190006

| **Subject:** Analog CMOS Design (Code: ECT 412) | **Year & Semester:** B. Tech Electronics & Communication Engineering 3rd Year & 7th Semester | | **Total Course Credit: 4** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** As the course title suggests, the course will be specific to Analog CMOS circuit implementations. In particular, the course will focus on different configurations of CMOS analog amplifier and different differential amplifier topologies and their analysis. The course will also cover voltage references and current mirrors.

**Course Outcomes:**

| | |
|---|---|
| CO1 | To design and analyze Basic CMOS Amplifier configurations Analysis using small signal model; and Large signal Analysis of Amplifiers |
| CO2 | Able to analyze and design analog circuits such as Differential Amplifier, OP-AMP, Current mirrors, Biasing, Voltage references, Frequency Synthesizers |
| CO3 | Ability to analyze high-frequency response of amplifiers and stability compensation for amplifiers |
| CO4 | Performance Analysis and Design of Multistage amplifiers |

## 1 Details of Syllabus:

| S. No. | Particulars |
|---|---|
| 1 | Introduction to analog VLSI and mixed signal issues in CMOS technologies. Basic MOS models, SPICE Models and frequency dependent parameters. |
| 2 | Basic NMOS/CMOS gain stage, CS, CG, CD configurations, cascade and cascode circuits. Frequency response, stability |
| 3 | Differential amplifier and OP-AMP design, Frequency response, stability |
| 4 | Current Sources and Voltage references, Frequency Synthesizers, Voltage Controlled Oscillators and Phased lock-loop |
| 5 | Multi stage Amplifiers |
| 6 | Noise issues in Amplifiers. |

## 2 Suggested Book :

| | | |
|---|---|---|
| **1.** | Design of Analog CMOS Integrated Circuits McGraw Hill | Behzad Razavi |
| **2.** | CMOS Analog Circuit Design, Oxford University Press | Allen and Holberg, |
| **3** | CMOS Circuit Design, Layout, and Simulation, PHI | Baker, Li, and Boyce |

# Department of Electronics & Communication Engineering
# National Institute of Technology, Srinagar-190006

| **Subject:** Advanced Power Electronics (Code: EET 4xx) | **Year & Semester:** B. Tech Electronics and communication Engineering 4th Year VII Semester | | **Total Course Credit: 4** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 3 | 1 | 0 |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Course Outcomes (COs):**

Upon successful completion of the course, student should be able to:

- **CO1:** Understand three phase voltage source and current source inverters and their modulation strategies.
- **CO2:** Understand the operation of non-isolated DC-DC Converters
- **CO3:** Understand the operation of isolated DC-DC converter.
- **CO4:** Perform comparative assessment of different modulation techniques
- **CO5:** Understand the applications of power electronics in appliances such as Power conditioners and UPS.

Details of syllabus

| S.No. | Particulars |
|---|---|
| 1 | **Unit 1:** Three phase Voltage source inverters in square wave mode. 120 and 180degree modes of conduction. Three phase Current Source Converter |
| 2 | **Unit 2**:Different modulation strategies- Sine PWM, Hysteresis Current Control Technique, Selective Harmonic Elimination, Space Vector Modulation. |
| 3 | **Unit 3:** Non Isolated D.C to D.C converters in CCM and DCM, Boundary conditions, Non-Ideal Behavior, Design of Passives for: Buck, Boost, Buck-Boost and Cukconverter circuits. |
| 4 | **Unit 4:** Isolated DC-DC converters: Flyback converter, Forward converter, Push-Pull converter, Half-Bridge converter and Full-Bridge converter |
| 5 | **Unit 5:** Power line disturbances and their effect on equipment, Power conditioners, offline and online UPS |

**Text Books**


1. Power Electronics by Daniel W Hart, Tata Mc Graw Hill
2. Power Electronics: Converter, Applications & Design, by N. Mohan, T.M. Undeland & W.P. Robbins, John Wiley & Sons, 1989
3. Fundamentals of Power Electronics, Erickson and Macsimovic


**References**


1. Power Electronics: Devices, Drivers, Applications, and Passive Components by Barry Williams
2. Modern Power Electronics and AC motor Drives By Bimal K Bose- Pearson Publishers.
3. Referred Journal/Conference publications.

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Design & Analysis of Algorithms **(Code: CST 306)** | **Year & Semester:** B. Tech Electronics & Communication Engineering 3rd Year & 5th Semester | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | - |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** (Maximum 25 Words) This course covers, principles of algorithm design, elementary analysis of algorithms, and fundamental data structures. The emphasis is on choosing appropriate data structures and designing correct and efficient algorithms to operate on these data structures.

**Course Outcomes (COs):**

Upon successful completion of the course, student should be able to:

**CO1:** Learn how to analyze algorithms and estimate their worst-case and average-case behavior (in easy cases);

**CO2:** Analyze the asymptotic performance of algorithms. Write rigorous correctness proofs for algorithms

CO3: Accustomed to the description of algorithms in both functional and procedural styles;

**CO4:** Learn how to apply their theoretical knowledge in practice (via the practical component of the course).

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **Analysis of Algorithms: Algorithm Design paradigms, motivation**. Review of algorithmic strategies, asymptotic analysis: upper and lower complexity bounds. Identifying differences among best, average and worst Case Behaviors. Big O, little O, omega and theta notations, Standard complexity classes. Empirical measurements of performance. Time and space trade-offs in algorithms. Analyzing recursive algorithms using recurrence relations. |
| 2. | **Divide & Conquer:** Structure of divide and conquer algorithms: examples, Binary search, Quick sort, analysis of divide and conquer run time recurrence relations.<br>**Greedy Algorithms:** Overview of the greedy paradigm, examples of exact optimization solution (minimum cost spanning tree), approximate solution (Knapsack problem), single sourceshortest paths. |
| 3. | **Dynamic Programming**: Overview, difference between dynamic programming and divide and conquer, applications: shortest path in graph, matrix multiplication, travelling salesperson problem, longest common sequence. |
| 4. | **Graph Algorithms:** Graphs and their Representations, Graph Traversal Techniques: Breadth First Search (BFS) and Depth First Search (DFS), Applications of BFS and DFS, Minimum Spanning Trees (MST), Prim's and Kruskal's algorithms for MST, Connected Components, Dijkstra's Algorithm for Single Source Shortest Paths, Warshall's Algorithm for finding Transitive Closure of a Graph, Floydd's Algorithm for All-Pairs Shortest Paths Problem. |

| | |
|---|---|
| **5.** | **Back Tracking:** Overview, 8-Queens problem and Knapsack problem. **Branch & Bound:** LC searching, bounding, FIFO branch and bound, Applications: 0/1 Knapsack problem, Travelling salesperson problem. |
| **6.** | **Computational complexity:** Complexity measures, Polynomial vs non-polynomial time complexity; NP hard and NP complete classes, Examples. |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | "Introduction to Algorithms"**, PHI.** | Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein |
| 2 | **"**Data Structures and Algorithm Analysis in C++"**,** | Mark Allen Weiss Third Edition, Pearson Education, 2006 |
| 3 | **"**Fundamentals of Computer Algorithms"**, Second Edition, Universities Press, 2011** | Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject: Fuzzy Logic and Neural Networks (Code: MAT xxx)** | **Year & Semester:** B. Tech Electronics & Communication Engineering 4th Year & -8th Semester | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | - |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objective:** The principle objective of this course is to have a knowledge of Fuzzy logic and natural neural networks and thereby develop the artificial neural networks for solving real life problem

**Pre –requisites :**

Fundamental of Computing Assumed knowledge: fuzzy control system is a control system based on fuzzy logic—a mathematical system that analyzes analog input values in terms of logical variables that take on continuous values between 0 and 1, in contrast to classical or digital logic.
MICROCONTROLLED BASED SYSTEM DESIGN,
AUTOMOTIVE ELECTRONICS,
VIRTUAL INSTRUMENTATION

**Course Outcomes**

CO1: To understand the Fuzzy logic systems
CO2: To study the basic architecture of neural networks and applications
CO3: To understand the basic neural network operations
CO4: To have knowledge of various types of neural networks, their operations and applications in real life problems.

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **FUNDAMENTALS OF FUZZY LOGIC:** Basic concepts: fuzzy set theory- basic concept of crisp sets and fuzzy sets- complements- unionintersection- combination of operation- general aggregation operations- fuzzy relations-compatibility relations-orderings- morphisms- fuzzy relational equations-fuzzy set and systems |
| 2. | ARCHITECTURE OF NEURAL NETWORKS: Architectures: motivation for the development of natural networks-artificial neural networks-biological neural networks-area of applications-typical Architecture-setting weights-common activations functionsBasic learning rules- Mcculloch-Pitts neuron- Architecture, algorithm, applications-single layer net for Page 1 of 7 pattern classification- Biases and |

| | |
|---|---|
| | thresholds, linear separability - Hebb'srule- algorithm -perceptron - Convergence theorem-Delta rule |
| **3.** | BASIC NEURAL NETWORK TECHNIQUES: Back propagation neural net:standard back propagation-architecture algorithm- derivation of learning rulesnumber of hidden layers--associative and other neural networks- hetro associative memory neural net, auto associative net- Bidirectional associative memory-applications-Hopfield nets-Boltzman machine |
| **4.** | COMPETITIVE NEURAL NETWORKS: Neural network based on competition: fixed weight competitive nets- Kohonenself organizing maps and applications-learning vector quantization-counter propagation nets and applications adaptive resonance theory: basic architecture and operation-architecture, algorithm, application and analysis of ART1 & ART2 |
| **5.** | SPECIAL NEURAL NETWORKS : Cognitron and Neocognitron - Architecture, training algorithm and application-fuzzy associate memories, fuzzy system architecture- comparison of fuzzy and neural systems. |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | Fuzzy System & Fuzzy logic | T1. Kliryvan- Prentice Hall of India, First Edition. |
| 2 | Fundamental of Neural network | Lawrence Fussett- Prentice Hall , First Edition. |
| 3. | Neural network and Fuzzy System‖ | Bart Kosko, Prentice Hall-1994. |
| 4 | Introduction to artificial neural systems‖- | J.M.Zurada, Jaico Publication house,Delhi 1994. |

# 8th Semester B Tech ECE
# Syllabus

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

<table>
<tr><td rowspan="2">Subject: Project Major (Code: ECP450)</td><td colspan="2" rowspan="2">Year & Semester: B. Tech Electronics and Communication Engineering 4th Year & 8th Semester</td><td colspan="3">Total Course Credits: 8</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td rowspan="2">Evaluation Policy</td><td>Mid-Term</td><td>Class Assessment</td><td colspan="3">End-Term</td></tr>
<tr><td>---</td><td>---</td><td colspan="3">----</td></tr>
</table>

**Objectives:** Students need to select a standard project related to electronics and communication. The project has to be workable to be demonstrated practically. Extensive literature review is to be carried out related to the project and same is to be submitted in form of a thesis. Related project will be completed with a power point presentation and viva.

**Course Outcomes:**

CO1 Identify methods & materials to carry experiments / develop code.
CO2 Reorganize the procedure with a concern for society, environment and ethics.
CO3 Analyze and discuss the results to draw valid conclusions.
CO4 Prepare a report as per recommended format and defend the work
CO5 Explore the possibility of publishing paper in peer reviewed journal/conference proceedings.

# Department of Electronics & Communication Engineering
# National Institute of Technology, Srinagar-190006

| | | | | | |
|---|---|---|---|---|---|
| **Subject**: Optical Fiber Communication (Code: ECT451) | Year & Semester: B. Tech Electronics and Communication Engineering 4th Year & 8th Semester | | Total Course Credits: 3 | | |
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| Evaluation Policy | Mid-Term | Class Assessment | End-Term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To make the students aware about the basic theory and working of various subsystems of optical fibre communication systems, their design and integration into a communication setup.

**Course Outcomes:**

CO1 Basic concepts about Optical Fibers, Ray optics and overview of modes.

CO2 Basic knowledge about various degradation phenomenon including attenuation, scattering dispersion and bending in optical fibers.

CO3 To understand concepts related to various optical fiber sources including LED and LASERS and their coupling with optical fibers. To understand operation of various Fiber Optical Receivers including PIN and APD diodes.

CO4 To understand point to point link considerations including link power budgets and rise time budgets. To understand operational principles of WDM, Soliton and analyze Noise effects on system performance including EDFA, Sonnet/ SDH networks.

**Details of the Syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **INTRODUCTION TO OPTICAL FIBERS:** Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes - Single Mode Fibers-Graded Index fiber structure. |
| 2. | **SIGNAL DEGRADATION OPTICAL FIBERS**: Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination - Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling -Design Optimization of SM fibers-RI profile and cut-off wavelength. |
| 3. | **FIBER OPTICAL SOURCES AND COUPLING:** Direct and indirect Band gap materials-LED structures -Light source materials - Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers- Power Launching and coupling, Lencing schemes, Fibre – to - Fibre joints, Fibre splicing. |
| 4. | **FIBER OPTICAL RECEIVERS**: PIN and APD diodes -Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise -Comparison of Photo detectors -Fundamental Receiver Operation - preamplifiers, Error Sources -Receiver Configuration -Probability of Error - Quantum Limit. |
| 5. | **DIGITAL TRANSMISSION SYSTEM:** Point-to-Point links System considerations -Link Power budget -Rise- time budget -Noise Effects on System Performance-Operational Principles of WDM, Solitons-Erbium-doped Amplifiers. Basic on concepts of SONET/SDH Network. |

**Recommended Books**

| | | |
|---|---|---|
| 1. | Optical Fiber Communication | By Gerd Keiser |
| 2. | Optical Communication, Principles and Practice | By J.Senior |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| | | | | | |
|---|---|---|---|---|---|
| **Subject**: Computer &Network Security (Code: ECT452) | **Year & Semester:** B. Tech Electronics and Communication Engineering<br>4th Year & 8th Semester | | **Total Course Credits: 3** | | |
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | Mid-Term | Class Assessment | End-Term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To develop an understanding of security on computer networks, various cipher techniques, public key cryptography, authentication, virtual private networks, firewalls.

**Course Outcomes:**

CO1 Develop concept of security needed in communication of data through computers and networks along with various possible attacks

CO2 Understand various encryption mechanisms for secure transmission of data and management of key required for encryption

CO3 Understand authentication requirements and study various authentication mechanisms

CO4 Understand network security concepts and study different web security mechanisms

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **Introduction:** Need of security, Security attacks, services and mechanisms, Network security, Model. |
| 2. | **Symmetric Ciphers:** Substitution and transposition techniques, Block cipher Principles and Modes of operation DES, Triple DES, Stream Ciphers and RC4. |
| 3. | **Public Key Cryptography:** Need and principles of Public key cryptosystems, RSA Algorithm, Key, Distribution and management, Diffie-Hellman Key Exchange, Digital |
| 4. | **Authentication:** Authentication Requirements, Message Authentication Codes, Hashes, MD5and SHA, User Authentication: Password, Certificate based and biometric |
| 5. | **Network Security:** Firewalls, IP Security, Virtual Private Networks and Intrusion Detection, Web Security-SSL and TLS. |

**Suggested Books:**

| | | |
|---|---|---|
| 1. | **Cryptography and Network Security, PHI** | **William Stalling** |
| 2. | **Cryptography and Network Security, Mc Graw Hill** | **Atul Kahate** |
| 3. | **Cryptography and Network Security, PHI 4.** | **Forouzan** |

# Department of Electronics & Communication Engineering
# National Institute of Technology, Srinagar-190006

| | | | | | |
|---|---|---|---|---|---|
| **Subject**: Industrial Organization & Management (Code: HSL4) | **Year & Semester:** B. Tech Electronics and Communication Engineering<br>4th Year & 8th Semester | | Total Course Credits: 4 | | |
| | | | L | T | P |
| | | | 3 | 1 | 0 |
| **Evaluation Policy** | Mid-Term | Class Assessment | End-Term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** The experimental setups are introduced to and performed by the students to enable them to give optimal performance in professional life.

**Course Outcomes:**

**CO1** Develop the ability to explain economic terms and concepts, Understand and explain the function of market, its types and determination of price under various competencies.

**CO2** Demonstrate the ability to employ the economic way of thinking like application of marginal analysis, use of benefit/cost analysis, utility and demand forecasting techniques.

**CO3** Practice the process of management's four functions: planning, organizing, directing and controlling to make an appropriate staffing decision which includes recruitment and selection design, implement and evaluate training programmes.

**CO4** Understand an organization's characteristics and how they might impact on management practices and analyze both qualitative and quantitative information to isolate issues and formulate best control methods.

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | Industry, meaning of Industrialization, Industrial revolution, Need problems and prospects of Industrial change in the developing countries. |
| 2. | Industrial Evolution in India. Downfall of early industries, evolution of modern industry, effects of partition, industrial policy and progress after independence. |
| 3. | Forms of Industrial Organization: a) Single Proprietorship b) Partnership c) Joint Stock companies |
| 4. | Growth of Industry and Management Meaning of industrial management, functions and tools of management, growth of management concepts. |
| 5. | Objectives of Industrial Management: Defining management objectives, managerial activity and objectives, tests of management of objectives, primary, secondary personal and social objectives of management. |
| 6. | Management Organization: Various forms of organization of departmentalization line staff, functional and committee organization, formal and non formal organization. |
| 7. | Management and Authority, Decision Making in Management |
| 8. | Leadership, Definition, Traits, inborn traits, acquired traits, analytical etc. |
| 9. | Marketing of Industrial Products and the Sales Manager. |
| 10. | Personal Management: Recent changes in personal management function of personal departments, sections, training and placement other functions of personal department. |

**Suggested Books:**

| | | |
|---|---|---|
| 1. | Principles of Management | G. R. Terry |
| 2. | Industrial Organization & Management | Tara Chand |
| 3. | Business Organization & Management | M. C. Suckla |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| | | | | | |
|---|---|---|---|---|---|
| **Subject**: Optical Fiber Communication Lab (Code: ECL454) | Year & Semester: B. Tech Electronics and Communication Engineering 4th Year & 8th Semester | | Total Course Credits: 1 | | |
| | | | L | T | P |
| | | | 0 | 0 | 2 |
| **Evaluation Policy** | Mid-Term | Class Assessment | End-Term | | |
| | Marks | Marks | Marks | | |

**Objectives:** To understand basic concepts about Optical Fibers and ray optics. To understand concepts related to various optical fiber sources including LED and LASERS and their coupling with optical fibers.

**Course Outcomes:**

CO1 Basic concepts about Optical Fibers, Ray optics and overview of modes.

CO2 Basic knowledge about various degradation phenomenon including attenuation, scattering dispersion and bending in optical fibers.

CO3 To understand concepts related to various optical fiber sources including LED and LASERS and their coupling with optical fibers. To understand operation of various Fiber Optical Receivers including PIN and APD diodes.

CO4 To understand point to point link considerations including link power budgets and rise time budgets. To understand operational principles of WDM, Soliton and analyze noise effects on system performance including EDFA, Sonnet/ SDH networks.

**Details of the syllabus:**

| S. No | Particulars |
|---|---|
| **1** | Voice transmission through optical link. |
| **2** | AM system using Analog & Digital Input Signals. |
| **3** | Frequency Modulation System |
| **4** | Pulse Width Modulation system. |
| **5** | Study of Propagation Loss in optical fiber System. |
| **6** | Study of Bending Loss |
| **7** | Measurement of Numerical Aperture |
| **8** | Characteristics of E-O Converter (LED) |
| **9** | Fiber optic digital link |
| **10** | PC to PC communication Link using optical fiber. |

# Department of Electronics & Communication Engineering
# National Institute of Technology, Srinagar-190006

**Elective III**

| | | | | | |
|---|---|---|---|---|---|
| **Subject:** Millimetre Wave Communication (Code:ECT454) | **Year & Semester:** B. Tech Electronics & Communication Engineering Year & -8th Semester | | **l Course credit:4** | | |
| | | | L | T | P |
| | | | 2 | 1 | - |
| **Evaluation Policy** | **Mid-Term** | **Class assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** To familiarise students with Millimetre wave communication technology which is a major part of future WLAN as well as cellular systems.

**Course Outcomes** Upon successful completion of the course, student should be able to:
**CO1:** Understand significance of Millimetre Wave(mmWave) Communication for future mobile applications
**CO2:** To know fundamentals of mmWave Propagation, devices and circuits
**CO3:** Understand various components of mmWave Communications system
**CO4:** To know antenna design at mmWave frequencies and mmWave MIMO and mmWave Standards

**Details of the syllabus:**

| **o.** | **Particulars** |
|---|---|
| | **INTRODUCTION :**Millimeter Wave (mmWave) Wireless, mmWave Implementation Challenges, Emerging Applications of mmWave Communications, propagation characteristics of mm waves: Large scale propagation channel effects, small scale channel effects, Outdoor and Indoor channel models, Coverage and capacity in mmWave. |
| | **MM WAVE DEVICES AND CIRCUITS:** Millimeter wave generation and amplification: Peniotrons, Ubitrons, Gyrotrons and Free electron lasers. HEMT, models for mm wave Transistors, transistor configurations, Analog mmWave components: Amplifiers, Mixers, VCO, PLL. Metrics for analog mm Wave devices, Consumption factor theory, Trends and architectures for mm wave wireless, ADC's and DAC's. |
| | **MM WAVE COMMUNICATION SYSTEMS:** Modulations for mmWave communications, mmWave link budget, Transceiver architecture, Transceiver without mixer, Receiver without Oscillator, mmWave calibration, production and manufacture, Future considerations. |
| | **ANTENNAS FOR MM WAVE SYSTEMS:** Antenna beamwidth, polarization, mmWave antenna design considerations, mmWave antennas for 5G, On-chip and In package mm wave antennas, Techniques to improve gain of mmwave antennas, mm wave adaptive antenna arrays, Advanced beam steering and beam forming for mmWave applications. |
| | **MM WAVE MIMO :** mmWave MIMO, Massive MIMO, Noise coupling in MIMO system, Multiple Antennas, Multiple Transceivers, Spatial, Temporal and Frequency diversity, Potential benefits of advanced diversity for mmWave communication, mmWave MIMO for 5G applications |
| | **MM WAVE STANDARDIZATION:** Introduction, mmWave Spectrum Regulations, International Recommendations, IEEE 802.15.3c, IEEE 802.15.3 MAC, IEEE 802.15.3c mmWave PHY, Wireless HD, ECMA-387, IEEE 802.11ad, WiGig. |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | Millimeter Wave Communication Systems", Wiley-IEEE Press | K.C. Huang, Z. Wang |
| 2 | Millimeter Wave Wireless Communication", Prentice Hall, 2014 | Robert W. Heath, S. Rappaport, |
| 3. | Millimeter - Wave Wireless Communication Systems: Theory and Applications, Hindawi Publishing Corporation | Chia-Chin Chong et al. |
| 4 | Millimeter-Wave Integrated Circuits, Springer | Eoin **Carey** |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Biomedical & Image Processing (Code:ECT455) | **Year & Semester:** B. Tech Electronics & Communication Engineering **4th** Year & **8th** Semester | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** This course presents the applications of digital signal processing to biomedical signals and images. This course provides practical experience in processing physiological data, with examples from cardiology.

**Course Outcomes (COs):**

Upon successful completion of the course, student should be able to:

**CO1:** Understanding of Fundamental concepts in signal processing and design of digital FIR/IIR filters.

**CO2:** Understanding of Wavelet theory with applications to medical signals and images

**CO3:** Understanding of various data acquisition techniques for biomedical signals; methods for removal of artifacts in biomedical signals and biomedical signal analysis.

**CO4:** Understanding of Image enhancement and feature extraction methodologies.

**Details of the syllabus:**

| S. No. | Particulars |
|---|---|
| 1. | **Background and review of DSP**: Digital filter design and structures: Basic FIR/IIR filter design & structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation |
| 2. | **Wavelets in Biomedical Signal Processing**: Introduction to wavelets, Scaling and wavelet functions, Multiresolution analysis, Filter Banks and Discrete wavelet transform, wavelets based signal processing and applications- Denoising, compression. |
| 3. | **Biomedical Signal analysis:** Introduction to biomedical signals (ECG,EEG,PCG and EMG), Objectives of biomedical signal analysis, Filtering for removal of artifacts, Adaptive noise canceller; Cancellation of 60 Hz interference in electrocardiography, Time Domain filters, frequency domain filters, wiener filtering, adaptive filters , Illustration of the Problem with Case-studies, canceling method to enhance fetal ECG monitoring, Event detection. Heart rate variability-analysis; |
| 4. | **Digital Image Processing**: Digital Image fundamentals, Image enhancement in spatial domain, Image enhancement in frequency domain, Image restoration, Image segmentation, wavelets based image processing |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1 | Digital Signal Processing, Principles Algorithms and Applications | John G, Proakis and Dimitris G Manolakis |
| 2 | Introduction to Wavelets and Wavelet Transforms- A Primer | C. Sidney Burrus, Ramesh A. Gopinath and |

| | | |
|---|---|---|
| | | Haitao Guo |
| 3. | Biomedical signal analysis-A Case-Study Approach | Rangaraj M Rangayan |
| 4 | Biomedical Digital Signal Processing | Willis J. Tompkins |
| 5. | Digital Image Processing | Rafael C. Gonzalez, Richard E. Woods |

# Department of Electronics & Communication Engineering
# National Institute of Technology, Srinagar-190006

| **Subject:** Molecular Electronics (Code: ECT 456) | **Year & Semester:** B. Tech Electronics & Communication Engineering 4th Year & 8th Semester | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **2** | **1** | **-** |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** | | |
| | **30 Marks** | **10 Marks** | **60 Marks** | | |

**Objectives:** The course treats the emerging field of molecular electronics from basics. Organic semiconductors will be an important introductory part of this course. The theory and practice of fabricating discrete and integrated molecular electronic devices and their applications in diverse fields will be covered. Lessons from biological molecular behaviour for molecular electronics will be addressed.

**Course Outcomes:**

| | |
|---|---|
| CO1 | Understand the physics behind organic semiconductors |
| CO2 | Transport properties in the molecular systems, Identify the molecules that can be used for different functions in molecular electronics |
| CO3 | Choose a proper method or combined several methods for fabricating and characterizing organic systems. |
| CO4 | Exploit the behaviour of the biomolecules for molecular electronic |

**Details of Syllabus:**

| **S. No.** | **Particulars** |
|---|---|
| 1 | Introduction to organic electronic materials and their basic properties; Electronic Structure of Molecules and energy structure of organic electronics |
| 2 | Electronic Properties; Optical properties: Energy levels, color changes, light emission and absorption; Charge transport Mobility, Doping and its Determination |
| 3 | Techniques to grow / Fabricate Organic films / Materials |
| 4 | Organic electronic circuit components: conductors, resistors, capacitors, diodes, transistors. |
| 5 | Organic electronics photovoltaics |
| 6 | Organic Memory |
| 7 | Characterization Techniques for organic Electronic materials |
| 8 | Organic bioelectronics : Applications in neuroscience and plant biology |
| 9 | An overview of current applications and commercialization: cost, implementation, environmental consideration, printed and flexible electronics |

**3 Suggested Book :**

| | | |
|---|---|---|
| **1.** | Electronics Processes in Organic Crystals and Polymers | Martin Pope & Charles L. Swenberg |
| **2.** | Polymer Electronics | Hsin – Fei Meng |
| **3** | Organic Electronic Materials and Devices | Shuichiro Ogawa |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Electrical Power Systems (Code: EET4xx) | **Year & Semester:** B. Tech Electronics & Communication Engineering **4th Year & 8th Semester** | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | **2** | **1** | **-** |
| **Evaluation Policy** | **Mid-Term** | **Internal Assessment** | **End-Term** | | |
| | **Marks** | **10 Marks** | **60 Marks** | | |

**Objective:** To introduce the concept of power systems, AC & DC distributors, transmission lines and to develop the concept of mechanical design of transmission lines.

**Course Outcomes (COs):**

Upon successful completion of the course, student should be able to:

**CO1:** Explain the knowledge of power systems generation, transmission & distribution.
**CO2:** Explain the knowledge of overhead line insulators and string efficiency.
**CO3:** Explain the modelling, design, capacity and various parameters of transmission lines.
**CO4:** Acquire knowledge of sag and tension calculations of overhead Transmission lines.
**CO5:** Explain concept of corona and its effect on line design.

**Details of the syllabus:**

| S. No | Particulars |
|---|---|
| **1** | **DC and AC Distribution System:-** Introduction to a power system, definition and classification of distribution systems, connection schemes, various types of DC and AC distributors, voltage drop calculations. |
| **2** | **Overhead AC Transmission lines: -** Line Parameters and their calculations, types of conductors, skin effect and proximity effect, classification of overhead AC transmission lines, performance of transmission lines. |
| **3.** | **Insulators for overhead lines:-** Overview of insulators and materials used, types of insulators and their uses, potential distribution over a string of suspension insulators, string efficiency, methods for equalizing the potential. |
| **4.** | **Interference of power lines with communication circuits**:- Electrostatic and electromagnetic effect, definition and theory of Corona formation, factors affecting corona, critical disruptive and visual critical voltage, power loss due to corona, methods of reducing corona effect. |
| **5.** | **Mechanical design of transmission lines**. Sag and tension calculations, effect of wind and ice loading, stringing charts. |

**Recommended Books:**

| S. No. | Name of Book | Author (s) |
|---|---|---|
| 1. | Elements of Power System Analysis | W. D. Stevenson |
| 2. | Transmission & Distribution of Electrical Energy | H. Cotton & Barber |
| 3. | Power System Engineering | Nagrath & Kothari |
| 4. | Electrical Power Systems | C. L. Wadhwa |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Artificial Intelligence & Machine Learning **(Code: CST 352)** | **Year & Semester:** B. Tech, Electronics & Communication Engineering 4th Year & 8th Semester | | **Total Course Credit: 4** | |
|---|---|---|---|---|
| | | | L | T |
| | | | 3 | 1 |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End Term** | |
| | 30 Marks | 10 Marks | 60 Marks | |

**Objectives:** (Maximum 25 Words) The objective of the course is to understand the fundamentals of computational intelligence, to know about the various knowledge representation methods, to understand the features of neural network and its implementation, to study about various data clustering methods. To gain knowledge in evolutionary computation and neuro – fuzzy systems.

**Course Outcomes (COs):**

Upon successful completion of the course, student should be able to:

**CO1:** Implement computational intelligence through applications

**CO2:** Understand knowledge representation methods and apply approximate reasoning

**CO3:** Apply evolutionary algorithm to solve the optimization problem

**CO4:** Gain research Knowledge to develop applications using hybrid systems

**CO5: Able to Model Flexible Fuzzy Inference systems for dynamic nonlinear data sets.**

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **Introduction to AI:** Philosophy of artificial intelligence, Course structure and policies. History of AI. Proposing and evaluating AI applications. |
| 2. | **Search and Planning:**Fundamental and advanced search techniques Problem spaces and search, Heuristic search strategies, Search and optimization (gradient descent), Adversarial search, Planning, and scheduling (A*, local search, suboptimal heuristic search, search in AND/OR graphs), Constraint optimization |
| 3. | **Knowledge Representation and Reasoning:**Logic and inference, Temporal reasoning, Knowledge representation and reasoning through propositional and first-order logic, modern game playing. Ontologies, Bayesian reasoning, |
| 4. | **Fuzzy Logic** Crisp set and Fuzzy set, Basic concepts of fuzzy sets, membership functions. Basic operations on fuzzy sets, Properties of fuzzy sets, Fuzzy relations. Propositional logic and Predicate logic, fuzzy If-Then rules, fuzzy mapping rules, and fuzzy implication functions, |
| 5. | **Applications in Machine learning: Supervised and Unsupervised methods** What is machine learning? Supervised vs. unsupervised learning, Regression -- linear, logistic, ridge , Classification – decision trees, SVM, random forests Reinforcement learning, Introduction to probabilistic graphical models (Bayesian networks, Hidden Markov models, Conditional random fields), Introduction to information systems (information retrieval, information extraction). |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1 | A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013 | Deepak Khemani. |
| 2 | Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009. | Stuart Russell and Peter Norvig. |
| 3 | Heuristics: Intelligent Search Strategies for Computer Problem Solving, Addison-Wesley, 1984. | Judea Pearl. |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| | | | | |
|---|---|---|---|---|
| **Subject:** Optimization Techniques (Code: MTH 802) | **Year and Semester:** B. Tech Electronics & Communication Engineering. 4th Year & 8th Semester | **Total Course Credit: 3** | | |
| | | **L** | **T** **P** | |
| | | **2** | **1** | **0** |
| **luation Policy** | **d-Term** | **Class Assessment** | **End -Term** | |
| | Marks | 10 Marks | 60 Marks | |

**Course Outcomes (COS):** Upon successful completion of the course, students should be able to:
**CO1:** Identify, formulate, and solve the practical Engineering design problems by applying the optimization techniques.
**CO2:** Figure out the optimal value of the objective function besides presenting an organized strategy for evaluating a feasible region's vertices.
**CO3:** Determine the schedule for transporting goods from source to destination in a way that minimizes the shipping cost.
**CO4:**

- Solve multitude of operations research situations through conveniently modeling as networks (nodes connected by branches).
- Find sequence of processing jobs to minimize total elapsed time.
- Determine performance of queuing situation for deciding an appropriate level of service for the facility.

**Details of the syllabus:**

| ) | **Particulars** |
|---|---|
| | **Unit-I: Introduction &Concepts of Optimization** Formulation of Linear Programming Problems, General Statement of LPP, Assumptions Underlying LP, Solution of Linear Programming Problems: Graphic Method. Some Special Cases of Graphic Method, Convex Set: Extreme points of Convex Set, Convex hull. |
| | **Unit-II: Simplex Techniques** LP Model in Equation Form, Transition From Graphical To Algebraic Solution, Simplex Algorithm, Artificial starting solution: Big M-Method, Two-phase Method, Special cases in Simplex Method: Degeneracy, Alternative Optima, Unbounded solution, infeasible solution. |
| | **Unit-III: Transportation Models** Mathematical Model of Transportation Problem, Methods of finding Initial basic feasible solution by NWC Rule, LCM,VAM, Test for optimality by Stepping Stone and MODI method, Balanced and Unbalanced Transportation Problems, Degeneracy. Assignment Model: Mathematical Model of Assignment Problem, The Hungarian Method, Simplex Explanation of the Hungarian Method. |

| | |
|---|---|
| **4.** | **Unit-V: Engineering Applications** Network Models: Shortest route Algorithm, network Construction, Rules for network diagram, Techniques in project planning and Construction, CPM, Project Crashing.<br>Sequencing Model: Advantages of Sequencing, Johnsons Algorithm of Sequencing problems, Type I: n jobs two machines, Type II: n jobs three machines, Type III: two jobs m machines.<br>General Structure of Queuing System, Operating Characteristics of Queuing System, Queuing Models, Role of Poisson and Exponential Distributions, Pure Birth and Death Models, Generalized Poisson Queuing Model, Specialized Poisson Queues: Single, Multiple and Machine Serving Models. |

**Recommended Books:**

1. Linear Programming by G. Hadlay, Addison Wasley.
2. Operations Research – An Introductory by Hamidi A. Taha, Macmillan.
3. Operations Research – Methods and problems by M. Sasieni, A. Yaspam and L. Friedman, John Wily and Sons Inc. London.

**References:**

1 Linear Programming by S.I. Gass, Mc-Graw Hill.
2 Introduction to Operations Research. John Wiley and Sons, New York.
3 Operations Research: An Introduction. Prentice Hall of India Private Limited, New Delhi Wagner.

**Elective IV**

| | | | | | |
|---|---|---|---|---|---|
| **Subject:** TV Engineering<br>le: ECE458) | **Year & Semester:** B. Tech Electronics & Communication Engineering<br>4th Year & 8th Semester | | **otal Course Credit: 4** | | |
| | | | L | T | P |
| | | | 3 | 1 | - |
| **Evaluation Policy** | **Mid-Term** | **lass Assessment** | **End-Term** | | |
| | 40 Marks | 10 Marks | 50 Marks | | |

**Objectives:** This course will develop the subject of TV Engineering from the basics. Starting from the analysis and theory of TV Pictures, Composite Video Signal, Receiver Picture Tube, we move on to the study of Monochrome Television Transmitter and Receiver systems. Aspects of Color TV systems theory will also be covered in detail.

**Course Outcomes** Upon successful completion of the course, student should be able to:
**CO1:** To study the analysis and synthesis of TV Pictures, Composite Video Signal, Receiver Picture Tubes and Television Camera Tubes
**CO2:** To study the principles of Monochrome Television Transmitter and Receiver systems.
**CO3:** To study the various Color Television systems with a greater emphasis on PAL system.
**CO4:** To study the advanced topics in Television systems and Video Engineering.

**Details of the syllabus:**

| o | Particulars |
|---|---|
| | **FUNDAMENTALS OF TELEVISION:** Geometry form and Aspect Ratio - Image Continuity - Number of scanning lines - Interlaced scanning - Picture resolution - Camera tubes- Image orthicon - vidicon-plumbicon-silicon diode array vidicon-solid state image scanners- monochrome picture tubes- composite video signal-video signal dimension- horizontal sync. Composition- vertical sync. Details – functions of vertical pulse train – scanning sequence details. Picture signal transmission – positive and negative modulation – VSB transmission sound signal transmission – standard channel bandwidth. |
| | MONOCHROME TELEVISION TRANSMITTER AND RECEIVER: TV transmitter – TV signal propagation – Interference – TV transmission Antennas – Monochrome TV receiver – RF tuner – UHF, VHF tuner- Digital tuning techniques- AFT-IF subsystems - AGC – Noise cancellation- Video and sound inter carrier detection- vision IF subsystem- video amplifiers requirements and configurations - DC re- insertion - Video amplifier circuits- Sync separation – typical sync processing circuits- Deflection current waveform – Deflection Oscillators – Frame deflection circuits – requirements- Line Deflection circuits – EHT generation – Receiver Antennas. |
| | **ESSENTIALS OF COLOUR TELEVISION:** Compatibility – colour perception- Three colour theory- luminance, hue and saturation-colour television cameras- values of luminance and colour difference signals- colour television display tubes- delta – |

| | |
|---|---|
| | gun-precision – in-line and Trinitron colour picture tubes- purity and convergence- purity and static and dynamic convergence adjustments- pincushion correction techniques- automatic degaussing circuit- grey scale tracking – colour signal transmission- bandwidth- modulation of colour difference signals – weighting factors- Formation of chrominance signal. |
| | **COLOUR TELEVISION SYSTEMS:** NTSC colour TV system- NTSC colour receiver- limitations of NTSC system – PAL colour TV system – cancellation of phase errors- PAL –D colour system- PAL coder – Pal-Decolour receiver- chromo signal amplifier- separation of U and V signals- colour burst separation – Burst phase Discriminator – ACC amplifier- Reference Oscillator- Ident and colour killer circuits- U and V demodulators- Colour signal matrixing – merits and demerits of the PAL system – SECAM system – merits and demerits of SECAM system. |
| | **ADVANCED TELEVISION SYSTEMS:** Satellite TV technology- Cable TV – VCR- Video Disc recording and playback- Tele Text broadcast receiver – digital television – Transmission and reception- projection Television – Flat panel display TV receiver – Sterio sound in TV – 3D TV – EDTV – Digital equipments for TV studios. |

**Recommended Books:**

| **. No** | **Name of Book** | **Author** |
|---|---|---|
| 1. | Monochrome Television Practice, Principles, Technology and servicing | By R.R.Gulati |
| 2 | Monochrome and colour Television | By R.R.Gulati |
| 3. | Colour Television, Theory and Practice | By S.P.Bali |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Telemedicine (Code:ECT460) | **Year & Semester:** B. Tech Electronics & Communication Engineering **4th** Year & **8th** Semester | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** This course presents how telecommunications technology is used by health care professionals to evaluate, diagnose and treat patients at a distance.

**Course Outcomes :**Upon successful completion of the course, student should be able to:

**CO1:** Understanding the Scope, Benefits and clinical applications of Telemedicine.
**CO2:** Understanding of data security & standards
**CO3:** Understanding of a tele-radiology system
**CO4:** Understanding various applications of telemedicine in medical fields.

**Details of the syllabus:**

| S. No. | Particulars |
|---|---|
| 1. | **History of Telemedicine:** Telemedicine: Definition and history, Block diagram, Scope, Benefits, Limitations and Clinical applications - Real-time and store-forward, Types of information: Audio, Video, Still Images, Text and data, and Fax - Types of Communication and Network: PSTN, POTS, ATN, and ISDN - Basic concepts of Communication and Network: Internet, and Wireless communications (GSM, Satellite and Micro- wave), Types of antennas depending on requirements. |
| 2. | **Medical Data Security and Legal Issues:** Data Exchanges: Network configuration, Video conferencing- Data security and Standards: Encryption, Cryptography, Mechanisms and phases of encryption- Protocols and Standards -encryption, Ethical and legal aspects of Telemedicine, patient rights and consent form, aces to medical records, Intelectual property rights. |
| 3. | Tele-Radiology and Tele-Pathology: Tele-radiology and its basic system components, Image acquisition system, Display system, Communication networks, Interpretation, Tele-pathology,<br>Multimedia databases, color images of sufficient resolution, image compression methods, Interactive control of color and controlled sampling. |
| 4. | **Other Medical Applications:** Tele-dermatology, Tele-psychiatry, Tele-cardiology, Tele-trauma, role of tele-education, evaluation in telemedicine, Tele-oncology, Tele-surgery, security and confidentiality tools. |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1. | Handbook of Telemedicine | Olga Ferrer-Roca, M.Sosa Ludicissa |
| 2 | Essentials of Telemedicine and Telecare | Norris A.C |

# Department of Electronics & Communication Engineering
# National Institute of Technology, Srinagar-190006

| **Subject**: RF Design (Code: ECT461) | **Year & Semester:** B. Tech Electronics and Communication Engineering 4th Year & 8th Semester | | Total Course Credits: 3 | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| Evaluation Policy | Mid-Term | Class Assessment | End-Term | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** This course will develop electronic circuits for radio frequency applications, specific to CMOS integrated circuits. As the course title suggests, the course will be specific to CMOS integrated circuits, and specific to radio frequencies. In particular, the course will focus on circuits for radio front-ends for mobile phone handsets. The course will cover low noise amplifiers, mixers, power amplifiers, frequency synthesizers (and phase locked loops). The course will also cover several modern radio architectures.

**Course Outcomes**

CO1 To design and analyze basic RF systems, architectures and passive RLC networks. To analyze the behavior of passive components at high frequencies.

CO2 Understanding the performance parameters and characteristics of noise parameters at high frequencies

CO3 Design and Analysis of RF amplifiers, Mixers, VCO and PLLs. Understanding the Frequency analysis of Oscillators and Mixers.

CO4 Design and Analysis of GSM, 3G and other communication technologies.

**Details of Syllabus:**

| S. No | Particulars |
|---|---|
| 1 | RFIC System Overview: Complexity comparison, Design bottle necks, Applications, Analog and digital systems, Choice of Technology, Overview of RF Filter design and Transmission Lines, Smith Chart |
| 2 | Receiver Architecture: Different types of Receiver architectures; Performance parameters |
| 3 | Noise: Classification of Noise; Noise performance and limitations of devices, integrated parasitic elements at high frequencies |
| 4 | Low Noise Amplifiers: Low noise Amplifier design in different technologies and their performance |
| 5 | Mixers: Design of Mixers at GHz frequency range, Various mixers- working and implementation, Spur Chart |
| 6 | Voltage-Controlled Oscillators and Phase-Locked-Loop: Basic topologies VCO and definition of phase noise, Noise power and trade off, Radio frequency Synthesizers- PLLS, Various RF synthesizer architectures and frequency dividers |
| 7 | Power Amplifiers: General considerations, linear and nonlinear PAs, classification, High Frequency power amplifier, large signal impedance matching, linearization techniques |

**Recommended Book :**

| | | |
|---|---|---|
| **1.** | RF Microelectronics Prentice Hall of India | Behzad Razavi |
| **2.** | The Design of CMOS Radio Integrated Circuits, Cambridge University Press | Thomas H. Lee |
| **3** | VLSI for Wireless Communication Prentice Hall of India | Leung Bosco |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject**: Smart Grid Communications (Code: ECT453) | Year & Semester: B. Tech Electronics and Communication Engineering<br>4th Year & 8th Semester | | Total Course Credits: 3 | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 2 | 1 | 0 |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** The objective of this course is provide electronics & communications engineering students with a basic understanding of communication systems concepts and principles as applied to electric utility applications. One of the key enabling technologies for the emerging "smart power grid" is the advanced communication technology. Hence, it is becoming imperative for ECE students to have an understanding of the communication technologies and their use for the smart grid. This course serves as an interdisciplinary course to prepare students to be knowledgeable in these critical and relevant areas of communications, cyber security and their use for the smart grid. In this course, students are also prepared to get exposure of recent trends in smart grid technology including IoT, Artificial Intelligence/Machine Learning based solutions for smart grid communication.

**Course Outcomes:**

CO1 To understand the overall objective of smart grid and its relevance to power distribution system.

CO2 To understand the smart grid communication network, data acquisition and control system

CO3 To understand the smart grid network architecture and its design and security issues.

CO4 To get exposure of recent trends in smart grid communication including IoT, Machine Learning and AI Based solutions.

**Details of the syllabus:**

| **S.No.** | **Particulars** |
|---|---|
| 1. | **Introduction to Smart Grid:**<br>Definition, Objectives and Domain of Smart Grid; Revision of Voltage, Current, Alternating Current Phasor representation, Power Generation, Transmission System, Distribution System and Faults in Power System |
| 2. | **Communication Networking for Smart Grid:**<br>Elements of Data Communication Networks; Protocols and Protocol Layers; Data Networking Technologies; Supervisory Control and Data Acquisition systems (SCADA); Networking with SCADA; Teleprotection |

| | |
|---|---|
| 3. | **Smart Grid Network Architect and Design:** Architecture Framework, Wide Area Network, Field Area Network (FAN), Network Design Process, Network Traffic, Routing architecture, QoS in Smart grid network, Security in Smart Grid Network |
| 4. | **Recent Trends in Smart Grid:** IoT based Smart Grid Communication, Machine Learning and Artificial Intelligence Based Solutions for Smart Grid, Other recent trends based on recent Journal papers. |

**Recommended Books:**

| | | |
|---|---|---|
| **1.** | Communication networks for smart grids. Springer London Limited, 2016. | Budka, Kenneth C., Jayant G. Deshpande, and Marina |
| **2.** | Smart grid: Communication-enabled intelligence for the electric power grid. John wiley & sons, 2014. | Bush, Stephen F. |
| **3.** | Smart grid communications and networking. Cambridge University Press, 2012. | Hossain, Ekram, Zhu Han, and H. Vincent Poor, eds. |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Computer Networks **(Code: CST 54)** | **Year & Semester:** B. Tech, Electronics & Communication 4th Year & 8th Semester | | **Total Course Credit: 4** | | |
|---|---|---|---|---|---|
| | | | L | T | P |
| | | | 3 | 1 | - |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

**Objectives:** (Maximum 25 Words) Concepts and implementation of computer networks; architecture, protocol layers, inter-networking and addressing; network application development.

**Course Outcomes:**Upon successful completion of the course, student should be able to:

**CO1:** Describe and analyze the hardware, software, components of a network and the interrelations.

**CO2:** Explain networking protocols and their hierarchical relationship

**CO3:** Compare protocol models and select appropriate protocols for a particular design.

**CO4:** Explain concepts and theories of networking and apply them to various situations, classifying networks

**Details of the syllabus:**

| S.No. | Particulars |
|---|---|
| 1. | **Basic concept of network:** Advantages and applications, Types of networks (LAN, MAN and WAN), Different network topologies like star, ring, hybrid, tree. |
| 2. | **Network Protocol Architecture**: OSI Reference model, Layers of the OSI model. Physical, Data-link, Network, Transport, Session, Presentation and Application layer. |
| 3. | **Network Switching Techniques:** Circuit switched, message switching and packet switched networks, Datagram and virtual circuit services, Frame relay, ATM |
| 4. | **Flow and Error Control:** Stop and wait flow control, Sliding window flow control, error control protocols, ARQ techniques, Stop-&-wait ARQ, Go back by N ARQ, Selective repeat ARQ. |
| 5. | **Routing algorithms:** Routing tables, features of a routing algorithm, classification, optimality principle, sink tree, shortest path algorithm, Dijkstra algorithm, flooding, fixed routing, random routing, adaptive routing, distance vector and link state algorithm. **Congestion Control:** Congestion in networks and quality of service. |
| 6. | **Medium Access Control Protocols**: TDMA, FDMA, CDMA, ALOHA, Slotted ALOHA, CSMA, CSMA/CD, Ethernet, Token Ring network |
| 7. | **Network security:** Need for network data security, plaintext, cifertext, encryption techniques, substitution, transposition, DES encryption standard, Private key, public key, Authentication. |

**Recommended Books:**

| S. No | Name of Book | Author |
|---|---|---|
| 1 | Data & Computer Communications, 7th Ed, PHI | William Stallings |
| 2 | Computer Networks, PHI | Andrew Tanenbaum, |
| 3 | Computer Networks, A Systems Approach", 5th ed., Elsevier, 2011 | Peterson and Davie |
| 4 | "Computer Networks: An Open Source Approach", McGraw-Hill, 2011. | Ying-Dar Liu, Ren-Hung Hwang, Fred Baker, |

## Department of Electronics & Communication Engineering
## National Institute of Technology, Srinagar-190006

| **Subject:** Discrete Mathematics (Code: MAT 801) | **Year & Semester:** B. Tech Electronics & Communication Engineering 4th Year & 8th Semester | | **Total Course Credit: 3** | | |
|---|---|---|---|---|---|
| | | | **L** | **T** | **P** |
| | | | 2 | 1 | - |
| **Evaluation Policy** | **Mid-Term** | **Class Assessment** | **End-Term** | | |
| | 30 Marks | 10 Marks | 60 Marks | | |

*Prerequisites:* Elementary knowledge of set theory is needed.

**Course Outcomes:** This course covers discrete mathematics for Electronics and Communication Engineering. So, at the end the student should be able:

| | |
|---|---|
| **CO 1** | to use different counting techniques |
| **CO 2** | to understand and identify structures on many levels |
| **CO 3** | to apply the concepts needed to test the logic of a programme |
| | to familiarize the applications of some elementary algorithims and classical theorems on graphs, apply graphs in concrete situations |
| | to apply the concepts and properties of algebraic structures like groups, rings and fields |
| | to familiarize the properties of modular arithmetic |

**Details of the syllabus:**

| S.No | Particulars |
|---|---|
| 1. | **Combinatorics (08 hrs)**<br>Introduction, basic counting principles, pigeon hole priniciple with applications, inclusion-exclusion principle, recurrence relations and generating functions, introduction to special numbers. |
| 2. | **Ordered sets and Lattices (08 hrs)**<br>Ordered sets, Partially ordered sets, Supremum and Infimum, well ordered sets, Lattices, basic properties of algebraic systems defined by lattices, complemented lattices and distributive lattices. Coding Theory: coding of binary information and error detection, decoding and error correction |
| 3. | **Graph Theory-I (08 hrs)**<br>Introduction to graphs, graph terminology, Euler and Hamiltonian paths, graph connectivity, graph homomorphism, graph isomorphism, planar graphs, graph coloring, matrix representation of graphs, introduction to directed graphs, strong directed graphs |
| 4. | **Graph Theory-II (06 hrs)**<br>Introduction to trees, properties of trees, spanning trees, minimal spanning trees, Prim's Algorithm and Kruskal's Algorithm, matrix tree theorem, Degree sequences in trees, Necessary and sufficient conditions for a sequence to be a degree sequence of a tree. |
| 5. | **Algebraic Structures (08 hrs)**<br>Groups, subgroups, generators and relations, cyclic groups, groups of rotations and reflections, cosets and Langrange's Theorem, homomorphisms and normal subgroups, isomorphisms, automorphisms, semi-groups, rings, ring homomorphism and isomorphism, ideals, finite fields. |

| | |
|---|---|
| **6.** | **Number Theory & Cryptography (08 hrs)**<br>Modular arithmetic, the distribution of primes, prime number theorem, Fermat's theorem and its consequences, symmetric ciphers, public key cryptography. |

**Text Books:**

1. G. Chartand and P. Zhang, *A first course in graph theory,* 2nd Edition, Dover publications, New York, (2012).
2. M. R. Spiegel: *Discrete Mathematics (Schaum's Outline series)*, Tata Mc-Graw Hill, (2009).
3. K. H. Rosen, *Discrete Mathematics and its* applications, 5th Edition, Tata Mc-Graw Hill, (2003).
4. I. Niven, H. Zuckerman, An Introduction to Theory of Numbers, 5th Edition, Wiley Publications, (1991).

**Reference Books:**

1. C. L. Liu, *Elements of Discrete Mathematics*, 2nd Edition, Tata Mc-Graw Hill, (2000).
2. B. Kolman, R. Busby and S. Ross, *Discrete Mathematical Structures*, 6th Edition, Prentice Hall, (2009).
3. D. B. West, *Introduction to Graph Theory*, 2nd Edition, Pearson publications, (2002).
4. T. Koshy, *Discrete Mathematics with Applications*, 1st Edition, Elesvier Academic press, (2004).