M. Sc. Electronics 1st Semester

Electronic Devices (EL-101)

Course Objectives:

EL-101.CO1	To instill fundamentals of Semiconductors
EL-101.CO2	To understand the physics of junction diodes and to learn to implement them in various applications
EL-101.CO3	Learning different configurations of Bipolar junction Transistors and understanding the effect of various parameters on their performance.
EL-101.CO4	To study the physics and construction of Field Effect transistors.
EL-101.CO5	To study the modern day transistor technology involving MOS devices and explore their various applications.

UNIT 1 **(7 Lec)**

Physics of Semiconductors

Introduction to semiconductors, Band Theory, Band formation, Crystal and Lattice structure, Kronning Penny model, E-K diagram, Density of states, Effective mass, Intrinsic and extrinsic semiconductor, direct and indirect band gap semiconductors, Carrier Transport phenomena, constituent equations of electron and hole transport.

UNIT 2 **(9 Lec)**

Junction Diodes

Introduction & construction of PN junction diode, Depletion region formation, junction capacitance, Diode characteristics, Junction breakdown mechanisms, special purpose diodes, metal-semiconductor contacts, Schottky effect, applications of diodes.

UNIT 3 **(10 Lec)**

Bipolar Junction transistor and its applications

BJT structure and operation, active mode –qualitative analysis, BJT configuration and small signal parameters, frequency response, Heterojunction BJT, Ebers-Moll model, Temperature effect: BJT width Modulation.

UNIT 4 **(8 Lec)**

Field effect Transistors: JFET & MESFET

JFET structure and principle, JFET operation- qualitative analysis, Signal transfer, Gain, Small signal equivalent circuit, MESFET structure and its operational principle, applications.

UNIT 5 **(13 Lec)**

Modern Day Transistor Technology: MOSFET, C-MOS & CCD, HEMT

MOSFET structure, MOS capacitor band diagram-quantitative analysis, I-V characteristics, small signal equivalent circuit, C-MOS technology, CCD structure and its operational principle, CCD applications; HEMT structure, operational principle & application.

Textbooks/References

1. S M Zee, *Solid State Devices*, Wiley Publication
2. S M Zee, *Physics of Semiconductor Devices*, Wiley Publication
3. David A.Bell, *Electronic Devices and Circuits*, Prentice Hall of India, 4 th edition, 2003.
4. Jacob Millman, Christos C. Halkias, *Electronic Devices and Circuits*, Tata McGraw-Hill edition, 1991.
5. Kittel, *Solid State Physics*, Wiley Publication
6. Robert Boylestad, Louis Nashelsky, *Eelctron Devices and Circuit Theory*, Pearson Education, 9th edition, 2007.
7. Thomas L. Floyd, *Electronic Devices*, Pearson Education, 6 th Edition, 2002.
8. Albert Malvino, David J.Bates, *Electronic Principles*, Tata McGraw-Hill, 7th Edition, 2007.

Analog and Circuit Electronics (EL-102)

Course Objectives:

EL-102.CO1	To learn about semiconductor diodes and their applications.
EL-102.CO2	To understand the basics of Operational applications with the helps of its various operational parameters.
EL-102.CO3	To study the working and construction of UJT, SCR, TRIAC and DIAC.
EL-102.CO4	To learn about various wave forming circuits and signal generators.
EL-102.CO5	To design different types of active filters.

Unit 1 **(10 Lec)**

Semiconductor Diodes: Ideal diode, piecewise linear equivalent circuit, dc load line analysis, Quiescent (Q) point. Clipping and clamping circuits. Rectifiers: HWR, FWR (center tapped and bridge). Circuit diagrams, working and waveforms, ripple factor & efficiency, comparison. Clippers, Clampers. Zener diode regulator circuit diagram and explanation for load and line regulation, disadvantages of Zener diode regulator.

Unit 2 **(11 Lec)**

Operational Amplifier: Characteristics, Definitions, Differential amplifier, common mode gain, Differential mode gain, CMRR, Introduction of Feedback principle & properties, Four Basic Feedback Topologies, Voltage series feedback amplifier, Voltage shunt feedback amplifier.Differential amplifier with one op-amp. Op-Amp as an inverter, summer, Integrator, Differentiator,

Unit 3 **(10 Lec)**

Power Electronics: UJT, Basic construction and working, Equivalent circuit, intrinsic Standoff Ratio, Characteristics and relaxation oscillator-expression. SCR, Construction,Working and Characteristics, TRIAC, DIAC, Circuit symbols, Basic constructional features, Operation and Applications.

Unit 4 **(8 Lec)**

Signal generator and Waveform shaping circuits: Triangular waveform generator, Square wave generator Principle of Sinusoidal oscillator – Wein bridge and RC phase shift,

Unit 5 **(8 Lec)**

Active Filters: Characteristics of filters, Ideal and Realistic frequency response, First and second order low pass, High-pass, Band-pass, Band-reject and All pass filters.

Textbooks/References

1. Electronic Devices and circuit theory, Robert Boylstead and Louis Nashelsky, 9th Edition, 2013, PHI
2. R. A. Gayakwad, Op-Amps and Linear IC's, Pearson Education (2003)
3. R. F. Coughlin and F. F. Driscoll, Operational amplifiers and Linear Integrated circuits, Pearson Education (2001)
4. J. Millman and C.C. Halkias, Integrated Electronics, Tata McGraw-Hill,(2001)
5. A.P.Malvino, Electronic Principals,6th Edition , Tata McGraw-Hill,(2003)

Signals and Systems (EL-103)

Course Objectives:

EL-107.CO1	To study various kinds of continuous and discrete signals and analogy of the two.
EL-107.CO2	To learn fourier series and to imply it various problems
EL-107.CO3	Understanding Z-transform and its applications
EL-107.CO4	To realise continuous and discrete time systems
EL-107.CO5	Learning to calculate probability and correlation of various random and distribution functions.

UNIT 1 **(12 Lec)**

Introduction to Signals and Systems

Description of continuous time and discrete time signals: Various type of signals, periodic and non-periodic signals. Operations on signals. Continuous time and discrete time convolutions. Linear Time Invariant systems. Stability of systems. Analogy between continuous time systems and discrete time systems

UNIT 2 **(15 Lec)**

Fourier series (continuous & discrete) properties and its application, Continuous & Discrete time Fourier Transform, their properties & applications. Laplace Transform properties & its application.

UNIT 3 **(9 Lec)**

Sampling of continuous time signals, Z-transform and its application.

UNIT 4 **(6 Lec)**

Realization of continuous time systems and discrete time systems.

UNIT 5 **(11 Lec)**

Probability, Random Variable, cumulative distribution function. Probability distribution function, relation between probability and probability density. Joint cumulative distribution function. Average value of a random variable, error Function. Rayleigh Probability Density . Mean and variance of the sum of random variable. Probability density of Z=X+Y. Correlation between random variable, central-limit theorem. Random Process. Auto-correlation.

Textbooks/References

1. AV Oppenheim, A J Wilskey with S Hamid Nawab, " Signals and Systems" Prentice Hall of India
2. H Taub and D L Schilling, "Principles of Communication Systems" McGraw-Hill, New York
3. Edward W Kamen & Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, 2007
4. H P Hsu, Rakesh Ranjan" Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007.

Microprocessors and Microcontroller (EL-104)

Course Objectives:

EL-104.CO1	To learn the basics and architecture of 8085 microprocessor
EL-104.CO2	To learn to program 8085 microprocessor in assembly language.
EL-104.CO3	To understand the interfacing concepts and to learn to interface external peripherals.
EL-104.CO4	To learn the basic functionality of 8051 microcontroller.
EL-104.CO5	To learn to program 8051 microcontroller in embedded C.

Unit 1: Microprocessor 8085 **(10 Lec)**

Introduction to microprocessors & microcomputers ,Microprocessor Architecture, Introduction to Assembly language Programming, Operation Bus, Timing (Read/ Write) Cycles ,I/O Addressing.

Unit – 2: Programming 8085 **(10 Lec)**

Introduction to 8085 Instructions, Addressing Modes, Assembly Language Programs, Stack & Subroutines, Counters & Time Delays

Unit – 3: Interfacing Peripherals (I/Os) & Applications **(12 Lec)**

IO and Memory Interfacing concepts, 8085 Interrupts, Programmable Peripheral Device- 8255A, Various Modes of 8255A, Programmable Interrupt Controller-8259A, Direct Memory Access (DMA) Controller-8257

UNIT – 4: Microcontroller-8051 **(8 Lec)**

Register Set, Architecture of 8051 microcontroller, I/O and Memory Addressing Interrupts, Instruction Set, Addressing Modes

UNIT – 5: Programming Of 8051 **(10 Lec)**

Introduction to Embedded C Programming, Timer , Serial Communication , 8051 Data Types & Directives, Instructions and related programs.

Textbooks/References

1. Ramesh Gaonkar, " Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition.
2. Krishna Kant, " Microprocessors & Microcontrollers", PHI Publications.
3. Muhammad Ali Mazidi and Janice Gillispie Mazidi, " The 8051 –Microcontroller and Embedded systems",7th Edition, Pearson Education , 2004.

Advance mathematics in Electronics (EL-105)

Course Objectives:

EL-105.CO1	To learn Laplace transforms and its applications
EL-105.CO2	To study Differential equations and Z-transforms
EL-105.CO3	To study Bessel Function and Legendre's polynomials
EL-105.CO4	To understand higher Calculus and fourier series
EL-105.CO5	To study vector calculus and fourier transformations

Unit-1 **(10 Lec)**

Laplace Transform's and its application**.**

Unit-2 **(8 Lec)**

Difference equation and Z-Transform**.**

Unit-3 **(10 Lec)**

Bessel function and Legendre's polynomial.

Unit-4 **(8 Lec)**

Higher calculus and Fourier series, calculus of variation , elliptic integrals, beta and gamma function.

Unit-5 **(12 Lec)**

Vector calculus, Fourier integrals and Fourier transformation. Line, surface and volume integrals, green's theorem , gauss and stoke's theorem, Fourier sine integral ,Exponential Fourier transform, infinite and finite integral, finite sine and cosine transform, application of different transform in the solution of different integral.

Fundamental of Nanoscience and nanotechnology (CBCS) (EL-106)

Course Objectives:

*EL-106.*CO1	To introduce the basics of nanotechnology and its applications in various fields
*EL-106.*CO2	To study the synthesis and working various semiconductor nanostructures
*EL-106.*CO3	To insist the detailed study of carbon nanomaterials and their applications in various fields
*EL-106.*CO4	To discuss the basic concepts of nanophotonics and its impact on various nanodevices
*EL-106.*CO5	To discuss the role of nanotechnology in the field of biotechnology with the help of its applications.

Unit 1- Introduction to Nanotechnology **(12 Lec)**

Historical background of nanotechnology, Quantum phenomena, Size effect, Electronic confinement in 1D,2D, and 3D structures, Nanomaterials , Molecular nanotechnology, Top down and Bottom up approaches, Green nanotechnology, Green Nanotechnology, Applications of Nanotechnology

Unit 2- Semiconducting Nanostructures **(10 Lec)**

Metal oxide Nanostructures: Background, Synthesis, Properties and Applications
Nanochalcogenides : Background, Synthesis, Properties and Applications

UNIT 3 Carbon Nanomaterials **(12 Lec)**

Introduction to Carbon Allotropes and Carbon Nanomaterials. Fullerenes : Background, synthesis, properties and applications, CNTs(SWCNTs and MWCNTs): Background, Synthesis, properties and application. Nano diamonds: Background synthesis, properties and applications.
Graphene: Background, synthesis, properties and applications. Carbon nano fibre and Carbon nano yarns: Background, synthesis, properties and applications.

Unit 4 Introduction to nano photonics: **(8 Lec)**

Introduction, Light – matter interaction at nano scale ,electromagnetic wave propagation. Periodic structures,1D,2D and 3D photonic crystal, waveguide, photonic circuit, plasmonics and its applications.

Unit-5 Introduction to nano biotechnology **(8 Lec)**

Introduction, nanomaterials as drug carriers, targeted drug delivery, reconstructed method, Nano imaging and nano bio sensors.

Computer Architecture (EL-107)

Course Objectives:

EL-103.CO1	To design various microoperations involving computer architecture and to learn their hardware implementation.
EL-103.CO2	Understanding the execution unit of a basic computer with the help of various algorithms and learning to implement through appropriate hardware
EL-103.CO3	To explore the basic concepts of Control Unit of a basic computer and to implement them through microoperations.
EL-103.CO4	To insist the fundamentals of parallel and vector processing to implement various types of processors.
EL-103.CO5	To learn the memory organization of a basic computer and different types of memories with their functional requirement in the system.

UNIT – 1: Introduction of computer Architecture (Lec-15)
Basic of computer architecture, Types of computers._Function of basic building blocks. Register transfer language, register transfer, Bus and memory Transfer, memory transfer. Arithmetic microoperations. Hardware implementation, some applications. Logic microoperations, hardware implementation, some applications. Shift microoperations, hardware implementation, arithmetic logic shift unit.

UNIT – 2: Execution Unit (Lec-10)
Introduction, indirect address, computer register. Computer Instruction set, addressing mode. Instruction types, Reduced instruction set computer(RISC),
CISC characteristics, RISC characteristics, Multiplication algorithms, Hardware implementation for signed magnitude data. Booth multiplication algorithm, Hardware algorithm. Division of unsigned integers.

UNIT – 3: Control unit (Lec-10)
Basic concepts, Design methods. Hardwired controlled design. Microprogrammed control unit. Microprogram examples. Microinstruction format. Symbolic Microinstructions. Symbolic MIcroprogram.

UNIT – 4: Pipeline and vector processing (Lec-15)
Fundamental of parallel processing, Flynn classification. Pipelining, speed- time diagram, speedup._Arithmetic pipeline. Instruction pipeline, Pipeline conflicts. Vector processing, Array processors, attached array processor, SIMD array processor, RISC pipeline, Three segment instruction pipeline.

UNIT – 5: Memory organization (Lec-10)
Characteristics of memory systems, memory hierarchy. Main memory design, RAM and ROM chips, memory address map. Main memory connection to CPU, Auxiliary memory. Electromechanical memory devices. Cache memory, Associative mapping, direct mapping, set-associative mapping. Virtual memory, address space, memory space, pages and blocks. Memory management concepts.

Textbooks/References

1. Morris Mano, "Computer System Architecture", Prentice-Hall of India, 2000
2. John P.Hayes, 'Computer architecture and Organization', Tata McGraw- Hill,Third edition, 1998.
3. V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, " Computer Organization", V edition, McGraw-Hill Inc, 1996

Microprocessor Lab-1 (EL-108)

Course Objectives:

EL-108.CO1	To learn basic assembly programming in 8085
EL-108.CO2	To implement subroutines in assembly language in 8085
EL-108.CO3	To learn basic programming of 8051 microcontroller
EL-108.CO4	To interface external interfacing devices to 8085 to draw patterns on CRO
EL-108.CO5	To interface external interfacing devices to 8051 microcontroller and implement them for various applications.

Experiments:

1. WAP to add two 16 bit numbers.
2. WAP to subtract two 16 bit number.
3. WAP to multiply two 8 bit numbers.
4. WAP to find the largest number from a given sequence.
5. WAP to sort a given series of 8-bit numbers in ascending order.
6. WAP to sort a given series of 8-bit numbers in descending order.
7. WAP to generate Fibonacci Series.
8. WAP to find the factorial of a number using subroutine.
9. WAP to separate 8-bit even numbers from odd numbers.
10. WAP to generate square wave using 8255.
11. WAP to generate triangular wave using 8255.
12. WAP to generate sawtooth wave using 8255.
13. WAP to generate staircase wave using 8255.
14. Interfacing 8051 with temperature controller module.
15. Interfacing 8051 with traffic controller module.

Electronic Devices Lab-2 (EL-109)

Course Objectives:

EL-109.CO1	To study the characteristics of UJT, DIAC and TRIAC
EL-109.CO2	To study transfer characteristics of JFET and MOSFET
EL-109.CO3	Understanding BJT and learning its CE characteristics through hands-on.
EL-109.CO4	Learning to determine basic semiconductor parameters like band gap, temp. coefficient etc.
EL-109.CO5	To understand the working of relaxation oscillator.

Experiments:

1. Determination of temperature coefficient of junction voltage and energy bandgap.
2. Study of depletion capacitance and its variation with reverse bias.
3. Determine reverse saturation current and material constant.
4. Drain and Transfer characteristics of JFET.
5. Application of transistor as an amplifier.
6. Drain and Transfer characteristics of MOSFET.
7. To study the characteristics of MOSFET.
8. To study the characteristics of DIAC.
9. To study the static emitter characteristics of UJT
10. To study the characteristics of BJT in CE configuration.
11. To study relaxation oscillator.
12. To study the I-V characteristics of SCR.
13. Ti\o determine the reverse saturation current and material constant η.

M. Sc. Electronics 2nd Semester

AWP & Microwave Electronics (EL-201)

Course Objectives:

EL-201.CO1	To instill the basics of wave propagation in unbounded medium
EL-201.CO2	To learn the construction and working of different types of Antenna with their radiation pattern
EL-201.CO3	To study different microwave sources and to compare their efficiencies.
EL-201.CO4	To understand various microwave solid state devices and their characteristics
EL-201.CO5	To study microwave passive devices with the help of their design and working.

Unit 1 Wave propagation in Unbounded Medium **(12 Lec)**

Maxwell's equations ,Wave equation, Plane wave propagation, polarization, plane wave in perfect dielectric and imperfect dielectrics & conductors; Reflection of plane waves Normally incident on Discontinuities: Perfect conductor, dielectrics, transmission line analogy of wave propagation, the impedance concept; Reflection of plane waves obliquely incident on Discontinuities: Perfect conductors, dielectrics; Snell's law of reflection, total internal reflection, Brewster's angle.

Unit 2 Radiation & Antenna **(13 Lec)**

Radiation phenomenon and equation, Basic antenna parameters: radiation resistance, Gain, directivity, Effective length, Radiation pattern; Radiation from short current element, Radiation from small current loop, radiation from arbitrary current distribution, half wave dipole antenna; Antenna impedance, Monopole antenna, Baluns, Antenna array: Broadside array and end-fire arrays, long wire antenna; Few antenna types: Folded dipole, Loop antenna, Yagi-Uda Antenna; Radio wave propagation: Antenna located over a flat surface, Ionospheric propagation, attenuation factor, coverage diagram.

Unit 4 Microwave Sources **(15 Lec)**

Introduction, limitation of conventional Tubes at High Frequencies; Two cavity klystron: construction, working and analysis, velocity-modulation process, bunching process, output power and beam loading, Efficiency of klystron; Reflex Klystron: construction and working, velocity modulation, electronic admittance; Helix Traveling-Wave Tubes (TWTs): principle and working, amplification process; wave modes; Oscillators: Cylindrical Magnetron, construction and working, cyclotron angular frequency; Linear Magnetron,

Unit 5 Microwave Solid State Devices **(10 Lec)**

Transferred Electron Devices: Gunn Effect, Two- Valley Model Theory; Modes of Operation, Criterion for Classifying the Modes of Operation; Avalanche Transit-Time Devices: Avalanche Effect, Read diode construction and working principle; IMPATT diodes: working, power output and Efficiency; Applications of microwave solid state devices.

Unit 6 Microwave Passive Devices **(10 Lec)**

Directional Couplers: design and working; Microwave junction Tees: E-plane, H-plane and Magic T; Gyrator; Isolator: Resonance Isolator; Circulators: Three and multi Port Circulator;

Textbooks/References

1. Samuel Y. Liao, Microwave Device and Circuits, Pearson 3rd Edition 2003.
2. David M. Pozar, Microwave Engineering, John Wiley & Sons, Inc, Fourth Edition 2012.
3. Robert E. Collin, Foundation for Microwave Engineering, Second Edition, McGraw Hill, 1998.
4. J D Krauss, A J Marhefka, Antenna for all applications, Tata-McGraw Hill, 3rd Edition.
5. Robert E. Collin, Antenna and Radio wave propagation, McGraw Hill, 1998

Computational Method And Computer Programming (EL-202)

Course Objectives:

EL-202.CO1	To learn the fundamentals of C++ programming
EL-202.CO2	To understand and implement interpolation and numerical differentiation using C++
EL-202.CO3	To study Numerical integration and integral equations through various methods
EL-202.CO4	To understand the numerical solution of algebraic and transcendental equations and to perform curve fitting with the help of standard methods
EL-202.CO5	To discuss the numerical solution of initial and boundary value problems

Unit-1 : Fundamentals Of C++ Programming (12 Lec)

Programming Preliminaries, Features available in C++ over C, Concept of object oriented programming (OOP), Input/output statement, control statement , for loop, while loop, do-while loop, nested loops, continue and break statements, similar statements of C and C++, header files, differentiate with structured programming, arrays, functions, structures, use recursion and introduction to objects and classes.

Unit-2: Interpolation And Numerical Differentiation (10 Lec)

Review of Newton –Gregory, Guass Stirling, Laplace-everett and Bessel interpolation formulae; Aitkenand cubic spline interpolation, errors in interpolation, newton's divided difference and Lagrange interpolation formulae for unequal intervals, Inverse Interpolation using Lagrange's formula , Method of successive approximation, Double Interpolation; Numerical successive differentiation using forward, backward, central difference Interpolation formulae and Newton's divided difference formula.

UNIT-3 : Numerical Integration And Integral Equations (8 Lec)

General Quadrature formula, Review of Trapezoidal, Simpson's 1/3 and 3/8 rules; Numerica Integration using Boole and Weddle rules, Guass –Chebyshev, Radau, Guass-Legendre and Lobatto rules, errors in quadrature formulae, Romberg's Integration method using Trapezoidal and Simpson's 1/3 rules, Numerical double integration, Numerical solutions of Integral Equations using finite difference methods and Chebyshev series method.

UNIT-4 : Numerical Solutions Of Algebraic And Transcendental Equations, Systems Of Linear Equations And Curve Fitting (15 Lec)

Review of Regula-false position method, Newton-Raphson method, Ramanujan's method, Muller's method , Ferrari's method for polynomial equations in one variable, rate of convergence , error analysis of the methods, Newton- Raphson method for the solution of a system of non-linear equations, Guass-elimination and Guass- Jordan method using matrix approach, Guass-Seidal method for solution of a system of linear equations in 4 unknowns, curve fitting by the sum of exponential using Moore's method.

UNIT-5 : Numerical Solutions Of O.D.E And P.D.E (Initial And Boundary Value Problems) (10 Lec)

Numerical solutions of a system of simultaneous (1^{st} order) and higher order ordinary differential equations using Picard's method and Runge-Kutta 4^{th} order Method, Adams- Bashforth and Adams-Moulton methods, Solution of boundary value problems using finite difference method and cubic spline method, numerical solution od P.D.E using finite difference method, Jacobi and Guass-Seidal Methods, Crank- Nicholson and Bender-Schmidt methods.

Note: In a total of five questions (each containing at least two parts) to be set in final examination, 50% questions would be set on computational methods and remaining 50% would be on computer programming of computational methods using C/C++.

Textbooks/References

1. S. C. Chapra and R.P Canale: Numerical Methods for Engineers with Programming and Software Applications, 3rd Edition, Tata McGraw Hill books Co., New Delhi-110001
2. M.K. Jain, S.R.K Iyengar & R.K. Jain: Numerical Methods for Scientific and Engineering Computation, 4th Edition, New age International Publisher, Dariyaganj, New Delhi-110001
3. S.S.Sastry: Introductory Methods of Numerical Analysis, 4th Edition, Prentice hall Of India, Jhilmil House, Patparganj, New Delhi.
4. J.H. Mathew and K.D.Fink : Numerical Methods Using MATLAB, 4th edition 2009, Prentice Hall of India, New Delhi.

Digital Electronics (EL-203)

Course Objectives:

EL-203.CO1	To instill the fundamentals of Digital Electronics and their implementation.
EL-203.CO2	To understand various combinational logic modules and to discuss their various applications
EL-203.CO3	To learn the working and implementation of various sequential circuits
EL-203.CO4	To learn and compare various A/D and D/A converters.
EL-203.CO5	To introduce to the digital design language -VHDL.

UNIT-1 **(12 Lec)**

Introduction to Digital Systems: Data representation and coding; Logic circuits, integrated circuits; Analysis, design and implementation of digital systems.

Boolean Algebra and Switching Functions: Basic postulates and fundamental theorems of Boolean algebra; Standard representation of logic functions - SOP and POS forms; Simplification of switching functions - K-map .

UNIT-2 **(8 Lec)**

Combinational Logic Modules and their applications: Arithmetic modules- adders, subtractors , Decoders, encoders, multiplexers, demultiplexers and their applications ; Parity circuits and comparators.

Logic Families: Introduction to different logic families. Electrical characteristics of logic gates logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product.

UNIT-3 **(15 Lec)**

Flip Flops: S-R, J-K, D & T Flip-flops, excitation table of a flip-flop, race around condition.

Sequential circuits: Shift registers, Ripple counter, Design of Synchronous counters. Design of state machines - state table, state assignment, transition/excitation table, excitation maps and equations, logic realization

UNIT-4 **(10 Lec)**

A/D and D/A converters: ADC Performance Characteristics - Resolution, Sampling Rate, Dynamic Range; Binary-weighted DAC, R-2R Ladder type networks, Successive-approximation ADC, Linear ramp ADC, Dual-slope ADC

Semiconductor Memories: Memory organization & operation, classification and characteristics of memories, RAM, ROM and content addressable memory.

UNIT-5 **(10 Lec)**

Programmable Logic Devices: PLAs, PALs and their applications; Sequential PLDs and their applications. Introduction to field programmable gate arrays (FPGAs).

Introduction to Design with VHDL: Introduction to VHDL: Defining modules in VHDL, Structural modeling, Data flow models, Behaviour models. Design of digital circuits using VHDL.

Textbooks/References

1. Morris Mano, “Digital Design”, PHI, 2nd edition. 2012.
2. Malvino and Leach, “Digital principles and applications”, TMH, 2000.
3. J. Bhaskar, “Verilog HDL Synthesis - A Practical Primer”, 3 rd Edition, Star Galaxy Publishing, 2008.

Optical Electronics (EL-204)

Course Objectives:

*EL-204.*CO1	To learn about different light sources with the help of their design features, working and characteristics.
*EL-204.*CO2	To understand the physics and characteristics of various photodiodes and solar cells
*EL-204.*CO3	To understand the geometrical optics and wave packet propagation of Optical Fibres.
*EL-204.*CO4	To discuss about various parameters involving the quality of optical communication
*EL-204.*CO5	To learn about different devices for modulation of light.

Unit 1 Light Sources **(16 Lec)**

Luminescence: Photoluminescence, Cathodoluminescence & Electroluminescence; Injection Luminescence & LED: Material system for LED, Operation of LED, external quantum efficiency, advanced LED structures; LED performance issues: Light current characteristics, spectral purity of LEDs, LED temporal response; Application of LEDs, reliability issues; Semiconductor LASER: operational principle, spontaneous and stimulated emission, Einstein's coefficients, population inversion, Two & three level laser system; Design Features and operating characteristics (in brief): He-Ne Laser, Ruby laser, Dye Laser.

Unit 2 Light Detection and Ranging **(10 Lec)**

Optical absorption in a semiconductor, photocurrent in p-n Diode and application to a solar cell; Photoconductive detectors, PIN photodetector, Avalanche photodetector, phototransistor; Metal semiconductor detectors; Noise & Detection limits; Charge coupled devices; advanced detectors.

Unit 3 Optical Fibers **(10 Lec)**

Geometrical optics, guided modes in a planer waveguide, optical confinement factor; Optical Fiber: wave optics, wavepacket propagation; Light coupling devices, beam-waveguide couplers.

Unit 4 Optical Communication **(12 Lec)**

Introduction about optical communication system, information content and channel capacity; properties of optical fibers: fiber losses, multipath dispersion, material dispersion, signal attenuation and detector demands; Fiber amplifier; Advanced devices: Optoelectronic Integrated Circuits (OEICs);Fiber fabrication and splicing (in brief).

Unit 5 Modulation of Light **(10 Lec)**

Birefringence, optical activity, electro-optic modulators, Liquid crystal cells-modulation of light; Non-linear optics.

Textbooks/References

1. A K Ghatak, Optoelectronics, Oxford University Press.
2. Jaspreet Singh, Optoelectronics- An Introduction to Materials and Devices, Mc-Graw Hill (Int.).
3. Ghatak & Thyagrajan, Lasers & Applications, McMillan.
4. W T Silfvast, Lasers Fundamentals, Cambridge University Press.
5. B B Laud, Lasers and Non-Linear Optics, Wiley Eastern Limited.

Nanomaterials, Synthesis and Applications (CBCS) (EL-205)

Course Objectives:

EL-205.CO1	To instill fundamentals of nanomaterials and their classification.
EL-205.CO2	To learn the synthesis of nanoparticles through chemical route.
EL-205.CO3	To learn the synthesis of nanoparticles through physical deposition techniques.
EL-205.CO4	To understand different types of lithography techniques and their applications.
EL-205.CO5	To introduce to the nanocomposites and their applications

UNIT-1 **(12 Lec)**

Introduction to nanomaterials, Properties of material s and nanomaterials, role of size in nanomaterials , nanoparticles, semiconducting nanoparticles, nanowires, nanoclusters, quantum well, conductivity and enhanced catalytic activity compared to the same material in the macroscopic state.

UNIT-2 **(10 Lec)**

Chemical Routes for Synthesis of Nanomaterials: Chemical precipitation and coprecipitation; metal nanocrystals by reduction, Sol-Gel Synthesis, Microemulusions or Reverse Micelles, Myle Formation; Solvothermal Synthesis; Thermolysis routes, Microwave heating Synthesis; Sonochemical Sysnthesis; Electrochemical Synthesis; Photochemical Synthesis; Synthesis in supercritical fluids.

UNIT-3 **(12 Lec)**

Self Assembly and Catalysis: Process of self-assembly, Semiconductors islands, Monolayers, Nature of catalysis, Porous materials, Pillared clays, Colloids, Biometrics.

UNIT-4 **(12 Lec)**

Fabrication of nanomaterials by physical methods: Inert Gas Condensation, Arc Discharge, Plasma Arc Technique, RF plasma, MW Plasma, ION, sputtering, Laser ablation., Laser Pyrolysis, Ball Milling, Molecular Beam epitaxy, Chemical Vapour Deposition method and electro deposition.

UNIT-5 **(10 Lec)**

M based nanolithography and nanomanipulation, E beam lithography and SEM based lithography and nanomanipulation, ion beam lithography, oxidation and metallization, mask and its application. Deep UV lithogarpy, X-ray based lithography.

UNIT-6 **(8 Lec)**

Nanocomposites: an introduction: Types of nanocomposites (i.e., metal oxide, ceramic, glass and polymer based), core-shell structured nanocomposite, super hard nanocomposite: Synthesis, application and milestones.

Textbooks/References

1. Nanochemistry: A chemical approach to nanomaterials by G.A.OZIN, A.C. Aresnault, L. Cadematriri, RSC Publishing
2. Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao et.al.
3. Nanoparticales: From theory to applications – G. Schmidt, Wiley Weinheim 2004.
4. Fabrication of fine pitch gratings by holography, electron beam lithography arnano-imprint lithography (proceedings paper) Authors(s); Darren Goodchild; Alex Bogdanov; Simon Wingar; Bill Benyon; Nak Kim; Frank Shephered.
5. A three beam approach to TEM preparation using in – situ low voltage argon ion FI milling in a FIBSEM.
6. Nanochemistry: A chemical approach to nanomaterials- royal society of chemistry Cambridge UK 2005.
7. Nanocomposite Science and Technologies – PM. Ajayan, L.S. Schadler,
   PV Brawn, W New York.

Embedded systems (EL- 206)

Course Objectives:

*EL-206.*CO1	To learn classification of embedded systems based on different parameters.
*EL-206.*CO2	To study details of 8051 microprocessor and to learn assembly programs
*EL-206.*CO3	Learning to program 8051 in C programming
*EL-206.*CO4	To interface I/O devices with 8051
*EL-206.*CO5	To introduce with AVR microcontrollers

Unit-1 **(10 Lec)**
Introduction to embedded systems: categories of embedded systems, overview of embedded systems architecture, Embedded systems vs. general computing systems, classification of embedded systems, Core of the embedded systems, Sensors and Actuators. Microcontroller programming and structure design, Factors to be considered in selecting a microcontroller, recent trends in embedded systems.

Unit 2 **(15 Lec)**
Overview of 8051 microcontrollers. Designing with 8051, why 8051 microcontroller, programming with 8051 microcontrollers, 8051 assembly language programming: Inside the 8051, Introduction to 8051 assembly programming, the program counter and ROM space in the 8051, 8051 flag bits and the PSW register, 8051 register banks and Stack. Jump, loop and call instructions: Loop and Jump instructions, Call Instructions, Time delay for various 8051 chips. I/O programming: 8051 I/O programming, I/O bit manipulation programming.

Unit 3 **(10 Lec)**
8051 Addressing modes: Immediate and register addressing modes, Bit addresses for I/O and RAM, 128 Byte on-chip RAM in 8052.Arithmetic, Logic instructions and programs: Arithmetic instructions, Logic and compare instructions, rotate instruction and data serialization. 8051 Programming in C:Data type and time delay in 8051 C, I/O programming in 8051 C,Logic operation in 8051 C.

Unit 4 **(10 Lec)**
Interfacing: LCD and Keyboard Interfacing, ADC, DAC, and Temperature Sensor Interfacing

Unit 5 **(15 Lec)**
Embedded systems development environment: The Integrated development Environment(IDE),Introduction to AVR family of microcontrollers, Microcontroller, AVR CPU, system clock and clock option.

Textbooks/References

1. Muhammad Ali Mazidi, The 8051 Microcontroller and embedded systems, Pearson
Education 2nd edition, 2006
2.Shibu K V, Introduction to Embedded systems, TMH education private limited.
3. Embedded C programming and the Atmel AVR,Barnett R,O Cull L,Cox S, Thomson Delmar learning,Canada.
4. Muhammad Ali Mazidi,SarmadNaimi, The AVR microcontroller and embedded systems using Assembly and C.Prentice -Hall of India 2011.

Opto-Electronics Lab-3 (EL-207)

Course Objectives:

*EL-207.*CO1	To study the characteristics of optoelectronic devices.
*EL-207.*CO2	To study and verify Malus Law
*EL-207.*CO3	To study the current and voltage characteristics of LED with change in temperature
*EL-207.*CO4	Understanding optical fibres and to calculate their bending losses and numerical aperture.
*EL-207.*CO5	To learn the operational principle of opto-coupler.

Experiments:

1. To study the characteristics of photovoltaic cell.

2. To study the characteristics of photoconductive cell.

3. To study the characteristics of PIN photodiode.

4. To study the characteristics of phototransistor.

5. To study the characteristics of optocoupler.

6. To study the polarization phenomenon using He-Ne laser.

7. To study the diffraction pattern of grating.

8. To study the temperature effect on the I-V characteristics of light emitting diode (LED).

9. to study the beam profile by determining the power distribution within the beam.

10. To determine Numerical aperture using Multimode Fibre.

11. To study the bending loss of Optical Fibre.

12. To study the weight loss of multimode optical fibre.

13. To determine the wavelength of laser light using diffraction grating.

Computer Programming Lab-4 (EL-208)

Course Objectives:

EL-208.CO1	To learn basic C++ programming
EL-208.CO2	To solve various Algebraic/Transcendental Equation problem using C++ programming
EL-208.CO3	Learning to implement various difference Interpolation in C++ programming
EL-208.CO4	To implement different numerical methods and testing their accuracy
EL-208.CO5	To implement OOPs to solve numerical problems in C++ programming

Experiments:

1. Basic C++ Programs
2. Newton's Forward Difference Interpolation
3. Newton's Backward Difference Interpolation
4. Newton's Divided Difference Interpolation
5. Simpson's 1/3 Rule for Numerical Integration
6. Simpson's 3/8 Rule for Numerical Integration
7. Trapezoidal Rule for Numerical Integration
8. Root of Algebraic/Transcendental Equation by Bisection Method
9. Root of Algebraic/Transcendental Equation by Regula Falsi Method
10. Root of Algebraic/Transcendental Equation by Newton Raphson Method
11. Root of Algebraic/Transcendental Equation by Secant Method.
12. Runge Kutta 4^{th} order Method for ordinary Differential Equations
13. Gauss Elimination Method for system of equations
14. Gauss Jordan Method for system of equations
15. Gauss Siedal Method for system of equations

M. Sc. Electronics 3rd Semester

Communication Electronics (EL-301)

Course Objectives:

EL-301.CO1	To learn the standard techniques of modern communication systems
EL-301.CO2	To study the working of radio transmitters and receivers.
EL-301.CO3	To learn various modulation techniques
EL-301.CO4	Learning to implement different digital carrier modulation techniques.
EL-301.CO5	To learn the basics of Information theory.

Unit 1: **(10 Lec)**

Introduction to Communication Systems: Block diagram of communication systems; need for modulation; concept of channels and base-band signals

Amplitude Modulation: Modulation and demodulations; AM, DSB, SSB, VSB transition

Unit-2: **(12 Lec)**

Angle Modulation: Frequency and Phase Modulation and Demodulation Circuits: Direct & Indirect methods, FM Detectors: Slope Detector, Frequency Discriminators, PLL .

Radio Transmitters and Receivers : Receiver Characteristics; Tuned Radio Frequency (TRF)Receivers; Superhetrodyne Receivers

Unit 3: **(8 Lec)**

Pulse Analog Modulation: Channel Capacity; Sampling Theorem; PAM, PWM, PPM modulation and Demodulation techniques

Pulse Code Modulation: Need for Digital Transmission; Quantizing; Encoding; Delta Modulation; Adaptive Delta Modulation; Multiplexing : TDM & FDM

Unit 4: **(8 Lec)**

Digital Carrier Modulation Techniques: Amplitude Shift Keying (ASK); Frequency Shift Keying (FSK); Phase Shift Keying (PSK); BPSK & QPSK

Unit 5: **(10 Lec)**

Information Theory: Entropy; Data Rate; Channel Capacity; Probability and random variables; statistical averages;

Random signals & Noise: Signal and noise in communication; Types of noise ; Signal to Noise Ratio; Noise Figure; Power Spectral Density; Guassian Process.

Textbooks/References

1. Simon Haykins," An Introduction to Communication Electronics", Wiley Publications.
2. John G. Proakis & Masoud Salehi, "Communication System Engineering", 2nd Edition, 2002.
3. William Stallings, "Data & Computer Communications", PHI.

Data structures and algorithms (EL-302)

Course Objectives:

EL-302.CO1	To study the basics of data structure and algorithms to implement various methods
EL-302.CO2	Learning to implement Stack, Queue and link list
EL-302.CO3	Learning to implement Trees and Graph with the help of algorithms
EL-302.CO4	To learn the basics of C++ to implement data structures
EL-302.CO5	To learn object oriented approach involving C++ for efficient programming practices.

Unit 1: Basic of data structure and Algorithms (15 Lec)

Difference between data structure and data type, Built in data structure, i.e. array and user defined data structure,i.e. Stack, Queue etc. **Array:** representation of an array ,types of array,i.e.1-Dimentional array ,2-dimentional array and n -dimensional Array, row and column major implementation of different types of array. Implementation of different types of array. **Algorithm:** time and space complexity of algorithm; asymptotic notation: big oh notation etc. **sorting algorithm**: Bubble sort, selection sort, insertion sort, merge sort and quick sort. **Searching algorithm:** linear search and binary search.

Unit 2: Stack queue and linked list (12 Lec)

Stack: introduction: Push and pop operation, array implementation of stack; application stack: evaluation of postfix expression, conversion of an expression from infix to postfix, Recursion and tower of Hanoi problem. **Queue:** Introduction, operation on queue i.e. insertion and deletion, Full and empty type of queue: linear queue, circular queue, Priority queue, and double ended queue, queue implementation. Linked List: Concept of linked list, inserting and removing nodes from the linked list, types of linked list: single and double linked list , implementation of stack and queue using linked list.

Unit 3: Trees and Graphs (10 Lec)

Trees: Concepts of Trees , Binary Trees, Strictly binary Trees, Complete binary Trees, Almost complete binary Trees, Height and Depth of a Tree, Array and Linked representation of Binary trees , Tree search Algorithms , Binary search Trees(BST) , Tree traversal algorithms: In order , Preorder, and Post order.

Graphs: Vertex and edge, types of graphs: Directed / undirected, Connected/Disconnected, Cyclic/acyclic, Representation of graphs: Adjacency Matrices, Operations on graph, traversing a graph; Spanning trees, and Minimum cost spanning trees.

Unit 4: Basic of C++ (8 Lec)

Beginning with C++, Constants, Variables, Operators, Expressions, Control structures, Loops, Arrays and Pointers, Functions prototype, Call by value, Call by Reference, Inline function, Function overloading.

Class and objects: specifying a class, program based on classes and objects.

Unit 5: Advanced C++ (8 Lec)

Constructors and Destructors, Multiple constructors in class, Dynamics Constructors and Destructors, Operators overloading ; Rules for operators overloading, Overloading unary and Binary operators, Polymorphism and related programs.

Textbooks/References

1. Seymour Lipschutz;" **Theory and problem of Data structures**" Tata McGraw Hill Book Company Ltd.
2. Seymour Lipschutz, **Data Structures with C**, Schaum's Outline Series.
3. Herbert Schildt; C++: **The Complete references** , Tata McGraw – Hill Publishing Company Ltd.
4. K.R. Venugopal, B.Rajkumar, and T.RaviShankar " Mastering C++" Tata McGraw-Hill Publishing company.

Computer Communication & Networking (EL-303)

Course Objectives:

EL-303.CO1	To understand the basic concepts of operating systems and Networking
EL-303.CO2	To insist the details of different OSI layers
EL-303.CO3	To understand the different Networking Methods
EL-303.CO4	Learning to work with different internet protcols
EL-303.CO5	To understand different networking models and their applications

UNIT 1 **(8 Lec)**

Introduction to Operating systems and Networking

Multitasking, Inter-process communication, Issues in Concurrent access to shared data, Introduction to Telephone Exchange, Network Criteria and physical structure. Interconnection of Networks: Internetwork, Protocols and networking standards, Standard Organization, Introduction to 7 layer OSI Model

UNIT 2 **(9 Lec)**

OSI layer 1 (Physical Layer)

Transmission media: Twisted pair, coaxial cable, microwave links, optical fibers, communication satellites, repeaters; Transmission techniques: Data and signals, digital and analog transmission, multiplexing; Switching techniques; Introduction to ISDN and protocols.

UNIT 3 **(12 Lec)**

OSI layer 2 (Data Link Layer)

Relationship with layer 1 and 3;Data packet formation; Error detection and correction techniques; Multiple access: protocols and methods; LANs: Ethernet, wired LAN, Virtual LAN, Bridge

UNIT 4 **(10 Lec)**

Network Layer

Relationship with layer 2 and 4; concept of packet switching, connection less and connection oriented service, Virtual circuit, and data structure requirements; retransmission and duplicate packet problem; Routing: Flow control, shortest path routing algorithms, GGP, sliding window.

UNIT 5 **(16 Lec)**

Transport layer: Relationship with layer 2 and 4; quality of service, congestion management; Hierarchical addressing, process to process delivery, TSAP, Buffering, Transport Layer Interface

Layer 5,6 & 7: session, presentation and application layer, OSI session service primitives, Client server model, RPC Data representation and compression, Cyphering and Decyphering data, FTP and SMTP

Internet Protocols: TCP/IP, UDP/IP, ARP, RARP, SNMP, ICMP.

Textbooks/References

1. Behrouz A. Forouzan, *Data Communication and Networking*, 4th ed. McGraw-HilI
2. Andrew S.Tanenbaum, "*Computer Networks", 4th* edition, Pearson education, 2014.
3. Rarnier Handel, N.Huber, Schroder, "*ATM Networks Concepts ,Protocols Applications*'', Addison Welsey, 1999
4. W.Stallings, "*Data & computer communication*", 2nd Edition, NY Pearson, 1988

Control Systems (EL-304)

Course Objectives:

*EL-304.*CO1	To learn the basics of control systems
*EL-304.*CO2	To study and implement open loop and close loop systems
*EL-304.*CO3	Learning to test the stability of any system through stability analysis
*EL-304.*CO4	Learning the signal flow diagram and implementing various LTI systems
*EL-304.*CO5	To understand the control system compensators and their state variable representation.

Unit 1 **(Lec-10)**

Basic control system components: Classification of systems, Block Diagrammatic descriptions, Reduction of Block diagrams. Properties of systems: Linearity, Time Invariance, Stability, Causality

Uni 2 **(Lec-9)**

Open loop and closed loop (Feedback) system. Special properties of linear time – invariant (LTI) systems. Transfer function, Impulse response, Poles, Zeros and their significance, stability analysis of these systems.

Unit 3 **(Lec-20)**

Signal flow graphs and their use in determining functions of systems, Rules for Drawing signal flow graphs, Transient and steady state analysis of LTI systems and frequency response, Time response of First order and second order control systems, Steady state error.

Unit 4 **(Lec-15)**

Stability analysis of control systems: Routh-Hurwitz criterion, Nyquist criterion, Bode plots, Root loci.

Unit 5 **(Lec-6)**

Control systems compensators: Elements of lead and lag compensations, Elements of proportional-integral-Derivative (PID) control. State variable representation and solution of state equations of LTI systems.

Textbooks/References

1. B.S.Manke," Linear control systems with MATLAB applications, Khanna Publishers 1987.
2. R.K.Gayakwad and L.Sokoff," Analog and Digital Control system,Prentice hall international,1988.
3. K.Ogata," Modern control Engineering, prentice Hall of India,1989.

Green Electronics (CBCS) (EL-305)

Course Objectives:

EL-305.CO1	To understand the charge transport in organic semiconductors through various models
EL-305.CO2	To study the construction, working and applications of organic transistors
EL-305.CO3	To study the construction, working and applications of organic LED
EL-305.CO4	To study the construction, working and applications of organic solar cells
EL-305.CO5	To study various devices involving hybrid optoelectronics

U nit-1 **Organic Semiconductors** **(15 Lec)**

Electronic configuration and Conc e p t s of a tomic Orbitals, Hy bridization and Overlapping of orbi tals. Molecular Orbit al. LCAO theory, Bondi ng and Antibond i n g orbitals, Sigma Bondi ng and pi bonding. Material Origin of bandgap in orga n ic semiconductor,Charge Transport in orga nic Semiconductors. Types of organ ic semiconduc tor, Optical and Electrical Properties of Organic Semiconductor, Fa brica tion and Processing o of Organic semiconductors

U nit-2 **Organic transistor s** **(10 Lec)**

I n t r o d u c t i o n , P-Cha nnel and N-Cha nnel Ma terials, Gate Dielectrics and Electrode material of Organic Semiconductors, A pplications of Orga nic semiconductor, Current resea rch and ma rket scena rio

Unit – 3 **Organic LEDs** **(12 Lec)**

I n t r o d u c t i o n , Organic Ligh t-Emitting Diodes (LEDs),Hole and electron Transporting material. Light emitting m aterials, Passive and Active M atrix OLDs, White OLEDs, fabrication of OLEDs, A pplications of OLEDs, Curren t market and research scena r i o.

U nit-4 **Organic Photovoltaic's** **(13 Lec)**

I ntrod uction to Orga nic Photovol tai cs, Energy diagram of organic photovoltaics, Excitons: Wan nier Excitons, Cha rge Tra nsfer Exci tons, Fran kel Excitons, Exciton diffusion, Exci tonic energy tra nsfer, Exci ton donor and acceptor ma terials, Differen t designs of organic photovo l t aics(Planner, B H J and in terdigited structu res), Fabrication of Organic solar cells. Application of orga nic sola r cells, R&D Status and cu rrent market scenario

Unit -5 Hybrid Optoelectronics **(10 Lec)**

Hybrid Solar Cells I n trod uction, Materials, Fabrications, Applications and Curren t R &D status.
Hybrid OLED: In troduction, M ateri a ls, Fabrications, Application, current R&D Status

Digital Signal Processing (EL-306)

Course Objectives:

*EL-306.*CO1	Understanding the details of DFT and its types.
*EL-306.*CO2	Learning to design digital filters and their software implementation.
*EL-306.*CO3	To study two dimensional signal processing and its application in filter designing.
*EL-306.*CO4	To understand the finite word length effect and its effect on digital signal processing
*EL-306.*CO5	To insist the details of multirate signal processing and different DS processors

Unit 1 Introduction to DFT **(18 Lec)**
Frequency Domain Sampling: The Discrete Fourier Transform, Properties of the DFT, DFT as a linear Transformation, Relationship of DFT to other transforms, frequency analysis of signals using DFT, Computation of DFT and FFT algorithms

Unit 2 Digital Filters **(12 Lec)**
FIR and IIR filters, definition and design of digital filters, Implementation of discrete time systems, Structure for FIR and IIR systems, Software implementation

Unit 3 Finite word length effects in digital filters **(10 Lec)**
Fixed point arithmetic, effect of quantization of the input data due to Finite word length, Product round off, need for scaling; Zero input limit cycle oscillations: Limit cycle oscillations due to overflow of adders, Table look up implementation to avoid multiplications.

Unit 4 Two Dimensional Signal Processing **(8 Lec)**
Introduction of two dimensional signal properties and their operations, Convolution, Two dimensional Z-Transform, Two Dimensional DFT, Two dimensional windows, Two dimensional FIR filter design

Unit 5 Introduction to Multirate Signal Processing and DSP Processors **(10 Lec)**
Multirate Digital Signal Processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Frequency domain characterization of Interpolator and Decimator; Polyphase decomposition;
Features of DSP processors - DSP processor packaging (Embodiments)- Fixed point v/s floating point DSP processor data paths - pipelining - TMS320 family of DSPs (architecture of C5x)- Memory architecture of a DSP processor (Von Neumann - Harvard) - Addressing modes.

Textbooks/References

1. John G Proakis and Dimitris C Manolakis, Digital Signal Processing Principles,Algorithms and Applications, Pearson Education, 3rd Edition, 2006
2. Sanjit K Mitra, Digital Signal Processing - A Computer based approach, Tata McGrawHill, New Delhi, 2001
3. Oppenheim & Schafer, Digital Signal Processing, PHI (latest edition).
4. Alan V Oppenheim, Applications of Digital Signal Processing, Prentice hall Inc.,Englewood Cliffs, New Jersy (1978).

Science and Technology of Semiconductors Lab- 5 (EL-307)

Course Objectives:

*EL-307.*CO1	To study various characterization techniques and using them to calculate various parameters.
*EL-307.*CO2	To learn spin-coating techniques and deposit thin film of nanomaterials.
*EL-307.*CO3	To learn various deposition techniques involving deposition of thin films for semiconductor devices
*EL-307.*CO4	To study the thin films with the help of UV-visible and photoluminescence spectroscopy
*EL-307.*CO5	To study the morphology of deposited thin films though scanning electron microscopy

Experiments:

1. To deposit thin film using spin coating techniques.
2. To characterize material using UV- visible spectroscopy.
3. To characterize material using photoluminescence spectroscopy.
4. To characterize material using X-ray Diffraction.
5. To observe the morphology of material using scanning electron microscopy
6. to understand the working of thermal evaporation method for the deposition of thin films.

Communication (Electronics) Lab -6 (EL-308)

Course Objectives:

*EL-308.*CO1	Learning to modulate and demodulate an input wave through AM and FM.
*EL-308.*CO2	Learning the generation and reception of SSB-AM
*EL-308.*CO3	Learning to modulate and demodulate an input wave through DSBSC
*EL-308.*CO4	Learning different modulation techniques like PWM, PPM and PAM
*EL-308.*CO5	Learning digital modulation technique – FSK and TDM-PCM.

Experiments:

1. To study the amplitude modulation / Demodulation.
2. To study the modulation / Demodulation of Double sideband suppress carrier.
3. To study the modulation / demodulation of SSB.
4. To study the frequency shift keying(FSK).
5. To study phase shift keying (PSK).
6. To study pulse Code Modulation / Demodulation.
7. To study pulse amplitude modulation / Demodulation.
8. To study Frequency modulation and demodulation.
9. To study the pulse width modulation /demodulation.
10. To study the PPM modulation and demodulation.

M.Sc Electronics 4th Semester

VLSI Circuit Design and Device Modeling (EL-401)

Course Objectives:

EL-401.CO1	To insist the basics of MOS transistor and to implement various gates using it.
EL-401.CO2	To study basic MOS circuits and major limitation to their performance
EL-401.CO3	To learn the characteristics of MOS inverters and their different designs
EL-401.CO4	Learning the fabrication of MOS transistors
EL-401.CO5	To learn VHDL and to use it to model different circuits

UNIT 1 **(10 Lec)**

Introduction to IC technology, MOS and related VLSI technology, Basic MOS transistors – Enhancement and Depletion mode, n MOS fabrication process, CMOS fabrication – n-well, p-well and twin tub process, Latch up in CMOS,
MOS transistor as switch, CMOS inverter, 2 input CMOS NAND and NOR gates, Complementary CMOS logic design – Pull Up Networks (PUN) and Pull Down Networks (PDN), Implementation of an arbitrary function using complementary logic.

UNIT 2 **(15 Lec)**

Basic MOS Circuits: I – V relationship, , The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET), MOSFET Current Voltage Characteristics: Gradual Channel approximation Channel length modulation.
MOSFET Scaling and Small-Geometry Effects: Full Scaling (Constant Field Scaling),
Constant-Voltage Scaling, Short-Channel effect, Narrow-Channel effect.
MOSFET Capacitances: Oxide related capacitances, junction capacitances.

UNIT 3 **(10 Lec)**

MOS Inverter Static characteristics: Voltage transfer characteristics (VTC), Resister load inverter, Power consumption and chip area,
Inverter with n-type MOSFET load, CMOS inverter, Design of CMOS Inverters, Supply voltage scaling in CMOS inverters

UNIT 4 **(10 Lec)**

Crystal growth, crystal structure, crystal defects, raw materials and purification, electronic grade silicon, Czochralski crystal growth methods, Wafer preparation and specifications, Basic concepts, manufacturing methods and equipment, Measurement methods.
Photolithography, Light sources, Photo resists, Wet and Dry oxidation, growth kinetics,
Diffusion, Ion implantation, epitaxial growth, deposition of dielectrics and metals commonly used in VLSI, Wet etching, Plasma etching, Etching of materials used in VLSI, Contacts.

UNIT 5 **(15 Lec)**

Introduction to Verilog HDL, hierarchical modeling concepts, Lexical conventions, data types, system tasks and compiler directives, modulus and ports, variable, arrays, tables, operators, expressions, signal assignments, nets, registers, concurrent & sequential constructs, tasks & functions
Gate-level, Dataflow and behavioral modeling using Verilog HDL, , switch level modeling.

Textbooks/References

1 . D. S. Pucknell & K. Esharghian, Basic VLSI Design, Third Edition, Prentice Hall, 2000.
2. Neil H. E. Weste & Kamram Eshraghian, Principles of CMOS VLSI Design, 2/e, Pearson Education.
3. S. M. Kang & Y. Leblebigi, CMOS Digital Integrated Circuits - Analysis and Design, 2/e,McGraw Hill.
4. Samir Palnitkar , Verilog HDL -A guide to Digital Design and Synthesis,SunSoft Press 1996.
5. Ming-Bo Lin, Introduction to VLSI Systems-A Logic, Circuit, and System Perspective,CRC Press.