Choice Based Credit System (CBCS)

Scheme for

M. Sc. Programme

in

ELECTRONICS

(APPROVED BY BOARD OF STUDIES HELD ON 16-12-2013)

Post Graduate

Department of Electronics & Instrumentation Technology

University of Kashmir

Hazratbal, Srinagar - 6, J & K

Course Layout
M. Sc. Programme in Electronics

SEMESTER I						
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
ELE-14101C	Engineering Mathematics	Core	3	0	0	3
ELE-14102C	Circuit Analysis and Synthesis	Core	3	0	0	3
ELE-14103C	Antennas and Wave Propagation	Core	3	0	0	3
ELE-14104LC	Digital Electronics, Circuit Analysis and Antenna Lab	Core	0	0	6	3
ELE-14105A	Linear Integrated Circuits and Applications	AE	3	0	2	4
ELE-14106A	Programming and Problem Solving through C	AE	3	0	2	4
ELE-14107A	Windows Programming	AE	3	0	2	4
ELE-14108A	Instrument Fabrication and Maintenance	AE	3	0	2	4
ELE-14109A	Numerical Techniques and FORTRAN Programming	AE	3	0	2	4
ELE-14110A	Electronics Engineering Materials & Components	AE	4	0	0	4
ELE-14111O	Computing and Informatics-I	OE	1	2	0	2

AE: Allied Elective
OE: Open Elective

Total Core Credits offered: 12.
Minimum Allied Elective Credits to be offered: 12

Course Layout
M. Sc. Programme in Electronics

SEMESTER II						
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
ELE-14201C	Analog Communication Systems	Core	3	0	0	3
ELE-14202C	Electronic Instrumentation	Core	3	0	0	3
ELE-14203C	Power Electronic Circuits and Systems	Core	3	0	0	3
ELE-14204LC	Analog Communication, Power Electronics and Instrumentation Lab	Core	0	0	6	3
ELE-14205A	Computer Organization and Architecture	AE	3	0	2	4
ELE-14206A	Design and Analysis of Active Filters	AE	3	0	2	4
ELE-14207A	Fiber Optic Communication	AE	3	0	2	4
ELE-14208A	Microwave Engineering	AE	3	0	2	4
ELE-14209A	Data Structures	AE	3	0	2	4
ELE-14210A	Operating Systems	AE	3	0	2	4
ELE-14211O	Computing and Informatics-II	OE	1	2	0	2

AE: Allied Elective
OE: Open Elective

Total Core Credits offered: 12.
Minimum Allied Elective Credits to be offered: 12

Course Layout
M. Sc. Programme in Electronics

SEMESTER III						
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
ELE-14301C	Physics of Semiconductor Devices	Core	3	0	0	3
ELE-14302C	Control System Engineering	Core	3	0	0	3
ELE-14303C	Microprocessors: Architecture, Programming and Interfacing	Core	3	0	0	3
ELE-14304LC	Microprocessor and Control Lab	Core	0	0	6	3
ELE-14305A	Data Communication and Networking	AE	3	0	2	4
ELE-14306A	Digital Signal Processing	AE	3	0	2	4
ELE-14307A	HDL and Digital System Design	AE	3	0	2	4
ELE-14308A	Microcontrollers and Embedded Systems	AE	3	0	2	4
ELE-14309A	Biomedical Instrumentation	AE	3	0	2	4
ELE-14310A	Soft Computing and Neural Networks	AE	3	0	2	4
ELE-14311A	Advanced Communication Systems	AE	3	0	2	4
ELE-14312A	Fundamentals of RF design	AE	3	0	2	4
ELE-14313A	Speech and Audio Processing	AE	3	0	2	4
ELE-14314A	Digital CMOS IC Design	AE	3	0	2	4
ELE-14315O	Basic Electronic Science and Applications	OE	1		2	2

AE: Allied Elective
OE: Open Elective

Total Core Credits offered: 12.
Minimum Allied Elective Credits to be offered: 12

Course Layout
M. Sc. Programme in Electronics

SEMESTER IV						
Course Code	**Course Title**	**Category**	**L**	**T**	**P**	**Credits**
ELE-14401C	Digital Communication and Information Theory	Core	3	0	2	4
ELE-14402C	VLSI Technology	Core	3	0	0	3
ELE-14403C	Industrial Organization and Technopreneurship Development	Core	2	0	0	2
ELE-14404C	Project Work	Core	0	0	8	4
ELE-14405TC	Industrial Training	Core	0	0	2	1
ELE-14406A	CMOS Circuit Design: Analog and Mixed	AE	3	0	2	4
ELE-14407A	Information Security	AE	3	0	2	4
ELE-14408A	Nanotechnology	AE	3	0	2	4
ELE-14409A	Mobile Communication	AE	3	0	2	4
ELE-14410A	Advanced Microprocessors	AE	3	0	2	4
ELE-14411A	Analytical Instrumentation	AE	3	0	2	4
ELE-14412A	Digital Image Processing	AE	3	0	2	4
ELE-14413A	Parallel Computation and Architecture	AE	4	0	0	4
ELE-14414A	Multimedia Systems	AE	3	0	2	4

AE: Allied Elective
OE: Open Elective

Total Core Credits offered: 14.
Minimum Allied Elective Credits to be offered: 12

ELE-14404: Project Work

Each student group should complete the Project Work in IVth Semester under the supervision of an internal guide. The students are expected to prepare a Project Report on the Hardware/Software project, which shall be evaluated by the internal guide as well as an external Examiner as partial fulfillment of the degree of M.Sc. (Electronics).

ELE-14405TC: Industrial Training

The students are required to undergo training at some centre of excellence, outside the State, to get additional exposure in the new and emerging trends in the discipline of Electronics. A Training Incharge from the Department shall accompany the students for making necessary academic and other arrangements at the host institute. The performance of the students shall be evaluated by the host institute in collaboration with the Training Incharge.

Course No.: ELE-14101C **Engineering Mathematics**
Paper Type: Core **Credits: 3L+0T+0P**

Unit I: Fourier Transform

Dirichlet's Condition, Determination of Fourier Coefficients, Fourier Series for arbitrary period, Half-wave expansion, Fourier Integral Theorem, Fourier Sine and Cosine integrals, Fourier Transforms: Properties of Fourier Transforms, Fourier Transform and Dirac delta function, Application of Fourier Transformation in Electronics.

Unit II: Laplace Transformation

Laplace transforms & its properties, Inverse of Laplace transform by partial fractions, solution of second order differential equation using Laplace transform, Application of Laplace transform in Electrical Networks.

Unit III: Function of Complex Variable

Analyticity of Complex variables, Cauchy Riemann Conditions, Cauchy integral Theorem, Laurent's Series, Singularities, Poles, Residues, Residue Theorem, Contour integration for Trigonometric functions (0 to 2□) , Contour Integration for functions (-∞ to +∞), Application of Functions of Complex variables in System Stability. Bessel and Legender Polynomials.

Text Books:

1. Applied Mathematics for Engineers and Physicist by Pipes and Harvill, McGraw Hill Book Company.
2. Advanced Engineering Mathematics by Edwin Kreyzing, Wiley Eastern Ltd.
3. Advanced Engineering Mathematics by H. K. Das, S. Chand Publishing Company.

References:

1. Numerical Methods for Engineers and Scientists by A.C. Bajpai, I. M. Calus and J. A. Fairley, John Wiley & Sons
2. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar, R. K. Jain. New Age International Publisher.
3. Statistical Methods by S. P. Gupta, S Chand and Company.
4. Numerical Methods for Engineers by Steven C. Chapra and Raymond P. Canale, TMH
5. Fourier Transformation and Laplace Transformations, Schaum Series Book , TMHCourse

Course No.: ELE-14102C **Circuit Analysis and Synthesis**
Paper type: Core **Credits: 3L+0T+0P**

Unit I: Graph Theory and Network Equations

Introduction to Graph Theory: Nodes, Branches, Graph and Sub-Graph, Path, Loop, Tree, Link and Twig, Isomorphism, Network Matrices, Incidence Matrix, Loop Matrix, Fundamental Loop, Cut - Set Matrix, Fundamental Cut Set, Relationship between Matrices, Formulation of Network Equations on the Loop and Node pair voltage bases, Fundamental Loop Mesh Equations, Nodal equations, Nodal Admittance, Source Transformations, Tellegen's Theorem and its Applications.

Unit II Two Port Networks and Network Functions

Two port networks, Various Two Port parameters, O. C. Impedance and S. C. Admittance Parameters, parameters, chain Parameters, Image Impedance, Applications of various Two port Parameters to T and π networks, Relationship between different two port parameters, Interconnection of Two port equivalent networks, Indefinite Admittance Matrix. Concept of Complex frequencies, system functions of Network, Driving Point and Transfer functions, Poles and Zeros of a network function, Impulse and step response of a first order system, Poles, Zeros and Frequency response, Physical interpretation of Poles and Zeros, Oscillatory response of Poles and Zeros

Unit III: State Space Analysis and Passive Network Synthesis

Basic consideration in writing state variable equations for electrical Network, Formulation of state equations for Electrical Networks and their solutions.

Introduction to passive network synthesis, Hurwitz Positive Real Function (PRF), Basic Synthesis Procedure, Synthesis by inspection method, LC Immittance Functions *(realized by Foster-I and Foster II form, Cauer-I Form, Cauer-II Form),* RC Impedance Function, RL impedance , RC Admittance Functions.

Recommended Books:

1. Networks and Systems by D.R.Choudury, Wiley Eastern Ltd: New Delhi.
2. Network Analysis By M. E. Valkenburg , Prentice Hall India.
3. Basic Circuit Theory by Charles A. Desoer and Ernest S. Kun, McGraw Hill
4. Circuit Analysis with Computer Application to Problem Solving by Gupta, Bayless and Piekari, Willey Eastern Ltd, New Delhi

Course No.: ELE-14103C **Antennas and Wave Propagation**
Paper Type: Core **Credit: 3L+0T+0P**

Credit- 1 Maxwell's Equations

Review of Electromagnetics and EM spectrum, Basic quantities of Electromagnetics, Basic laws of electromagnetism, Transformer and Motional Electromotive forces, Maxwell's Equations in differential and integral form. Equations of continuity for time varying fields, inconsistency of Amperes law, Displacement current (Physical interpretations), Time varying field equations Boundary condition, Surface Charge and Surface Current, Boundary Conditions at media interface (Dielectric and Conducting interface)

Credit- II Electromagnetic Waves

Homogenous unbounded medium, Wave equation for time harmonic fields, solution of the wave equation, uniform plane wave, wave polarization, wave propagation in conducting medium, power flow and pointing vector (Physical interpretation), plane wave at dielectric interface, reflection and refraction of waves in dielectric interface, Normal Incidence on a layered medium, Total Internal Reflection, Wave Polarization at Media interface.

Credit- III Antenna Radiation Mechanism

Basics of antenna radiation, Potential functions, solution of potential functions, radiation from the hertz dipole, total power radiated by the hertz dipole, radiation resistance of the hertz dipole, radiation pattern of the hertz dipole, directivity, antenna gain, effective area of antenna

Credit- IV Practical Antennas

Folded dipole antennas, modification of folded dioples, loop antennas, far- field patterns of circular loop antennas, horn antennas, reactangular horn antennas, the paraboloidal reflector, spherical reflector, introduction to microstrip antennas, some salient features of microstrip antennas, rectangular microstrip antennas, applications of microstrip antennas

Referances:

1. Antennas and Wave propagation: John D Kraus, Ronald J Marhefka, Ahmad S Khan McGraw Hill, 4th edition

2. Electromagnetic Waves: R. K. Shevgaonkar Tata McGraw Hill

Course No.: ELE-14104LC: Digital Electronics, Circuit Analysis and Antenna Lab
Paper type: Core Credits: 0L+0T+6P

Digital Electronics

Implementation and verification of truth table of logic gates; Study Half/Full Adder/Subtractor. Excess-3 to BCD Converter; Binary-to-Grey Converter; MUX/DMUX; Comparators; Encoder/Decoder; Flip-Flops; Shift Registers/Counters; Jhonson/Ring Counter; Multivibrators.

Circuit Analysis

Find the branch currents and branch voltages of:
A given network using mesh analysis and compare them with the theoretical values;
A given network using node analysis and compare them with the theoretical values.

For a T and Π network find open circuit and short circuit parameters and Verify that the overall ABCD parameters of a cascade of two networks are equal to the sum of individual ABCD parameters. Study the pole-zero response of a network function using Matlab. Study the effect of the variation in poles and zeros on the frequency response of a network function.

Antennas

To study:
The directional properties of Hertz Antenna; directivity, gain and effective aperture of Antenna systems; the Polarization properties of directional antennas;

To simulate antenna system using simulation software.

To perform experiments on microwave antenna system

Course No. ELE-14105A **Linear Integrated Circuits and Applications**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

Unit I: Operational Amplifier Applications

Review of Op-amps, Linear Applications of Op-amps: Amplification (Inverting Amplifier, Non-inverting Amplifier, Logarithmic and Exponential Amplifiers, Instrumentation Amplifier) Integration and Differentiation; Op-amp based Active filter design, Analog multiplexer and Voltage-to-Frequency and Frequency-to-Voltage Converters, Frequency response of OP-Amps

Unit II: Wave shaping, Wave generators and Data Converters
Rectifiers, Clippers and Clampers, Peak Detector, Comparators, Applications of comparators, Schmitt-trigger, Square wave and triangular wave generators, pulse generators, voltage time-base generators, Step (Stair-case) generators, sinusoidal generators: Phase shift oscillator, Wien-bridge oscillator, Sample and hold systems, Digital-to-Analog (Weighted Resistor, R-2R Ladder Network) and Analog-to-Digital Converters (Flash, Successive Approximation)

Unit III: Timer, PLL and Voltage Regulators
555 timer: Applications as Astable and Monostable Multivibrator, Phase locked loop (PLL): Applications as Frequency Synthesizer, FM demodulator, PLL motor speed control, Voltage regulators: Fixed voltage regulators, Adjustable voltage regulators, switching regulators.

Unit IV: Practicals

To study and/or design op-amp: Inverting Amplifier, Non-inverting Amplifier, Logarithmic and Exponential Amplifiers, Instrumentation Amplifier, Active filters, Analog multiplexer, Voltage-to-Frequency and Frequency-to-Voltage Converters, Frequency response, Rectifiers, Clippers and Clampers, Peak Detector, Schmitt-trigger, Square wave and triangular wave generators, Square wave and triangular wave generators,

Phase shift oscillator, Wien-bridge oscillator, Sample and hold system, Weighted Resistor and R-2R Ladder Network type DAC, Flash and Successive Approximation type ADC.

Books Recommended

1. *Integrated Electronics By Milliman, McGraw hill Book company*
2. *Microelectronics By Milliman and Grabel, McGraw Hill Company*
3. Design with Operational Amplifiers and Analog Integrated Circuits, Sergio Franco, Mc-Graw Hill, 2002.
4. *OP- Amp and Linear Integreated Circuits by R. A. Gayakward Prentice Hall of India Ltd.*

Course No.: ELE-14106A **Programming and Problem Solving through C**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

Unit I: Introduction to Programming
Algorithms, Flow-charts, Programming Languages, Compilation, Linking and Loading, Testing and Debugging, Documentation, Introduction to 'C' Language - Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement, Simple 'C' programs , Conditional Statements and Loops - Decision making within a program, Conditions, Relational Operators, Logical Connectives, if statement, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, structured Programming.

Unit II: Arrays and Functions
Arrays - One dimensional arrays: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; Two dimensional arrays, Addition/Multiplication of two matrices, Transpose of a square matrix; Null terminated strings as array of characters, Representation sparse matrices, Functions - Top-down approach of problem solving, Modular programming and functions, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, Passing arguments to a Function: call by reference, call by value, Recursive Functions, arrays as function arguments

Unit III: Structures, Pointers and Files
Structures and Unions- Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions, Pointers- Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays. File Processing - Concept of Files, File opening in various modes and closing of a file, Reading from a file, writing onto a file.

Unit IV: Practicals
Exchanging values of two variables, summation of a set of numbers, Decimal Base to Binary Base conversion, Reversing digits of an integer, GCD (Greatest Common Division) of two numbers, Test whether a number is prime, Organize numbers in ascending order, Find square root of a number, factorial computation, Fibonacci sequence, Evaluate 'sin x' as sum of a series, Reverse order of elements of an array, Find largest number in an array, Print elements of upper triangular matrix, multiplication of two matrices, Evaluation of Polynomials, programs using structures and pointers, File processing, programs for solving engineering problems.

Recommended Books:

1. P.K. Sinha and P. Sinha, "Foundation of Computers" BPB Publishers
2. Turban, Mclear and Wetherbe ,"Information Technology and Management"
3. Byron Gottfried "Programming with C"
4. R.G. Dromey, "How to solve it by Computer"
5. E.Balaguruswamy, "Programming with ANSI-C"
6. A.Kamthane, "Programming with ANSI & Turbo C"
7. Dietel "Programming with C"

Course No.: ELE-14107A **Windows Programming**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

Unit I: Dot-Net Architecture

DOT NET framework, MSIL, CLR, CLS, Name spaces, Assemblies Common Language Implementation Assemblies Metadata and Intermediate Language. Garbage Collection Versioning and Side-by-Side Execution. Integration Development Environment of VB, User Interface, Designing, Basics of Event driven programming. From- Designing, Showing & Hiding.

Unit II: Windows Programming Foundations

VB language- Data types, Variables & Constant, Arrays, Function, Collections, Procedures, Arguments passing, Control Flow statements: if- then, if-then-else, select case, looping statement: Do-loop, For-next, While-Wend, Nested Control Structure, Exit statement. Intrinsic and Active X Controls, Properties & Methods – Text box, List box, combo box, Scrollbar, slider Controls. Advance Active X Control – Common Dialog controls, Color, Font, File open, file save using Rich Textbox Controls. String Manipulations on Textboxes. Graphics controls – Picture Box, Coordinate system, Graphics Methods- Text drawing, Lines & Shape, Filling Shapes.

Unit III: Advanced Windows Programming

Grid methods Menu editor: Pull-down, Pop-up Menus. Multiple Document Interface- Parent & Child Forms & Methods. OLE – Basics, OLE control Properties & Methods, Error handling in VB- Types of Errors, Error handling methods and functions. Database Programming with VB database Models, Visual Data manager, DATA Control- Methods, Properties, Connectivity with database, DATA bound controls, ADO Database Controls, Creating & using Database with object model, Attaching Queries with database. Filtering Data. DATA Report Designer.

Unit IV: Practicals

Programming exercises using VB.NET for problem solving involving use of arrays, collections, procedures, control flow, intrinsic and active-x controls, files, SDI and MDI interfaces and databases.

Recommended Books:

1. Mastering VB .NET by Evangelos Peteroutsos, WROX Publications
2. Dietel and Dietel, “Visual Basic, How to Program”, Pearson Education.
3. Peter Norton’s Guide To Visual Basic 6 By Peter Norton
4. Beginning Visual Basic 6 By Peter Wright, Shroff Publishers
5. Programming In Visual Basic 6.0 By Mohammed Azam, Vikas Publishing House

Course No.: ELE-14108A **INSTRUMENT FABRICATION AND MAINTENANCE**

Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

Unit-I: Transformers, UPS and Batteries

Transformers: Single-Phase Transformers, Construction, Types, Transformer ratio, Cooling, Auto Transformer, Transformer Tests, Efficiency of Transformer, Transformer winding, autocuts and line protection. Three phase transformers - connections, parallel operation. Fabrication and repairs of Transformers. UPS: Principle and operation, performance parameters, capacity, Repairs of UPS.

Rechargeable Batteries: Principle, types, capacity, AH rating. Fabrication and repairs of batteries.

Unit-II: Generators, Motors and other Appliances:

DC/AC Generators: Magnetic induction, Principle, Torque Equation, Main Parts, Types, Application. Motor Winding, Fan Winding, Repairs of DC/AC Motors, Generators & Fans. Repairs of Xerox Machines, FAX Machines &Telephone equipment. Repairs of Washing Machines.

Unit-III: Assembling and maintenance of Computers & Mobile Phones

Assembling of a computer system, Hardware maintenance of a computer system, memory upgradation, software faults. Maintenance of printers and other computer accessories. **Mobile phones:** Computerized Chip Level Mobile Repairing, IC Replacement and Rebolling, methods of Flashing, Mobile Unlocking, Mobile Formatting, UI Settings. Mobile Downloading, Blue-Tooth & Card-Reader Cables.

Unit-IV: Practicals on equipment Maintenance

Practical exercises on fabrication of power transformers, transformer winding, UPS assembling, repairs of Xerox machines, Fax machines. Practical exercises on repairs of mobile phones.

Assembling of computer system and memory upgradation.

Course No.: ELE-14109A **Numerical Techniques and FORTRAN programming**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

UNIT I: Roots of Equations, System of Equations and Curve fitting
Approximation Methods and Errors: Accuracy and precision, Truncation and round-off errors. Roots of Equations: Bracketing Methods (false position, bisection), Iteration Methods (Newton-Raphson Method). Systems of linear algebraic equations: Gauss's Elimination Method; Curve fitting: Least squares regression, Linear, multiple linear and nonlinear regressions, Cubic spline.

UNIT II: Interpolation, Differentiation and Integration
Interpolation Methods: Newton's divided difference and Lagrange interpolating polynomials. Numerical differentiation and integration: Divided difference method for differentiation, Newton-Cotes formula, Trapezoidal and Simpson's rules. Ordinary differential equations: Euler's method and its modifications, Runge-Kutta methods, Boundary value and Eigen value problems.

UNIT III: FORTRAN Programming
Formatting source codes. Data types. Constants, variables, arrays, indices. Expressions, operators, operands. Standard and statement functions. Rules for expression evaluation, priorities of operators. Cycles, statements, constructs.
Type declaration, array declaration, definition of named constants, data initialization, memory sharing, retaining local variables. Assignments, goto statements, conditional statements, cycle statements, empty statement, stopping and pausing, return from a unit. Subroutines, functions, data subprograms.

UNIT IV: Practicals
FORTRAN programs for evaluation of polynomials and matrices.
FORTRAN programs for numerical techniques: False position method, Bisection method, Newton-Raphson Method, Gauss's elimination Method, Least squares regression, Lagrange interpolating polynomials, Trapezoidal and Simpson's rules, Euler's method and Runge-Kutta methods

Books Recommended

1. Numerical Mathematical Analysis, J.B. Scarborough, John Hopkins (1966).
2. Introductory Methods of Numerical Analysis, S.S. Sastry, Prentice Hall of India (1983)
3. Numerical Methods for Engineering, S.C. Chapra and R.C. Canale, McGraw-Hill (1989).
4. W.H. Press, S.A. Teukolsky, W.T. Vetterling, B.P. Flannery, Numerical Recipes in Fortran 77: The Art of Scientific Computing, Second Edition, Cambridge University Press, 1996.

Course No.: ELE-14110A **Electronic Engineering Materials & Components**
Paper Type: Allied Elective **Credits: 4L + 0T + 0P**

UNIT-I Electrical Properties of Materials
Classification of electrical materials; Fundamentals of Atomic Structure and Chemical Bonding; Structure and properties of conductors, semi-conductors and insulators;

UNIT-II Magnetic Properties of Materials
S and properties of magnetic materials, ferroelectric, piezo-electric, ceramic optical and superconducting materials.

Structure of solids : Crystalline and Non-crystalline states; Crystallographic directions and phases; Determination of crystal
structures.

UNIT-III Electronic Components
Passive components; Resistors, capacitors, inductors and their types; color coding; ferrites, Quartz crystal and ceramic resonators, electromagnetic and electromechanical components.

UNIT IV Physical Electronics
Electrons and holes in semiconductors; Hall effect; mechanism of current flow in a semi-conductor, junction theory, different types of diodes and their characteristics (rectifying, Zener, LED, Photo). Introduction to three terminal devices (BJT and FET).

Books Recommended:

1. Electronic Devices and Circuit Theory. By: Robert Boylestad & Louis Nashelsky. Prentice Hall.
2. Elements of Materials Science & Engineering. By: L.H. Van Vlack. Addison-Wesley Publishing Company, New York.

Course No.: ELE-14112O **Computing & Informatics-I**
Paper Type: Open Elective **Credits: 1L + 1T + 0P**

Unit I: (Theory)

Computer basics. History, generations and classification of computers; Number systems; Hardware. Components of a computer input/output devices, CPU unit and memory unit, secondary storage. Software, System software; application software; compilers and translators. Operating systems. Introduction to operating systems;' types of operating systems and their functions; popular operating systems- Linux, UNIX and Windows, Introduction to office automation and Internet.

Unit II: (Tutorial)

Identification of various internal and external parts of computer system, connecting various parts of computer system, learning basic commands for file management on windows operating system, learning to create, format and print documents, spreadsheets and presentations, using Internet.

Recommended Books:

1. V. Srivastava "Computing and Informatics" Ist Edition S. K. Kataria & Sons.
2. Chandwani "Computing and Informatics" Jain Brothers.
3. Anital Goel "Computer Fundamentals" Pearson
4. P.K.Sinha "Computer Fundamentals" BPB Publications.

Course No.: ELE- 14201C Analog Communication Systems
Paper Type: Core Credit: 3L+0T+0P

Unit I- Amplitude Modulation/Demodulation Techniques

Introduction to Signals and its classification**,** Properties of Signals and Noise,**:** Basic Mathematical theory of A. M modulation, Time domain and Frequency domain representation, Generation and demodulation of Amplitude Modulation, Double Side band Suppressed Carrier, (DSB- SC) System: Mathematical Analysis, Generation and Demodulation of DSB- SC signals, Costas receiver. Advantages of SSB transmission, Hilbert Transform, properties of Hilbert transform, pplications of Hilbert Transform, Generation of SSB; Vestigial Side-Band Modulation (VSB). SSB and VSB demodulation, independent sideband transmission and receiption

Unit II- FM Modulation/ Reception

Concept of Angle Modulation: Mathematical theory, Phasor Representation of Angle modulated signal, Bandwidth calculation, Generation of FM by Direct Methods. Indirect Generation of FM; The Armstrong Method, FM Stereo Transmission. FM Receiver Direct Methods of Frequency Demodulation; Slope Detector, Foster Selay or Phase Discriminator, FM Detector using PLL and Stereo FM Multiplex Reception.

Unit III Performance of Analog Communication Systems

Noise in Communication System, Time-domain representation of Narrow band Noise, Filtered White Noise, Noise equivalent Band-width, Effective Noise temperature, Noise figure. AM Receiver model, Noise analysis of DSBSC and SSBSC using coherent detection, Noise in AM using Envelope detection, Noise in FM using Limiter-discriminator detection, FM threshold effect, Pre- emphasis and De-emphasis in FM.

Books Recommended:

1. Modern Digital and Analog Communication Systems, by B. P. Lathi, Oxford Press.

2. George Kennedy, “Electronic Communication System”, McGraw- Hill.

3. Gary M. Miller and Jeffery S. Beasley, “Modern Electronic Communications “, PHI.

4. Simon Haykin, “ Communication Systems”, 8th edition, Wiley Pubclishers.

5. Wayne Tomasi, “ Electronics Communication systems”, 4th edition, Pearson Publishers.

Course No.: ELE-14202C **Electronic Instrumentation**
Paper Type: Core **Credits: 3L + 0T + 0P**

Unit I: Measurements and Instrumentation

Fundamentals of Measurements: General Concepts on Instruments; Introduction to Portable Instruments; Errors and; Controlling and Networking of Instruments; Signals and Signal Conditioning; Noise and Interference

Transducers: Classification of transducers, characteristics and choice of transducers; Resistance, Capacitance, Peizoelectric, Thermoelectric, Hall effect, Photoelectric, Techogenerators, Measurement of displacement, velocity, acceleration, force, torque, strain, speed, and sound, temperature, pressure, flow, humidity, thickness, pH, position.

Unit II: Digital Measurements

Counters, Digital frequency meters and time meters, Universal counter timer. Digital Voltmeter: General Characteristics, Ramp type DVM, Staircase ramp DVM, Successive approximation type DVM, Integrating type DVM Dual slope A/D DVM, Digital ohm meter, Digital capacitance meter, Digital modulation index meter, Digital quality factor meter, Digital tan delta meter, Digital IC tester.

Unit III: Measurement Instruments

Oscilloscopes: The basic operation of an oscilloscope, advanced techniques: Multiple time bases, Oscilloscopes with dual channels and dual time bases, Use of low cost microprocessor blocks, Digital storage oscilloscopes (DSOs): Sampling techniques, DSO characteristics, Recent developments on DSO techniques

Spectrum analyzers: Spectrum Analysis, Types of spectrum analyzer: Real time technique, Fourier transform analyzer, swept tuned analyzer, Superheterodyne spectrum analyzer

Books Recommended

01. Digital and Analogue Instrumentation testing and measurement, Nihal Kularatna, The Institution of Electrical Engineers, 2003
02. Measurement, Instrumentation and Sensors Handbook, J. G. Webster, CRC Press, 1999.
03. Digital Measurement Techniques by T. S. Rathore, Narosa Publishing House, New Delhi.

Course No.: ELE-14203C **Power Electronic Circuits and Systems**
Paper type: Core **Credits: 3L+0T+0P**

Unit I: Power Devices

Review of switching characteristics of semiconductor devices *(Power diodes, BJT's,),* Characteristics of an ideal switch, Types of electronic switches. Thyristor construction and characteristics, Methods of turning ON, Turn-off mechanism, effect of high di/dt and dv/dt , Snubber circuits, Gate triggering circuits, Device specifications and ratings, DIAC, TRIAC and UJT V-I characteristics.

Unit II: Thyristor Circuits and Applications

Controlled rectifiers, AC voltage controllers, Principle of ON- OFF control, Principle of phase control, Single phase bi-directional controllers with resistive loads, Commutation techniques: Natural commutation, Impulse commutation, complementary commutation, external pulse commutation, Load side and line side commutation, Series and Parallel combination of SCRs.

Unit III: Switch Mode DC to DC Power Converters

Principle of step down and step up operation, Performance parameters of DC-DC converters, Design of BUCK converters, BOOST converters, BUCK–BOOST converters, Forward converter, Half-Bridge converter, Push Pull converter and Full Bridge converter.

Unit IV: Inverters and Cyclo-converters

Inverter: Principle of operation, performance parameters, Pulse width modulation techniques, Design of inverters, Single-phase half bridge inverter, Single phase full bridge inverter, Analysis in each case (for resistive and inductive loads), Cyclo-converters: step up and step down , design of single-phase step down Cycloconverters , Power supplies: SMPS, UPS.

Recommended Books:

1. Power Electronics, Circuits, Devices and Applications by M. H. Rashid, PHI.
2. Power Electronics by Mohan, Undeland, Robbins, John Wiley and Sons.
3. Power Electronics by P. C. Sen, Tata McGraw Hill, Pub. Co.

Course No.: ELE-14204LC **Analog Communication, Power Electronics and Instrumentation Laboratory**

Paper type: Core **Credits: 0L+0T+6P**

Anolog Communication

To study analog Multiplier (AD633). Design and simulate AM modulator/Demodulator. Design and Simulate Frequency modulation/Demodulation. To study of PLL and detection of FM signal using PLL. Generation & simulation of DSB-SC and SSB signal. To Implement and Simulate Hilbert Transformer. Measurement of Noise Figure using a Noise generator. Study the functioning of super heterodyne AM receiver. Measurement of Sensitivity, Selectivity and Fidelity of radio receivers. Noise power spectral density measurement.

Power Electronics:

Study switching characteristics of Power transistors and power MOSFETs. To study IV characteristics of SCR and find its break over voltage on state resistance, holding current and latching current. To study IV Characteristics of DIAC and find its break over voltage. To study IV Characteristics of TRIAC and UJT. To design and realize UJT relaxation oscillator. Thyristor triggering circuits: and HW/FW controlled rectifiers using SCR. To study AC voltage control using DIAC TRIAC combinations. To study self commutation of SCR. To design and realize step up and step down chopper, buck Regulator, Boost Regulator and Buck-Boost Regulator.

Instrumentation:

Study of: Analog and Digital Oscilloscopes, Spectrum Analyzers Study characteristics of: Resistive, Capacitive, Peizoelectric transducers. Measurement of physical parameters using transducers. Study and Design: Digital frequency meter and time meter, Universal counter timer, Ramp type DVM, Staircase ramp DVM, Successive approximation type DVM, Dual slope A/D DVM, Digital ohm meter, Digital capacitance meter, Digital modulation index meter, Digital quality factor meter

Course No.: ELE-14205A **Computer Organization and Architecture**
Paper Type: Allied Elective ***Credits: 3L + 0T + 2P***

Unit I: Structure, Function, Measuring Performance and Memory

Computer Level Hierarchy and Evolution, Von-Neumann Architecture, Structure and Components of Computers, Computer Functions, Instruction Execution and Instruction Cycle State Diagrams, Computer Buses, Bus Interconnection and Hierarchy, Elements of Bus Design, Bus Arbitration and Timings, introduction to High speed buses. Measuring Performance – MIPS, FLOPS, CPI/IPC, Benchmark, Geometric and Arithmetic Mean, Speedup, Amdahl's and Moore's Laws. Memory Hierarchy, types and Characteristics, Primary Memory- Types, Working, Chip Organization, Expansion, Cache Memory- Mapping Schemes, Replacement Policies, Hit and Miss, Write policies, Coherence. Introduction to Virtual Memory, Overlays, Paging, Segmentation, Fragmentation, RAID and CAM.

Unit II: Instruction Set Architecture, Register Set and I/O Organization

Instructions and Instruction Set–Characteristics, Types, Functions, Execution, Representation, Format, Addressing Modes, CPU Registers – Organization, Programmer Visible, Status/Control, Accumulator, and general purpose registers, Stack based CPU, Micro-operations and RTL – Register Transfer, Bus and Memory Transfer, Arithmetic, logical and shift micro-operations, Implementation of simple Arithmetic, logical and shift units, Micro-operations and instruction execution, I/O Organization – I/O Module, its functions and structure, I/O Techniques, Introduction to I/O Interfaces

Unit III: Data Representation, ALU and Control Unit Design (Theory)

Scalar Data Types Sign Magnitude, One's and Two's Complement representations of Integers, Integer Arithmetic's (Negation, Addition, Subtraction, Multiplication, Division, Incrementation and Decrementation). Booths Algorithms and Hardware Implementation. Floating Pont Representation and IEEE Standards. Floating Point Arithmetic's (Negation, Addition, Subtraction, Multiplication and Division). ALU – Fixed and Floating point ALU Organization. Control Unit – Functional Requirements, Structure, Control Signals, hardware and Micro-programmed /Wilkes Control unit, Micro-instructions and its formats, Control Memory. Introduction to Pipelining and Parallel Processing.

Unit IV: Practicals

Digital design of binary adders, subtractors, comparators, fast adders, etc. Chip implementation of various arithmetical and logical circuits, Design of 4/8 bit ALU. Study of Booths algorithm and its hardware implementation, understanding format and representation of various data types in High and low level languages, Design of a floating point adder.

Recommended Books:

1. Computer Organization and Architecture by Stallings, PHI.
2. Computer Organization by M. Mano, PHI.
3. Computer Organization and Architecture by Gilmore, TMH.
4. Computer Organization and Design, Patterson Henessney, Harcourt India
5. Computer Organization by J. P. Hayes. Tata McGraw Hill.

Course No.: ELE-14206A **Design and Analysis of Active Filters**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

Unit I: Filter Approximation Models and Sensitivity analysis

Introduction to Analog filter theory, filter approximations, Butterworth approximation, Chebyshev approximation, Bessel filters, frequency transformations, low pass-lowpass, low pass-highpass, lowpass-bandpass and low pass to band reject transformations, Sensitivity study, Sensitivity function, magnitude and pass sensitivities, single parameter sensitivity, multiple parameter sensitivity.

Unit II: Active filter synthesis and Operational Transconductance Amplifier

Cascade approach, Simulated Inductance Approach, Operational Simulation of LC ladders and FDNR approach. Immitance converters and inverters, Generalized Impedance converter. Operational Transconductance Amplifier (OTA), Circuit Description of OTA, Advantages, limitations. Elementary Transconductor Building Blocks: Resistor, Integrator, Amplifier, summers, gyrators and Modulators. First and Second order Filters, High-order filters.

Unit III: Switched Capacitor filters

The MOS switch, The Switched capacitor/resistor equivalence, analysis of switched capacitor filter using charge conservation equations, First-order building blocks (Inverting and Non-inverting Amplifier, Integrator and Differentiator), Sampled-Data operation, Switched capacitor First and Second order Filters, Switched capacitor High-order filters.

Unit IV: Practicals

Study of CA3080 OTA chip, Design OTA based: Voltage amplifier (I & NI), Simulated Resistor (Grounded & Floating), Simulated Inductor (Grounded & Floating), Amplifier summer, Integrator (I & NI), Differentiation (I & NI), Gyrator; Design of OTA based low and high order fitters. Designs an OP-amp based GIC and verify it for inductor simulation, Design LC Ladder based 2nd order LP/HP/BP/BS filtering function using FDNR approach, Study the transformation of a given filtering function into the remaining filtering functions & verify them by using theoretical transformations, Design a simulated resistor of a given value using switched capacitor fitter, Design of Switche capacitor building blocks (Inverting and Non-inverting amplifier, Integrator and Differentiator), Design 1st order 2nd order filtering functions using SCF.

Books Recommended

1. *Analog Filters, Second Edition, Kendall Su, Kluwer Academic Publishers, 2002*
2. *Design and Analysis of Analog Filters: A Signal Processing Perspectiv, Larry D. Paarmann, Kluwer Academic Publishers, 2003*
3. *Analog Filter Design, M. E. van Valkenburg and Rolf Schumann, Oxford University Press, 2005.*
4. *Demystifying Switched-Capacitor Circuits, Mingliang Liu, Newnes, Elsevier, 2006.*

Course No.: ELE- 14311A: **Optical Fibre Communication**
Paper type: Allied Elective **Credits: 3L+0T+2P**

Unit–I: Optical Fiber: Structures and propagation

Introduction to Optical Communication Systems; Optical fibers, light propagation through fibers, different types of fibers, optical fiber modes and configurations, mode theory, attenuation, dispersion, characteristics of single mode fibers sources and detectors; LED's and lasers, light sourse linearity, reliability consideration

Unit- II Digital and Analog links

Point to point links, power links, error control, coherent detection, differential quadrature phase shift keying (QPSK), overview of analog links, carrier- to- noise ratio, multichannel transmission techniques, RF over fiber, radio over fiber links

Unit- III WDM and Optical Networks

Overview of WDM, Passive optical couplers, isolators and circulators, fiber grating filters, phase array based devices, network concepts, network topologies, SONET/ SDH, high speed lightwave links, optical Add/Drop multiplexing, optical switiching, WDM examples, passive optical networks, IP over DWDM, Optical ethernet Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers. Optical system design Considerations, Component choice

Unit- IV Practicals

To perform various experiments using OFC training kit, Multiplexing, Point-to- point links, System considerations, Overall fiber dispersion in Multi mode and Single mode fibers, Transmission distance, Line coding in Optical links, Measurement of Attenuation and Dispersion, Eye pattern.

Test Books and References:

1. Microwave Principles by Herbert J. Reich, East- West Press.

2. Antenna and Wave Propagation by A.K. Gautam.

3. Modern Electronic Communications by Jeffrey S. Beasley, PHI.

4. Lasers and Optical Fibre Communications by P. Sarah International Publishing House.

Course No.: ELE-14208A **Microwave Engineering**
Paper type: Allied Elective **Credits: 3L+0T+2P**

Unit I: Microwave Transmission Lines

Transmission Line and Distributed parameters, Basic Transmission line equations, Solutions, Distortions in Transmission line, Condition for Distortion less line, Characteristic impedance, Propagation Constant, Reflection and Transmission coefficients, Standing wave and Standing wave ratio, Impedance matching by Stubs and Tapped Quarter wave line-transformer, Short circuited line, Open circuited line, Line terminated by arbitrary load.

Unit –II Micro wave Waveguides and Components

Fundamentals of Microwave Waveguides, Rectangular Waveguides, TE & TM modes in Rectangular magnitudes, excitation of modes in Rectangular Wave guides, Degenerative & dominant modes, S-Parameters: Microwave Hybrid Circuits: Waveguide tee: E-plane tee, H-plane tee , Magic tee, hybrid rings (rat-race circuits), directional Couplers, S-Matrix of direction Coupler, Circulators and isolators.

Unit III: Microwave Amplifiers & Oscillators

Microwave tubes: lead inductance and Inter electrode capacitive effects Transient angle effect, Gain bandwidth Limitation, Microwave Cavity Resonators, Klystrons: Multicavity Klystron and Reflex Klystron, Magnetron oscillator (cylindrical), Gunn Oscillator, Parametric amplifier, Introduction to Strip lines: Micro strip and Parallel Strip lines.

Unit IV: Microwave Devices

To study VI characteristics of Gunn diode, To determine the frequency and wavelength in a rectangular wave guide working on TE 10 mode, To determine the standing wave ratio and reflection coefficient, To study functioning and behavior of Isolator, E-Plane Tee, H-Plane Tee, Magic tee, Study of characteristics of Klystron tube and to determine its electronic tuning range.

Text Books:

1. Microwave Devices and circuits by Samuel Y. Liao

2. Microwave Principles By Herbert J. Reich

3. Foundations for Microwave engineering by Robert E. Collin

4. Elements of Engineering Electromagnetics by Nannapaneni Narayana Rao

5. Electromagnetic Field theory by Rishabh Anand

Course No.: ELE-14209A **Data Structures**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

Unit I: Lists, Stacks & Queues

Lists, Abstract Data Type-List, Array Implementation of Lists, Linked Lists, Doubly Linked Lists, Circularly Linked - Implementation and Applications. Stacks, Abstract Data Type-Stack, Implementation of Stack, Implementation of Stack using Arrays, Implementation of Stack using Linked Lists, Applications. Queues, Implementation of Queue, Array Implementation, Linked List Implementation, Implementation of Multiple Queues, Implementation of Circular Queues, Array Implementation, Linked List Implementation of a circular queue, Implementation of de-queue, Array Implementation of a de-queue, Linked List Implementation of a de-queue.

Unit II: Trees & Graph Algorithms

Trees, Abstract Data Type-Tree, Tree Traversals, Binary Trees, Binary Tree Traversals, Recursive Binary Tree Traversals, Non Recursive Binary Tree Traversals, Applications. Binary Search Trees, Traversing a Binary Search Trees, Insertion of a node into a Binary Search Tree, Deletion of a node from a Binary Search Tree, AVL Trees, Insertion of a node into an AVL Tree, Deletion of a node from and AVL Tree, AVL tree rotations, Applications of AVL Trees, B-Trees, Operations on B-Trees ,Applications of B-Trees. Graphs Definitions, Shortest Path Algorithms, Dijkstra's Algorithm, Graphs with Negative Edge costs, Acyclic Graphs, All Pairs Shortest Paths Algorithm, Minimum cost Spanning Trees, Kruskal's Algorithm, Prims's Algorithm, Applications, Breadth First Search, Depth First Search, Finding Strongly Connected Components.

Unit III: Searching, Sorting and Advanced Data Structures

Linear Search, Binary Search, Applications. Internal Sorting, Insertion Sort, Bubble Sort, Quick Sort, 2-way Merge Sot, Heap Sort, Sorting on Several Keys. Splay Trees, Splaying steps, Splaying Algorithm, Red-Black trees, Properties of a Red Black tree, Insertion into a Red-Black tree, Deletion from a Red-Black tree, AA-Trees.

Unit IV: Practicals

Design, Implementation and tests of lists, Linked Lists, Stacks, Queues, Trees (Binary Tree, Recursive Implementation of Binary Tree Traversals, Non Recursive Implementations of Binary Tree Traversals, Applications.), Advanced Trees, Graphs, Searching, Sorting Techniques.

Recommended Books:

1. E. Balaguruswami "Data Structures through C" 1st Edition, Tata McGraw Hill.
2. Seymour Lipschutz "Data Structures with C" Schaum's Outline Series
3. S. K. Srivastava "Data Structures through C in Depth", BPB Publication.
4. Reema Thareja"Data Structures using C", Oxford P
5. R. B. Patel "Expert Data Structures with C" Khanna Publication.

Course No.: ELE-14210A: Operating Systems
Paper Type: Allied Elective Credits: 3L + 0T + 2P

Unit I: Introduction to Operating System

Operating System, Evolution of Operating System, Operating System Structure, Layered Structure Approach, Virtual Machine, Client-Server Model, Kernel Approach, Classification of Advanced Operating System, Architecture Driven Operating System, Application Driven Operating System, Characteristics of Modern Operating System, Microkernel Architecture, Multithreading and Symmetric Multiprocessing. Concept of Process, System Calls for Process Management, Process Scheduling, Scheduling Algorithms-First Come First serve (FCFS),Shortest Job First (SJF) ,Round Robin (RR), Shortest remaining time next (SRTN) ,Priority Based Scheduling or Event Driven (ED) scheduling, Performance evaluation of the Scheduling Algorithms.

Unit II: Inter-process Communication and Synchronization& Deadlocks

Inter-process Communication and Synchronization , Semaphores ,Classical problems in concurrent programming , Locks, Monitors and Conditional Variables, Deadlocks, Characterization of a Deadlock, A Resource Allocation Graph, Dealing with Deadlock Situations : Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery, Deadlock detection and recovery, Deadlock Prevention: Havender's Algorithm Deadlock Avoidance: Banker's Algorithm

Unit III: Memory, File Management and Security & Protection

Overlays and Swapping, Logical and Physical Address Space, Single Process Monitor, Contiguous Memory Methods, Paging: Principles of operation, Page allocation, Hardware Support for Paging, Sharing. Segmentation: Principles of operation, Address Translation, Operating systems' view of file Management: Directories, Disk Space Management, Disk address translation, and File related system services. Security Threats, Policies and Mechanisms, Authentication: Passwords, Alternative Forms of Authentication, Protection in Computer Systems, Security Models: Access-Control Matrix, Mandatory Access Control, Discretionary Access Control, Rule and Role Based Access Control.

Unit IV: Practicals

History, Features of Unix/Linux, Commands and Processes, Unix/Linux file system, Wild card characters, syntax of Unix/Linux commands, Unix/Linux commands (terminal control characters, login and authentication, information, file management, display content of files, directories, special character handling for C-shell, email and communication, editors and formatting utilities, compiler, interpreter and programming tools), Bourne shell programming.

Recommended Books:

1. Silberschatz Galvin, "Operating System Concepts", 1999, Addison-Wesley Longman.
2. Andrew S.Tanenbaum, Albert S. Woodhull, "Operating Systems: Design & Implementation", 2002, Pearson Education Asia.
3. D. M. Dhamdhere, "Operating Systems: A Concept Based Approach", 002, Tata McGraw Hill Publishing Company.
4. William Stallings Operating Systems internals and design principles 6th Edition, Pearson Education
5. A. S. Godbole, Operating Systems", Tata McGraw Hill, 2002
6. Yashwant Kanitker "Unix Programming" BPB Publication.

Course No.: ELE-14211O **Computing & Informatics - II**
Paper Type: Open Elective **Credits: 1L + 1T + 0P**

Unit-I (Theory):

Introduction to algorithms and flow charts, Introduction to programming, types and categories of programming languages. Introduction to C programming language, declarations, expressions, control statements, arrays, functions, and pointers. Introduction to database management system, basic networking concepts, electronic mail and WWW, introduction to information security.

Unit-II (Tutorial):

Writing C programs using basic programming elements including control statements, arrays, function and pointers. Familiarity with e-mail and information security.

Recommended Books:

1. Yashwant Kanitker "Let Us C" 13th Edition BPB Publication.
2. Michael E. Whitman "Principles of Information Security" 4th Edition, Cengage Learning India.
3. S. K. Srivastava "C in Depth" BPB Publications.
4. Philipa,Wingate "Internet for Beginners" E.D.C Publishing .

Course No.: ELE-14301C **Physics of Semiconductor Devices**
Paper Type: Core **Credits: 3L + 0T + 0P**

Unit I: Crystal Structure and Carrier Transport

Crystal Structure, Space lattices, Primitive and Unit Cell, Index system for crystal planes, Separation between the parallel planes of a cubic crystal, Description of Schrodinger wave equation, Physical interpretation of wave function, Kroning Penney Model, K-space diagram, Effective mass, Concept of Hole, Derivation of Density of state functions, Fermi-Dirac Distribution function, Carrier concentration at thermal equilibrium, Carrier transport Equation ,Decay of photo excited carriers, carrier lifetime, Hall effect.

Unit II: Semi conductor diodes

Abrupt and Graded PN junction, Current- voltage characteristics of PN junction, Depletion capacitance, Diffusion capacitance, Junction breakdown phenomenon, Schottky effect, Bipolar junction transistors, current gain parameters, minority carrier distribution and terminal currents, Eber-Moll model.

Unit III: Field Effect Transistors, Microwave and Opto Electronic Devices

Field effect transistors, JFET and MOSFET- Basic device characteristics with analysis, MOS Capacitors, MOSFET Types- Basic device Characteristics with analysis, Equivalent Circuit.

IMPATT: Static and Dynamic Characteristics, Gun diode and its Modes of operation, P-N Junction Solar Cells, V-I Characteristics, Ideal Conversion efficiency.

Books Recommended

1. *Semiconductor Physics and Devices, Basic Principles by Donald E. Neaman, McGraw-Hill Publishing, 3rd Edition, 2003.*
2. *Solid State Electronic Devices Ben G. Streetman, , Prentice Hall of India Ltd, N. Delhi.*
3. *Physics of Semiconductor Devices S. M. Sze, Wiley eastern Ltd.*
4. *Electronic Processes in Semiconductors, Azeroff and Brophy, McGraw Hill Publishingcompany.*
5. *Physics and Technology of Semiconductor Devices A. S. Grove, , John Wiley and Sons, New York.*

Course No.: ELE-14302C **Control System Engineering**
Paper type: Core **Credits: 3L+0T+0P**

Unit I: Control Systems and System Representation

Control Systems, types of control systems, feedback & its effects, linear & non-linear systems, superposition in linear systems, cascade and feed-forward control, Signal Flow Graph modeling of electrical and electronic systems, SISO and MIMO systems, Transfer function calculation using block diagram algebra and signal flow graph methods, Control of
Physical Systems: Speed and temperature.

Unit II: Time Domain Analysis of Control Systems

Standard test signals, time response of first order and second control systems, Steady- state and transient response, Transient response specifications, S-plane root location & the transient response, Error analysis, Static and dynamic error coefficients, Controllers: Proportional, PI,PD and PID controllers.

Unit III: Stability and Frequency Analysis

Stability : Conditional an absolute stable systems, location of poles and stability, Routh- Herwitz criterion, Root-locus plot , effect of addition of poles and zeros on root locus, Frequency domain analysis, advantages and disadvantages, Frequency domain specifications, Polar plot, Bode plot, gain margin and phase margin, Nyquist criterion.

Unit IV: Introduction to Modern Control Theory

State equations, advantages of state space techniques, State space representation of electrical networks, state transition matrix, state transition equations, state diagrams, Block diagram representation of state equations, state space representation from ordinary differential equations, concepts of controllability and observability.

Recommended Books:

1. Modern Control Engineering by K-Ogata.
2. Feedback & Control Systems by Disteflno, Stubberud and Williams, McGraw Hill International
3. Automatic Control systems by B. C. Kuo.
4. Linear Control System Analysis & Design by D. Azzo, Houfil.

Course No.: ELE-14303C **Microprocessors: Architecture, Programming and Interfacing.**

Paper Type: Core **Credits: 3L + 0T + 0P**

Unit I: Architecture, Addressing Modes, Instruction Set and ALP

Introduction to 8086 Microprocessor, Architecture of 8086 Microprocessor, Functions of BIU and EU, Working of 8086 Microprocessor, Registers of 8086 Microprocessor and their purpose, Addressing Modes of 8086 microprocessor, Memory Segmentation in 8086 Microprocessor based system. Introduction to Programming, Various level of Programming, Assembly language programming, Assembler, Linker, Debugger, Instruction set of 8086 Microprocessor, Data transfer instructions, Arithmetic and Logical instructions, Branch Instructions, Processor control instruction, String operation instructions. Assembly language Programming for 8086 microprocessor. Use of Macros in ALP.

Unit II: Interrupts, Timing and Processor Modes

Introduction to procedures, interrupts and interrupt service subroutines, 8086 Interrupt Structures, Interrupt Vector table, various types of Interrupts, Software Interrupts, Hardware Interrupts, Multiple Interrupts, Input /Output structure, ALP using interrupts, Device Access, Operating Systems Calls, BIOS Calls and Direct Device Access, 8259 Programmable Interrupt Controller-Features, Interfacing & Programming, Various Types of 8086 microprocessor, Architecture and operation of 8284A Clock Generator, Buffering and Latching of 8086 Microprocessor, Bus timings, Timing Diagrams, Wait States, Minimum Mode 8086 System, 8288 Bus Controller, Maximum Mode 8086 System.

Unit III: Peripheral Devices and Interfacing

Peripheral Devices and Interfacing, Introduction to memory and its types, Memory interfacing, Memory mapped and I/O Mapped Schemes, Even and Odd Addressing. Data Transfer Schemes, I/O Interfacing, Isolated and Memory Mapped I/O instructions, Ports. Study of Peripheral chips: Features, Block Diagram, Control & Status Registers, Operating Modes, Interfacing & Programming of 8255 Programmable Peripheral Interface, 8257 Programmable DMA controller, 8254 Programmable Interval timer, Introduction to DAC0830 Digital to Analog Converters, ADC0804 Analog to Digital Converters, 8279 Keyboard and Display Controller, 8251/16550 (USART), and 8087 Co-processor. Various emerging trends in Microprocessor Design.

Recommended Books:

1. Introduction to 8086, 80186, 80286, 80386, 80486, Pentium and Pentium Pro Processors, B. Bray, Tata McGraw Hill Publishing Company.
2. Microprocessor Theory and Applications, M. Rafiq-u Zaman, McGraw Hill Publishing Company.
3. Microprocessor and x86 Programming, V. R. Vengopal, McGraw Hill Publishing Company.
4. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Application by W. A. Treibel and Avtar Singh, Prentice Hall.
5. Microprocessors and Interfacing Programming and Hardware, D. Hall, TMG.
6. Microprocessor 8086 Architecture, Programming and interfacing by Sunil Mathur. PHI Learning Pvt. Ltd.

Course No.: ELE-14304LC **Microprocessor and Control Lab**
Paper Type: Core **Credits: 0L + 0T + 6P**

Microprocessors

Addition/Subtraction of 8, 16 and 32 bit numbers. Multi-byte addition and subtraction Multiplication/Division of 8, 16 and 32 bit numbers. Addition of array of 8-bit and 16-bit numbers. Finding Maximum and minimum in an array of 8-bit and 16-bit numbers, to copy a block of data from one portion of memory to another (overlapping and non-overlapping). to find the largest signed number in a given series of data other array operations, multiplication by repetitive addition method, multiplication using MUL instruction, signed multiplication, BCD multiplication 16 bit by 8 bit division, division using DIV instruction, signed division, BCD division, hexadecimal to ASCII conversion and vice versa, ASCII to packed BCD conversion and vice versa, factorial of a given number using iteration and procedures, etc. **Interrupts and Interfacing:** Programming problems using interrupts, subroutines and stack, DOS Interrupts, Stepper motor interfacing with microprocessor, DC motor controller, Elevator simulator, Traffic light controller interfacing with microprocessor, ADC/DAC interfacing with microprocessor.

Control Systems

Design & realize a Op- amp based proportional controller, Integral controller, PD controller. I controller, PlD controller, Lead-lag compensation N/W. Write a Matlab program to find Pole, zero, residue & constant terms of a transfer function, find the transformation of transfer function to state space representation transfer a system representation in state space to transfer function representation, find Step response of a first order system Impulse response of first order system. Write a Matlab program to obtain impulse, step & ramp response of a second order system. Write a Matlab program to find rise time, peak time, maximum overshoot & settling time of second order systems. Write a Matlab program to find unit step response of second &higher order systems. Also express the transfer function in term of partial fractions. Write a Matlab program to plot root locus of second & higher order system & hence comment on stability. Write a Matlab program to plot root locus of a system defined in state space. Write a Matlab program to demonstrate effect of addition of poles & zeros to a transfer function.

Course No.: ELE-14305A **Data Communication and Networking**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

Unit-I: Data Communication

Introduction: Data communication and its components, Data representation and flow. Bit rate, Baud rate, and Bit length. Transmission modes (Serial and parallel) Categories of networks. Line coding and line coding schemes. Digital-to-digital conversion (ASK, FSK, PSK, QPSK), Analog-to-digital conversion (PCM, DM). Multiplexing and multiplexing techniques (FDM, WDM, and TDM). Transmission media Guided and unguided. Transmission impairments.

Unit–II: Networking and Networking Standards

Introduction to Computer Networks, Network Topologies: Bus, Star, Ring, Hybrid, Tree, Topology; Types of Networks: Local Area Networks, Metropolitan Area Networks, Wide Area Networks; Features of LANs, Components of LANs, Usage of LANs, LAN Standards, IEEE 802 standards, Channel Access Methods, Aloha, CSMA, CSMA/CD, Token Passing, Ethernet, Layer 2 & 3 switching, Fast Ethernet and Gigabit Ethernet, Token Ring.

Layering architecture of networks, OSI model, Functions of each layer, Services and Protocols of each layer. Introduction to LANs, TCP/IP, Layers of TCP/IP.

Unit-III: Networking Protocols

Internet Protocol, Transmission Control Protocol, User Datagram Protocol, IP Addressing, IP address classes, Subnet Addressing, Congestion and congestion control mechanism.

Internetworking Devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: Internet address, sub-netting; Routing techniques, static &. Dynamic routing, Routing table. Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IPV6 Unicast and multicast routing protocols.

Unit-IV: Practicals:

Identification of guided media (UTP, STP, Coaxial) Color coding. Configuration of different types of networks (linear, star and ring). IP addressing (static and dynamic). Sharing the resources in wired network (software and hardware). Configuring the Windows server (Active directory) and DHCP server. Configuring the Linux server. Configuring the wireless networks (Adhoc and infrastructure).Sharing of resources in wireless network.

Recommended Books:

1. Data Communications, Computer Networks and Open Systems (4th edition), Halsall Fred,
2. 2000, Addison Wesley, Low Price Edition.
3. Data Communications and Computer Networks 5E, Forozaun, McGraw Hill
4. Business Data Communications, Fitzgerald Jerry,
5. Computer Networks–A System Approach, Larry L. Peterson & Bruce S. Davie, 2nd Edition.
6. Computer Networks by Andew S. Tanenbaum 3rd Edition. Prentice Hall.
7. Computer Networking – ED Tittel, 2002, T.M.H.

Course No.: ELE-14306A: **Digital Signal Processing**
Paper type: Allied Elective **Credits: 3L+0T+2P**

Unit-I: Discrete Time Signals and Systems

Review of Signals and Discrete Time Systems, Properties of Systems, Difference Equations: FIR systems, IIR systems, Recursive Systems, Non- recursive Systems, Representation of LSI systems by Constant Coefficient Equations, Correlation: Cross- Correlation and Auto-Correlation, Properties, A/D Conversion Process: Sampling, Frequency Relationships, Aliasing, Quantization, Encoding, Anti Aliasing Filter. Fourier Series and Fourier Transform, Sampled data and discrete time convolution, Z transform and its Properties.

Unit –II: Discrete Fourier Transform (DFT)

Introduction, Frequency Domain Sampling, Properties of DFT, Linear Filtering Techniques based on DFT, Spectrum Analysis using DFT, Efficient Computation of DFT: FFT algorithms, Properties of *WN*, Radix- 2 FFT algorithms: Decimation in Time and Decimation in Frequency FFT algorithms.

Unit -III: Theory and Design of Digital Filters

Types of Digital Filters: Structure of FIR Systems, FIR Filter Design using Windows: Rectangular Windows for FIR Filter Design, Gibbs Phenomenon, Commonly used Windows functions (Examples), Design of Hilbert Transformers, FIR differentiators and Integrators, Brief introduction to IIR filter design

Unit- IV: Practicals using MATLAB

Introduction to digital signal processing toolbox (MATLAB). Commonly used DSP based commands in MATLAB, Computation of Correlation and convolution of various sequences using MATLAB. Optimal order FIR filter design in MATLAB. Performance analysis of various windowing techniques for a given set of specifications using MATLAB

Recommended Books:

1. Theory and Applications of Signal Processing, L. R. Rabiner and B. Gold, Prentice Hall 1985
2. Digital Signal Processing, A. V. Oppenheim and R. W. Shafer, Prentice Hall, 1985
3. Introduction to digital Signal Processing, J. G. Proakis and DG Manolakis, Prentice Hall
4. Introduction to Digital Signal Processing, Roman Kue, McGraw Hill Book Co.

Course No.: ELE-14307A **HDL and Digital System Design**
Paper type: Allied Elective **Credits: 3L+0T+2P**

UNIT I: Hardware Description Languages and VHDL
Hardware Description Languages: Introduction to VHDL, Design flow, Code structure: Library declarations, Entity and Architecture, Introduction to behavioural, dataflow and structural modeling. Data types: BIT, Standard logic, Boolean, Integer, real, Signed and Unsigned Data types, Arrays, Bit vector and Standard logic vectors, Operators and attributes: Assignment, Logical, Arithmetic, Relational and concatenation operators

UNIT II: Concurrent, Sequential Codes and State Machines
Concurrency, Concurrent verses Sequential codes, advantages of concurrent codes, concurrent and sequential statements: WHEN (simple and selected), GENERATE, PROCESS, IF, ELSIF, WAIT, CASE, LOOP, Signal versus Variable, Bad Clocking, Brief concepts of Finite State Machines,(Melay and Moore Machines), state diagrams and state tables.

UNIT III: Combinational and Sequential Circuit Design(Theory+Practical)
Elements combinational and sequential circuits, VHDL modeling combinational systems: Gates, Binary adders and Subtractors, Multiplexers, Demultiplexers, encoders, decoders,code converters, comparators, Boolean functions using Multiplexer. Shanons expansion theorm, VHDL Modelling of Sequential Circuits: Flip-Flops, Shift Registers, Counters UPDOWN, Johnson and Ring Counters.

UNIT IV: Practicals
Introduction to COMPONENTS and FUNCTIONS, Port Mapping, Digital system design: VHDL modeling of ALU, Pseudo random Number Generator, Sequence detector, Barrel shifter, Programmable Logic Array (PLA), Programmable Array Logic(PAL), Introduction to Complex Programmable Logic Devices (CPLD) and Field Programmable Logic Arrays(FPGA), Advantages of FPGAs, Application Specific integrated Circuits (ASIC), FPGA design flow.

Recommended Books:

1. Pedroni V. A., Circuit Design with VHDL, PHI, 2008.
2. J.Bhasker, VHDL Primer, Pearson Education, India.
3. Perry D. L., VHDL Programming by Example, TMH,2000.
4. Wakerly J. F., Digital Design – Principles and Practices, Pearson Education,2008.
5. Brown S. and Vranesic Z., Fundamentals of Digital Logic with VHDL Design, TMH.2008.

Course No.: ELE 14308A: Microcontrollers and Embedded Systems
Paper Type: Allied Elective Credits: 3L+0T+2P

UNIT-I: Embedded systems and processors

Introduction to embedded systems, Components of an embedded system, Types of embedded system, Levels of embedded system, Embedded System applications, embedded system design considerations, Embedded Processors: Microprocessors, Microcontrollers, DSP and ASICs, Comparative Assessment of Embedded Processors. Embedded memory devices and Embedded I/O. Embedded programming.

Microcontrollers: Microcontrollers for embedded systems, classes of microcontrollers, types of microcontrollers. Choosing a Microcontroller for an embedded application.

UNIT-II: 8051 Architecture

8051 Microcontroller hardware, internal Architecture, input/output pin and port architecture, bare minimum system with external circuits, other members of 8051.Addressing modes :accessing memory using various addressing mode, Jump, Loop and call instructions ,time delay generation and calculation, Single bit instructions and programming, I/O port programming.

UNIT-III: 8051 Timers, Counters, Serial Communication, Interrupts and Programming

Timer and counter architecture in 8051, programming 8051 timers, counter programming, pulse frequency and pulse width measurements. Serial communication in 8051: Basics of Serial communication, 8051 connection to RS232, 8051 serial communication programming. Interrupts programming: Interrupts of 8051, programming timer interrupts, programming external hardware interrupts, and programming serial communication interrupts.

Interfacing memory with 8051, Programmable peripheral interface (PPI)-8255, 8255 interfacing with 8051. Interfacing Key board, LCD, A/D & D/A converters, DC motor, Relay, solenoid, stepper motor ,servomotor with 8051.

UNIT-IV:Practicals

Programming using 8051 microcontroller kit, Interfacing of A/D converter and D/A converter modules with Microcontroller 8051,Interfacing of Alphanumeric LCD display and Matrix keyboard interface modules with Microcontroller 8051,Interfacing of Seven segment display and Stepper motor modules with Microcontroller 8051. Design and construction of a simple flash programmer for 89C51/89C2051 µC, Computer aided assembly language program development for 89C51/89C2051 using Keil micro vision environment, Use of assembler, linker and simulator for 89C51/89C2051. Microcontroller Interfacing and construction of the following modules, Alphanumeric LCD display- Matrix keyboard interface- Seven segment display- dc geared motor- Stepper motor- Infra red transmission and reception.

Recommended Books

1. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw Hill, Third Reprint, (2003).
2. John Catsoulis, O'Reilly, "Designing Embedded Hardware". Indian Reprint (2003).
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, The 8051 Microcontroller, and Embedded Systems, Prentice Hall 2000.
4. Kenneth J.Ayala., "The 8051 Microcontroller Architecture Programming and Applications", Penram International Publishing (India). 1996.

Course No.: ELE-14309A: **Bio-Medical Instrumentation**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

UNIT I: Electro-Physiology and Bio-Potential Recording
The origin of Biopotentials; biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, EOG, lead systems and recording methods, typical waveforms and signal characteristics.

UNIT II : Bio-Chemical And Non Electrical Parameter Measurement
PH, PO2, PCO2, PHCO3, Electrophoresis, colorimeter, photometer, Auto analyzer, Blood flow meter, cardiac output, hearing aids, respiratory measurement, oximeter, Blood pressure, temperature, pulse, Blood cell counters.

UNIT III: Assist Devices, Bio-Telemetry and Recent Trends
Cardiac pacemakers, DC Defibrillator, physiotherapy, diathermy, nerve stimulator, artificial kidney machine. Telemetry principles, frequency selection, Bio-telemetry, radio-pill and tele-stimulation. Medical imaging, X-rays, laser applications, ultrasound scanner, echo-cardiography, CT Scan MRI/NMR, cine angiogram, colour doppler systems, Holter monitoring, endoscopy.

UNIT IV: Practicals
Study of Electrocardiogram, Electroencephalogram, Electromyogram, Bio-chemical parameters, Oximeter, Blood pressure measurement machine, Hearing Aid, Assist devices, telemetry system. Study of Bio-medical Instruments.

Books Recommended

1. Leislie Cromwell, “Biomedical instrumentation and measurement”, Prentice Hall of India, New Delhi, 2002.
2. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, New Delhi, 1997.
3. Joseph J.Carr and John M.Brown, “Introduction to Biomedical equipment Technology”, John Wiley and Sons, New York, 1997.

Course No.: ELE-14310A **Soft Computing and Neural Networks**
Paper Type: Allied Elective **Credits: 3L+0T+2P**

Unit I: Overview of Crisp Sets, Fuzzy Sets and Relations

Basic Concepts of Crisp Sets and Fuzzy Sets, Basic Types of Fuzzy Sets, Sets, Representation of Fuzzy Sets, Fuzzy Relations, Operation on Fuzzy relations, Composition of Relations, Extension Principle for Fuzzy Sets, Concept and models of Fuzzy logic Circuits-viz. AND, OR and NOT.

Unit II: Fuzzy Logic and Rule based Systems

Overview of classical logic, Multi-valued logic, Fuzzy sets and probability theory, Probability vs. possibilities, Approximate reasoning, Fuzzy rule based Systems: Structure of Fuzzy rules, decomposition of compound rules, aggregation of fuzzy rules, Graphical techniques of inferences, Types of fuzzy rule based models.

Unit III:

Introduction to Neural Networks

Biological and Artificial Neurones, Neuron Models: Classification and Linear Separability, X-OR Problem, Hopfield Networks, Overview of Neural Networks Architectures: Mulyilayered Feed forward and Recurrent Networks, Learning: Supervised, Unsupervised and Reinforcement, Learning Laws. Back-propagation (BP) Networks, Generalized delta rule, BP Training Algorithm and Derivation for Adaptation of Weights, Applications of BP Networks.

Unit IV: Practicals

Write a program to:

Implement and function using Adaline with bipolar inputs andoutputs; to implement and function using Madaline with bipolar inputs andoutputs; implement art 1 network for clustering input vectors with vigilance parameter; implement composition of fuzzy and crisp relations; perform max-min composition of two matrices obtained fromCartesian product; verify the various laws associated with fuzzy set.

Write a Matlab program to:

Implement discrete Hopfield network and test for input pattern; implement back propagation network for agiven input pattern; implement full counter propagation network for agiven input pattern; implement fuzzy set operation and properties.

Text Books:

1. Fuzzy Sets and Fuzzy Logic: Theory and Applications, G. Klir abd B. Yuan, Printice Hall of India
2. Neural Networks and Fuzzy systems,: A Dynamical System Approach to Machine Intelligence, Printice Hall of India
3. Neura;l Networks in Computer Intellligence, Limin Fu, Mcgraw Hill International
4. Adaptive Recognition and Neural Networks, Yoh-Han Pao, Addison Weseley
5. Introduction to the Theory of Neural Computations, John Hertz, Anders Krogh and Richard G. Palmer, Addison Wesley.

Course No.: ELE-14311A **Advanced Communication Systems**
Paper type: Allied Elective **Credits: 3L+0T+2P**

Unit-I Modern Radar System

Fundamentals of Surveillance Radar and Design : Bandwidth considerations, prf, Un-ambiguious range and velocity, Pulse length and Sampling, Radar Cross-section and Clutter. Tracking Radar Tracking and Search Radars, Antenna beam shapes required, Radar guidance, Frequency agility, Importance of Mono pulse Radar.

Unit-II Telecommunication Switching Techniques

Time division switching: Time switching, space switching, Three stage combination switching, n-stage combination switching; Traffic engineering: Hybrid switching, Two/Four wire transmission, Erlang formula and signaling

Unit-III Satellite Communication

Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design Of Down Links, Domestic Satellite Systems Using Small Earth Stations, Uplink Design, Design Of Satellite Link For Specified (C/N). Multiple Access Techniques, Frequency Division Multiple Access (FDMA), TDMA, CDMA, Estimating Channel Requirements, Practical Demand Access Systems, Random Access, Multiple Access With On Board Processing. VSAT.

Unit- IV Practicals

To develop a simple switching model using Matlab, to study various multiplexing techniques used telecommunication networking, to study stored program based space division switch, to under fading in satellite communication using wireless communication link, to verify radar equation in Matlab

References:

1. J.G. Proakis, “Digital Communication”, MGH 4TH edition.
2. Edward. A. Lee and David. G. Messerschmitt, “Digital Communication”, Allied Publishers (second edition).
3. J Marvin.K.Simon, Sami. M. Hinedi and William. C. Lindsey, “Digital Communication Techniques”, PHI.
4. William Feller, “An introduction to Probability Theory and its applications”,Wiley.
5. Sheldon.M.Ross, “Introduction to Probability Models”, Academic Press, 7th edition.

Course No.: ELE-14312A **Fundamentals of RF Design**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

UNIT I: Introduction, Active RF Component and Modelling
Importance of RF Design, RF Behaviour of Passive Components, Chip Components and Circuit Board Considerations, General Transmission Line Equation, Micro Strip Transmission Lines, **Single and Multi Port Networks:** Interconnecting Networks, Network Property and Application, Scattering Parameters.

Semiconductor Basics, RF Diode, Bipolar Junction Transistor, RF Field Effect Transistors, High Electron Mobility Transistor, Diode Models, Transistor Models

UNIT II: RF Transistor Amplifier & RF Filter
Characteristics of Amplifiers, Amplifiers Power Relation, Stability Considerations, Constant Gain, Noise Figure Circles, Constant VSWR Circles, Broad Band, High Power and Multistage Amplifiers

Overview of RF Filter design, Matching and Biasing Networks. Basic blocks in RF systems and their VLSI implementation, Low noise, Amplifier design in various technologies,

Power Amplifier design, Design issues in integrated RF filters.

UNIT III: RF Oscillators and Mixers
Basic Oscillator Model, High Frequency Oscillator Configuration, Basic Characteristics of Mixers. Design of Mixers at GHz frequency range, various mixers- working and implementation. Oscillators- Basic topologies VCO and definition of phase noise, Noise power and trade off. Resonator VCO. designs, Radio frequency Synthesizers- PLL, Various RF Synthesizer architectures and frequency dividers

UNIT IV: Practicals:
Simulated Design of RF: Low Noise Amplifier (LNA), Filter, Oscillator, Frequency Synthesizer, Power Amplifier, Mixer, PLL, Frequency Divider, VCO

Books Recommended

1. *Reinhold Ludwig, Pavel Bretchko,"RF Circuit Design",1st Indian Reprint,2001,Pearson Education Asia*
2. *B Razavi,"Design Of Analog CMOS Integrated Circuit",Mc Graw Hill,2000.*
3. *R. Jacob Baker, H.W. Li, D.E. Boyce " CMOS Circiut Design, layout and Simulation" PHI 1998*
4. *Y.P. Tsividis "Mixed Analog and Digital Devices and Technology" TMH 1996*
5. *Thomas H. Lee "Design of CMOS RF Integrated Circuits" Cambridge University Press 1998.*

Course No.: ELE- 14313A **Speech and Audio Processing**
Paper Type: Allied Elective **Credits: 3L+0T+2P**

UNIT-I: Fundamentals of Speech

The human speech production mechanism, LTI model for speech production, nature of the speech signal, linear time varying model, types of speech, voiced and unvoiced decision making, audio file formats: nature of WAV file, parameters of speech, spectral parameters of speech

UNIT-II: Linear prediction of speech and Quantization

Lattice structure realization, forward linear prediction, auto correlation covariance method, uniform and non-uniform quantization of speech, waveform coding of speech,the .726 standarad for ADPCM, parametric speech coding technique, RELP based vocoder, Transform domain coding of speech, sub-band coding of speech

UNIT-III: Speech Synthesis

History of text- to- speech system, synthesizer technologies, HMM based speech synthesis, sine wave synthesis, speech transformation, emotion recognition from speech, watermarking for authentication of a speech/ Music signal, digital watermarking, watermarking in capestral domain

UNIT-IV: Practicals using Matlab

To simulate speech processing model using Matlab, Speech recognition systems implementation Acoustic analysis, linear time warping, dynamic time warping (DTW), Statistical Sequence Recognition for ASR: Bayes rule, Hidden Morkov Model (HMM), VQ- HMM based speech recognition. Speech watermarking using Discrete cosine Transform (DCT), Discrete Wavelet Transform

References:

1: Speech and Audio Processing, Dr. Shaila D. Apte, Wiley Publications

2: Digital Signal Processing, Dr. Shaila D. Apte, Wiley Publications

3: Theory and Applications of Signal Processing, L. R. Rabiner and B. Gold, Prentice Hall 1985

4: Digital Signal Processing, A. V. Oppenheim and R. W. Shafer, Prentice Hall, 1985

5: Introduction to Digital Signal Processing, J. G. Proakis and DG Manolakis, Prentice Hall

Course No.: ELE-14314A **Digital CMOS IC Design**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

UNIT-I: Digital ICs and their Implementation Strategies
Digital IC, issue in digital IC design, Quality, metrics of Digital Design. Review of CMOS. Custom, Semi custom Circuit Design, Cell–Based Design Methodology, Array Based implementation Approach. Introduction to Digital Circuit Layout

UNIT-II: Digital Combinational and Sequential Circuit Design
Static CMOS Inverter and its characteristics, CMOS Design consideration Transistor Sizing, Power Dissipation, Design Margining, Ratioed Logic, Pass Transistor Logic, Dynamic CMOS design, basic principle, speed and power Dissipation of Dynamic Logic, Signal Integrity in Dynamic Design, Cascaded Dynamic. Introduction, Static Latches and registrars, Dynamic Latches and Registers, Alternative Register Styles, Pipelining.

UNIT-III: Memory Design and Programmable logic devices
Memory Classification, Memory Architecture and Building Block, Read only Memories, Nonvolatile Read Write Memories, Read-Write Memories, Memory Peripheral Circuits. Introduction to Programmable logic devices: PLA, PAL, PLD/CPLD, FPGA, ASIC, their applications and Architecture

UNIT-IV: Practicals:
Designing Static and Dynamic Combinational/Sequential Logic Circuits in CMOS; Designing Static and Dynamic Memory in CMOS; Designing Programmable logic devices in CMOS.

Books Recommended

1. J.M. Rabaey, A. Chandrakasan and B. Nikolic: Digital Integrated Circuits- A Design Perspective, 2nd ed., PHI, 2003.
2. D.A. Pucknell and K. Eshraghian, Basic VLSI Design, PHI, 1995.
3. E.D. Fabricius, Introduction to VLSI Design, McGraw Hill, 1991.
4. N.H.E. Weste and K. Eshraghian, Principles of CMOS VLSI Design - a System Perspective, 2nd ed., Pearson Education Asia, 2002.
5. S.M. Kang and Y. Leblevici, CMOS Digital Integrated Circuits Analysis and Design, 3rd ed., McGraw Hill, 2003.
6. J. P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley & Sons (Asia) Pte Ltd, 2002.
7. W. Wolf, Modern VLSI Design - System on Chip design, 3rd ed., Pearson Education, 2004.
8. R. Jacob Baker, CMOS Circuit Design, Layout, and Simulation, IEEE Press, 1997.

Course No.: ELE-14315O **Basic Electronic Science and Applications**
Paper Type: Allied Elective **Credits: 1L + 0T + 2P**

UNIT-I Theatrical Foundation
The fundamental concepts of electricity and electronics that involve Direct Current (DC), Alternating Current (AC); Series and parallel resistive and capacitive circuits; magnetism; inductance; capacitance; transformers and motors; Transformer winding.

Electronic components (Resistor, Capacitor and Inductors), and various types of test equipment found in industry;

Semiconductor devices like Diodes and Binary Junction Transistors (BJT); Rectifiers and Filters, identification of Regulator ICs, 5 to 15 V regulated DC Power supplies, Transistor biasing and amplifier circuits.

Basic Logic Gates and Boolean Algebra. Binary numbers. Introduction to ICs (linear and digital). Identification of parts of a digital computer.

UNIT-II Practicals
Experimental work on the basic electronic circuits and systems as listed in Unit-I
Implementation of few Electronic Hobby circuits.

Books Recommended:

1. Electronic Devices and Circuit Theory. By: Robert Boylestad & Louis Nashelsky. Prentice Hall.
2. Microelectronics. By: Milliman and Grabel, McGraw Hill Company
3. Electricity Principles and Applications by Richard Fowler
4. Modern Digital Electronics. By: R P Jain. Tata McGraw-Hill Education

Course No.: ELE-14401C **Digital Communication and Information Theory**
Paper Type: Core **Credit: 4L+0T+0P**

UNIT I: Information Theory

Introduction to Information Theory, Measure of information, Information content of Messages, Information sources, Markoff Model for Information sources, Information Content of a Discreate Memoryless Channel ,Entropy and Information rate of Markoff sources, Joint Entropy and Conditional Entropy,Mutual Information, Discrete Communication Channels, Channel representation and Channel Matrix, Mutual information for each channel, Channel Capacity, Shannon's Theorem, Shannon- Hartley Theorem, Bandwidth S/N Trade–off, Source Encoding, Coding Efficiency, Shannon- Fano Coding, Huffman Coding,.

UNIT II: Pulse Code Modulation

Sampling Theorem, Signal Reconstruction: The Interpolation Formula, Elements of Pulse Code Modulation (PCM), Quantization: Uniform and Non-uniform Quantization, Compading Characteristics, Encoding, Bandwidth and Noise in PCM Systems, Differential PCM, Delta modulation and Adaptive DM,

UNIT III: Band Pass Digital Carrier Modulation and Channel Coding

Digital modulation techniques: Generation and Detection of Amplitude Shift Keying (ASK), frequency Shift keying (FSK), Phase Shift Keying, and Differential Phase Shift Keying (PSK and DPSK), base band receiver Optimum Filter, Correlator, Probability of Error in each Scheme,. Error Control Coding: Linear Block codes, (7, 4) Linear Block Coding, matrix representation of linear block codes, Cyclic Codes, polynomial representation (examples)

UNIT IV: Wide Band Digital Communications

Basics of Wide band Systems, Generation of Spreading Codes (PN Codes, Gold Codes), Properties of PN codes, Theory of Spread Spectrum Modulation, Model of Spread Spectrum Digital Communication System, Direct-Sequence Spread Spectrum (DSSS): Processing Gain, Performance and Generation and Detection, Frequency Hopping Spread-Spectrum (FHSS): Generation and Detection, Types, Introduction to Digital Cellular Communication Systems: Architecture of GSM

Text Books and References:

1. Digital Communication By Simon Hykin.
2. Digital and Analog Communication by K. Shan Mugam.
3. Digital and Analog Communication by Tomasi.
4. Digital and Analog Communication Systems by Leon W. Couch, II.Pearsons Education
5. Digital Communications By Bernard Sklar, Pearsons Education.
6. Digital Communications By John G. Proakis McGraw- Hill International Editions.
7. Wideband Wireless Digital Communications by Andreas F. Molisch, Pearsons Education.
8. Information Theory Coding and Cryptography by Ranjan Bose, TMH.

Course No. ELE-14402C **VLSI Technology**
Paper Type: Core **Credits: 3L+0T+0P**

Unit I: Crystal Growth, Epitaxy and Diffusion:

Crystal Growth and Wafer Preparation, Electronic grade Germanium and Silicon, Zone melting process of purification, Simple purification process, Czhrolaski method. Epitaxy, Vapor phase epitaxy, Transport process and Reaction kinetics, Molecular beam Epitaxy process *(introduction).*
Fick's one dimensional diffusion equation, Diffused layers, Pre deposition step, Drive-in diffusion with expression, Field aided diffusion, Diffusion system, C-V technique for profile measurement, Junction depth and sheet resistance measurement.

Unit II: Oxidation and Lithography:
Oxidation Techniques, Growth mechanism and Kinetics of Oxidation layers, Oxidation techniques and Systems. Lithography, Lithography process and Types of Lithography, Optical Lithography, Contact proximity and projection Lithography techniques, Resists, Electron beam Lithography, Electron Resists.

Unit III: Etching, Metallization and IC Fabrication
Etching, Subtractive and Additive method of pattern transfer, Resolution and edge profiles in Subtractive pattern transfer, Selectivity and feature size control of an etching process. Contacts *(Ohmic and rectifying)*, Physical vapor deposition, Methods of physical vapor deposition, Resistance heated evaporation, Electron beam evaporation, Thickness measurement and monitoring. Basic consideration for IC processing and Packaging, Modern IC fabrication.

Text Books and References:
1. Physics of Semiconductor Devices, S. M. Sze, , Wiley eastern Ltd.
2. Electronic Processes in Semiconductors, Azeroff and Brophy, , McGraw Hill Publishing company.
3. Physics and Technology of Semiconductor Devices A. S. Grove, , John Wiley and Sons, New York.
4. Solid State Electronic Devices Ben G. Streetman, , Prentice Hall of India Ltd, N. Delhi.
5. S. M. Sze, VLSI Technology, Mcgraw Hill Publishing Company.

Course No.: ELE-14403C **Industrial Organization and Technopreneurship Development**

Paper Type: Core **Credits: 2L+0T+0P**

Unit-I Technology Innovation and Technopreneurship Development

Technology innovation and invention, Intellectual Property Rights (IPR), Patents & Designs, Drafting of a Patent application, Concept and role of Technology based entrepreneurship (Technopreneurship).

Unit-II Principles of management and Human & Industrial relations:

Management, different functions of management, planning, organization, co-ordination and control. Structure of an industrial organization, Functions of Different Departments.

Human relations and performance in organization, Understanding self and others for effective behavior, Behavior modification techniques, Relations with subordinates, peers and superiors.

Unit-III Professional ethics and Entrepreneurship Development:

Concept of Ethics, need for professional ethics, code of professional ethics, Typical Problems of Professional Engineers.

Concept of Entrepreneurship, Need of Entrepreneurship, Characteristics of an Entrepreneur, Meaning and importance of small scale industry, steps for planning a small scale industry. Consideration for product identification and selection, project report preparation, management of small scale industry.

Course No.: ELE-14406A **CMOS Circuit Design: Analog and Mixed**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

Unit I: MOSFET Operation and analog CMOS Sub-circuits

Overview of MOSFET: Regions of operation, Threshold Voltage and Body Effect, Floating Gate and Bulk MOSFETs, I-V Characteristics of MOSFETs, Long-Channel and Short Channel Modeling of MOSFETs, A brief introduction to Design layout. MOS Switch; MOS Diode/Active Resistor; Current Sinks and Sources; Current Mirrors; Current and Voltage References; Amplifier, Differential Amplifier; Comparator;

Unit II: Translinear Circuits, Analog Multipliers and Mixers

Translinear Circuits: Ideal Translinear Element, Translinear Signal representations, Translinear Principle, Translinear-loop-circuit synthesis, Various Translinear circuits, Squarer/divider, Squarer rooting. The Gilbert Cell; Analog Multipliers: Multiplier Design Using Squaring Circuits, The Multiplying Quad, Simulating the Operation of the Multiplier; Mixing, Modulation and Frequency Translation: Single-Device Mixers, MOSFET Mixers, Fully Balanced (Quad) Mixer; Modulators; AM Demodulation using Analog Multipliers; FM Demodulators using Multipliers.

Unit III: Data Converters

Analog Versus Discrete Time Signals; Converting Analog Signals to Digital Signals; Sample-and-Hold (S/H) Characteristics; Digital-to-Analog Converter (DAC) and Analog-to-Digital Converter (ADC) Specifications; DAC Architectures: R-2R Ladder Network DAC, Cyclic DAC; Pipeline DAC; ADC Architectures: Flash ADC; Two-Step Flash ADC, Pipeline ADC, Integrating ADC, The Successive Approximation ADC; Oversampled converters; First-Order ΣΔ Modulator; Higher Order ΣΔ Modulators;

Unit IV: Practicals

Introduction to PSPICE Orcad, Generating a Netlist File, PSPICE Schematics, Circuit description, DC circuit analysis, Transient analysis, AC circuit analysis, PSPICE Simulation Examples on: MOSFET effects and Characteristics, MOS Switch; MOS Diode/Active Resistor; Current Sinks and Sources; Current Mirrors; Current and Voltage References; Amplifier, Differential Amplifier; Comparator, Translinear Circuits, Gilbert Cell; Analog Multipliers, ADC, DAC and Oversampled converters

Books Recommended

1. *Analysis and Design of analog integrated circuits, P. R. Gray, P. J. Hurst, S. H. Lewis and R. J. Meyer, John Wiley and Sons, 2001.*
2. *CMOS, Circuit Design, Layout, and Simulation, R. Jacob Baker, JOHN WILEY & SONS, 2010.*
3. *CMOS analog circuit design, P. E. Allen and D. R. Holberg, Oxford University Press, 2002.*
4. *Analog VLSI: Circuits and Principles, Shih-Chii Liu et al, The MIT Press, 2002.*

Course No.: ELE-14407A **Information Security**
Paper type: Allied Elective **Credits: 3L+0T+2P**

Unit 1: Information security

Need for information security, Active and passive attacks, Introduction to Cryptography, Transposition and substitution ciphers, One time pad, Stream and Block ciphers, Cryptanalysis. Cryptanalysis of classical ciphers. Introduction to modular arithmetic.

Unit II: Cryptographic Algorithms

Data scrambling and descrambling, Introduction to Data encryption standard, Security of DES, Differential and linear cryptanalysis, Advanced Encryption standard (AES), Private and public keys. Need of Pseudorandom Code Generators in Cryptographic algorithms. PN sequence generator, Geffe generator, Stop and Go generator

Unit III: Information Hiding for covert communications

Need of information hiding, Hiding versus Encryption, Requirements of a Data Hiding System, Hiding Capacity, Robustness and Imperceptibility, Steganography and watermarking. Hiding in Spatial and Frequency domains. Advantages and disadvantages of spatial and frequency domain embedding. LSB based embedding algorithm for data hiding.

Unit IV: Practicals using MATLAB

Introduction to image processing toolbox. Frequently used commands for image manipulation (IMSHOW, IMREAD, IMWRITE, RAND, RANDN, RANDPERM etc.), Image encryption using MATLAB. Implementation of LSB and ISB algorithms, Frequency domain data hiding in MATLAB.

Recommended books:

1. W. Stallings, "Cryptography and Network Security: Principles and Practice", Prentice-Hall, New Jersey, 1999.
2. B. Schneier, “Applied Cryptography", John Willey & Sons, Inc., 2nd edition, 1996.

3. Lu, S.: Multimedia security: Stegnography and digital watermarking techniques for protection of intellectual property, Idea Group Publishing, USA. (2005).

Course No.: ELE-14408A: **Nanotechnology**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

Unit–I: Nanotechnology and Nano-electronics

Introduction to Nanotechnology: size–dependant physical properties, Melting point, solid state phase transformations, excitons, band-gap variations-quantum confinement, effect of strain on band-gap in epitaxial quantum dots. The p-n junction and the bipolar transistor; metal semiconductor and metal-insulator, Semiconductor junctions; field-effect transistors, MOSFETs,

Unit-II: CMOS Heterostructures and SET

CMOS: heterostructures, high-electron-mobility devices, HEMTs, Quantum Hall effect, Resonant Tunnel Diodes. Introduction to single electron transistors (SETs): quantum dots, single electron effects, Coulomb blockade.

Unit-III: Semiconductor Nanoparticles and Nanowires

Semiconductor nanoparticles – applications, Optical luminescence and fluorescence from direct band gap semiconductor nanoparticles, surface-trap passivation in core-shell nanoparticles, carrier injection, polymer-nanoparticle, LED and solar cells, electroluminescence, barriers to nanoparticle lasers, doping nanoparticles, Mn-Zn-Se phosphors, light emission from indirect semiconductors, light emission form Si nanodots.

Semiconductor nanowires, Fabrication strategies, quantum conductance effects in semiconductor nanowires.

Unit-IV: Practicals

Study of Methods to create and Nanofeatures; designing Nano-Devices in Simulation; study of performance change with material change; Process and Device Simulation of Single-Electron Transistor (SET); SOI based nanowire single-electron transistor - Design, simulation and process development; Simulation study of nanowire TFET device; Process design and development of 30 nm CMOS inverter; Characterization and analysis Double gate SOI MOSFET for nano electronic circuits; Process and device simulation of Silicon Nanowire FinFET device.

Books Recommended:

1. Encyclopedia of Nanotechnology- Hari Singh Nalwa
2. Springer Handbook of Nanotechnology - Bharat Bhusan
3. Handbook of Semiconductor Nanostructures and Nanodevices Vol 1-5- A. A. Balandin, K. L. Wang.
4. Nanostructures and Nanomaterials - Synthesis, Properties and Applications - Cao, Guozhong.

Course No.: ELE- 14409A **Mobile Communication**
Paper type: Allied Elective **Credits: 3L+0T+2P**

Unit-I Introduction to Cellular Mobile Systems:

A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, analog & digital cellular systems. Elements of Cellular Radio Systems Design: General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems. Interference: Introduction to co-channel interference, real time co-channel interference co-channel measurement design of antenna system, antenna parameter and their effects, diversity receiver in co-channel interference – different types.

Unit-II Cell Coverage for Signal & Traffic:

General introduction, obtaining the mobile point to point mode, Radio propagation characteristics: models for path loss, shadowing and multipath fading, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation.

Unit-III Cell Site Antennas and Mobile Antennas:

Characteristics of antennas, antenna at cell site, mobile antennas Frequency Management, Channel Assignment and hand off: Frequency management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment, Why hand off, types of handoff and their characteristics, handoff analysis, dropped call rates & their evaluation.

Unit-IV Practicals

To study Multiple access techniques used in mobile wireless communications: FDMA/TDMA, CDMA. FDM/TDM Cellular systems, to study architecture of Global System for Mobile Communication (GSM) system overview: Mobility management, Network signaling , Hands on practice on GSM and CDMA using training systems

Books Recommended:

1. Wireless Communication; Principles and Practice; T.S.Rappaport
2. Principles of Mobile Communication, G.LStuber Kluwer Academic, 1996.
3. Wireless and Digital Communications; Dr. Kamilo Feher (PHI)
4. Mobile Communication Hand Book; 2nd Ed.; IEEE Press
5. Mobile Communication Engineering – Theory & Applications; TMH

Course No.: ELE-14410A **Advanced Microprocessors**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

Unit 1: Intel 8086, 80186 and 80286 Processors

Architecture and working of 8086 and 80186 Microprocessor, Register set of 8086 and 80186 Microprocessor, Addressing Modes and memory segmentation in 8086 and 80186 microprocessor, Differences between 8086 and 80186 microprocessors. Intel 80286 Microprocessor, 80286 Architecture, system connection – Real and Protected mode operations.

Unit 1I: Intel 80386 and 80486 Processors

Intel 80386 Microprocessor, 80386 Architecture and system connection – Real operating mode – 386 protected mode operation – segmentation and virtual memory – segment privilege levels and protection – call gates – I/O privilege levels – Interrupts and exception handling – task switching – paging mode – 80386 virtual 86 mode operation.80486 – Processor model – Reduced Instruction cycle – five stage instruction pipe line – Integrated coprocessor – On board cache – Burst Bus mode.

Unit 1II: Advanced and Special Purpose Processors

Pentium – super scalar architecture – u-v pipe line – branch prediction logic – cache structure – BIST (built in self-test) – Introduction to MMX technology. Difference between CISC and RISC processors, various emerging trends in Microprocessor Design. Architecture, addressing and programming of Digital Signal processors.

Unit IV: Practicals

Instruction sets of Intel Processors, Programming exercises for 16, 32 and 64 bit data processing, Use of Macros and Procedures, IVT and ISR, DSP programming for Image Processing such as Image Compression, Image restoration, image Enhancement.

Recommended Books:

1. Introduction to 8086, 80186,80286, 80386, 80486, Pentium and Pentium Pro Processors, B. Bray, Tata McGraw Hill Publishing Company
2. Advanced Microprocessors by Daniel Tabak McGraw-Hill.
3. Advanced Microprocessors by A. P. Godse, D. A. Godse Technical Publications.
4. Advanced Microprocessors and Peripherals by K. M. Burchandi, A. K. Ray Tata McGraw Hill Education
5. Advanced Microprocessors by Y. Rajasree, New Age International.

Course No.: ELE-14411A **Analytical Instrumentation**
Paper Type: Allied Elective **Credits: 3L + 0T + 2P**

Unit-I: Instrumental Methods

Introduction: Introduction to chemical analysis, Classical and Instrumental methods, Classification of Instrumental techniques, important considerations in evaluating an instrumental method; Absorption methods: Spectrometric UV and VIS methods: Laws of photometry, Instrumentation. IR spectrometry: correlation of IR spectra with molecular structure, Instrumentation. Atomic absorption spectrometry: Principle, Instrumentation

Emission methods: Flame, AC/DC arc, spark, plasma excitation sources, instrumentation

Unit-II: Spectrometry and Chromatography

Spectrofluroscence and phosphorescence spectrometer: Instrumentation, Raman spectrometer.

Mass spectrometer: Ionisation methods, mass analysers, mass detectors, FTMS.

Chromatography: Classification, Gas chromatography, Liquid chromatography, Instrumentation

Unit-III: Diffractometry, Electron microscopy, spectroscopy and Electroanalytical methods

X-ray and Nuclear methods: x-ray absorption, fluorescence and diffractometric techniques, and microprobe, ESCA and Auger techniques, nuclear radiation detectors.

NMR spectroscopy: Principle, chemical shift, spin-spin coupling, instrumentation, types of NMR. Electroanalytical methods: potentiometry, voltammetry, coulometry techniques.

Unit-IV: Practicals

Study of: Recorders, Flame Photometer, Spectro-Photometer, Liquid Analyser, Gas Analyser, Dissolved Oxygen Analyser, Gas chromatograph, Scanning Electron Microscope (SEM), X-ray Diffractometer.

Books Recommended

1. Willard, Merritt, Dean and Settle, *Instrumental Methods of Analysis*, 7th edition, (CBS publishers, New Delhi).
2. Galen W. Ewing, *Instrumental Methods of Chemical Analysis*, 5th edition, (McGraw-Hill Book Company)

Course No.: ELE-14412A **Digital Image Processing**
Paper type: Allied Elective **Credits: 3L+0T+2P**

Unit I: Digital Image Fundamentals

Digital image fundamentals: representation - elements of visual perception - simple image formation model - Image sampling and quantization - basic relationships between pixels – imaging geometry. Review of matrix theory results: Row and column ordering. Various Pixel manipulation operations using MATLAB. Review of Image transforms: 2D-DFT, FFT

Unit II: Image Enhancement and Restoration

Image enhancement: Spatial domain methods: point processing - intensity transformations, histogram processing, image subtraction, image averaging; Spatial filtering- smoothing filters, sharpening filters. Frequency domain methods: low pass filtering, high pass filtering, Image restoration: Degradation model - Diagonalization of circulant and Block circulant matrices - Algebraic approaches - Inverse filtering - Wiener filter - Constrained Least squares restoration - Interactive restoration - Geometric transformations..

Unit III: Image Compression

Image compression: fundamentals- redundancy: coding, inter pixel, psychovisual, fidelity criteria, Models, Elements of information theory, Error free compression- variable length, bit plane, lossless predictive, Lossy compression- lossy predictive, transform coding. Fundamentals of JPEG and MPEG. Image Compression using MATLAB

Unit IV: Practicals

Introduction to Image processing Toolbox. Frequently used commands in image processing. Image filtering and restoration using MATLAB. Image compression using MATLAB.

Books Recommended

1. Gonzalez and Woods, “Digital Image Processing”, 2 Ed, Pearson Education, 2002.
2. Anil K. Jain “Fundamentals of Digital Image Processing”, Pearson Education, 2003.
3. Mark Nelson, Jean-Loup Gailly “The Data compression Book” 2 Ed, bpb Publications.
4. Pratt William K.,”Digital Image Processing”, John Wiley & sons
5. Chanda & Majumdar, “Digital Image Processing and Analysis” , PHI.
6. M.Sonka,V. Hlavac, R. Boyle, “Image Processing, Analysis and Machine Vision”, Vikas Publishing House

Course No.: ELE-14413A **Parallel Computation and Architecture**
Paper Type: Allied Elective **Credits: 4L + 0T + 0P**

Unit I:
Introduction: scope and issues of parallel computing, taxonomy of Parallel Architectures, Control Mechanism, Address-space Organization, Interconnection Networks, Processors Granularity, SIMD Architecture: Overview of SIMD Architecture. Design and Performance Issues, MIMD Architecture: Shared Memory Architecture, Uniform and Non-uniform Memory Access Multi Processors, Parallel Vector Processors (PVP), Symmetric Multiple Processors (SMP), CC-NUMA, NUMA and COMA Architectures, Distributed Memory Architecture: Cluster Architecture -Design and other Issues MPP Architecture

Unit II:
Basics of Interconnection Networks: Interconnection Environments, Network Components, Network Characteristics, Network Performance Metrics, Network Topologies and Properties: Topologies and Functional Properties, Routing Schemes and Functions, Networking Topologies, Buses, Crossbar and Multistage Switches: Multiprocessor Buses, Crossbar Switches, Multistage Interconnection Networks, Comparison of Switched Networks, Gigabit Network Technologies: Fiber Channel and FDDI Rings, Fast Ethernet and Gigabit Ethernet, Myrinet for SAN/LAN Construction

Unit III:
Paradigms and Programmability: Algorithmic Paradigms, Programmability issues Parallel Programming Examples, Parallel Programming Models: Implicit Parallelism, Explicit Parallel Models, Other Parallel, Programming Models, Shared Memory Programming: The POSIX Threads (Pthreads) Model, The Open MP Standard, Message-Passing Programming: The Message Passing Paradigm, Message Passing Interface (MPI), Parallel Virtual Machine (PVM), Data Parallel Programming: The Data Parallel Model, The Fortran 90 Approach, Ottler Data Parallel Approaches

Unit IV:
Performance Metrics for Parallel Systems: Run Time, Speedup, Efficiency Cost, Scalability and Speedup Analysis: Amdahl's Law: Fixed Problem Size, Gustafson's Law: Fixed Time, Sun and Ni's Law: Memory Bounding, ISO performance Models, Sources of Parallel Overheads: Inter-processor Communication, Load Imbalance Extra Computation, System and Application Benchmarks: Micro Benchmarks, Parallel Computing Benchmarks. Business and TPC Benchmarks, SPEC Benchmark Family.

Recommended Books:

1. Kai Hwang and Zhiwei Xu, "Scalable Parallel Computing", 1997, McGraw Hill New York.
2. Vipin Kumar, Ananth Grama, Anshul Gupta, George Karypis, "Introduction to Parallel Computing, Design and Analysis of Algorithms", 1994, Redwood City, CA, Benjmann/ Cummings.
3. Barry Wilkinson and Michael Allen, "Parallel Programming", 1999, Pearson Education Asia.
4. AI Geist, Adam Beguelin, Jack Dongarra, Weicheng Jiang, Robert Manchek and Vaidy Sunderam,
5. "PVM: Parallel Virtual Machine -A Users' Guide and Tutorial for Networked Parallel Computing", 1994, MIT Press.
6. Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, Dror Maydan, and Jeff McDonald, "Parallel Programming in OpenMP", 2000, Morgan Kaufmann.

Course No.: ELE-14414A **Multimedia Systems**
Paper type: Allied Elective **Credits: 3L+0T+2P**

Unit I: Introduction to Multimedia Systems and Processing

Introduction to multimedia systems, Multimedia signals, various sources of multimedia signals, Motivation for growth of multimedia theory, different elements of multimedia communication system, Challenges involved with multimedia signal processing and communication

Unit II: Lossless Image Compression

Redundant information in images. Lossless and lossy image compression. Elements of an image compression system, Huffman coding. Limitations of Huffman coding. Arithmetic coding(Basic principal). Encoding and Decoding procedure of a n arithmetic coded bitstream. Coding limitations of arithmetic coding. Introduction to Lempel-Ziv and Run length coding

Unit III: Lossy Image Compression

Theory of Quantization, uniform and non-uniform quantization, scalar and vector quantization. Lloyd-Max quantizer. Rate-distortion function,Lossy predictive coding. Pixel encoding using Delta modulation, source coding theorem.

Unit IV: Multi-resolution Analysis: Theory of Sub band Coding

Subband coding and decoding of one-dimensional signals. Analysis and synthesis filters. Down-sampling and upsampling. Subband coding for a two-dimensional four-band filter bank. Introduction to Discrete Wavelet Transforms (DWT) and its inverse. Calculation of DWT and inverse DWT through subband coding and decoding. DWT-based still image compression and coding system. Introduction to embedded wavelet coding.

Recommended Books:

1. Shuman and Thomson, Introduction to Multimedia, Tata Mcgrah Hill 2007.
2. Gonzalez and Woods, "Digital Image Processing", 2 Ed, Pearson Education, 2002.
3. N. J. Fliege, Multirate Digital Signal Processing: Multirate Systems - Filter Banks – Wavelets, Wiely publishers ,1999