SYLLABUS FOR THE

MASTER OF SCIENCE in ELECTRONICS

(Two-Year Full Time Programme)

Rules, Regulations and Course Content
(Choice Based Credit System)

Department of Electronics
Faculty of Science
Deen Dayal Upadhyay Gorakhpur University

Gorakhpur-273009

(2019)

Ordinance of M.Sc. (Electronics)

1. There shall be M.Sc. Course in Electronics under the Department of Electronics, Faculty of Science, D.D.U. Gorakhpur University.

2. **Duration of Course**: The duration of M.Sc. Electronics programme is two years: each year comprising of two semesters.

3. **Eligibility:** B.Sc. (3-year course) degree of any Indian University with Electronics or Physics as a subject in the third year. Applicants whose B.Sc. results are awaited may also appear in the entrance test. However, they will have to submit the mark sheet at the time of admission.

4. **Admission** is done through an admission test. The medium of test is English only. Syllabus of the test includes theory papers of B.Sc. Physics 1st,2nd, and 3rd year as well as B.Sc. Electronics 1st,2nd, 3rd year of this university.

5. **The Number of Seats:** The number of students admitted to the course shall be 15. Out of this 11 seats shall be filled from the students offering Electronics and Physics in their B.Sc. 3rd year and 4 seats shall be filled by candidates offering Physics and Mathematics/ Physics and Chemistry/ Physics and Computer Science in their B.Sc. 3rd year.

6. **Reservation:** As per the rules and regulations of D.D.U. Gorakhpur University.

7. Admitted candidates shall obey the general rules and regulations of the university.

8. **Fee Structure:** In addition to the regular fee prescribed by the University, a fee of Rs 10,000/- (Rs Ten Thousand) per semester will be taken, in the form of DD in favor of " M.Sc. Electronics A/C, Gorakhpur", from the admitted candidates in this course. This additional fee will be used for contingent expenses, guest faculty lectures and for providing lab facilities in other institutions. The account of this additional fee will be maintained separately by the university and will be operated by Head, Department of Electronics and Finance Officer.

Program Specific Outcomes of M.Sc. Electronics:

1. To develop an ability to apply knowledge in design and development of various Electronic/Electrical System.

2. To develop comprehensive understanding of the entire range of electronic devices, analog and digital circuits with added state-of art knowledge on advanced electronic systems.

3. To provide knowledge and exposure on different DSP systems for industrial applications.

4. To develop in-depth knowledge of Control system Design, Communication System Analysis to pursue a career in the communication, Control & Instrumentation sector.

5. To develop good knowledge in microprocessors/microcontrollers, data structures, computer programming and simulation software.

6. To provide in depth concept of IC technology and VLSI design together with Hardware Descriptor Language and Nanoelectronics.

7. To develop the ability to systematically carry out projects related to Electronics/Electrical systems.

8. To develop the ability to participate as members in various professional bodies as well as multidisciplinary design teams.

9. To develop the ability to choose and apply appropriate resource management techniques so as to optimally utilize the available resources.

10. To develop the confidence to apply engineering solutions with professional, ethical and social responsibilities.

Scope of Employment

- Opportunities in Electrical/ Electronic System Design/Development.
- Options to pursue M.Tech. / MS / Ph.D.
- Opportunities in various national level competitive examinations such as Engineering Services Examination, NET, GATE, Scientific Organizations /Academic Institutions, carrier opportunity in various MNCs in the field of hardware/software design, simulations & testing etc.

Course Structure

1. There shall be four theory papers and laboratory course in each of first three semesters. The fourth semester will be entirely devoted to major project work of six months duration.
2. In each laboratory course the candidates, besides the classroom experiments, shall do mini project, workshop and seminar.

M.Sc. Previous (Electronics)

(Effective from Session 2019-2020)

The M.Sc. Previous (Electronics) examination will consist of two semesters, called as first and second semesters. Semester examinations will be held in the months of December and May respectively. In each of these semester examinations, there will be four compulsory papers. Each paper will be of three hours duration (maximum marks70), except where stated otherwise. Besides this, there will be an internal evaluation consisting of 30 marks in each paper based on following parameters:

1. Attendance	10 Marks
2. Class Test/Assignment	10 Marks
3. Seminar	10 Marks

Semester I

Theory

Paper Code	Title	Type	Marks	Credit
ELE101	Network Analysis and Synthesis	Core Course	100	4
ELE102	Devices and Linear Integrated Circuits	Core Course	100	4
ELE103	Switching Theory and Digital Design	Core Course	100	4
ELE104	Introduction to Computer and Programming	Core Course	100	4
	Total		400	16

Practical

Paper Code		Marks	Credit
ELE105	Lab Course I: Analog and Digital Electronics Lab	100	4
	Lab Course II: Programming in ‘C’	100	4
ELE 106	Mini Project and Seminar	25	1
	Total	225	9

Semester II

Theory

Paper Code	Title	Type	Marks	Credit
ELE201	Control System and Data Acquisition System	Core Course	100	4
ELE202	Electromagnetic Theory and Antenna	Core Course	100	4
ELE203	Advanced Microprocessor and Interfacing	Core Course	100	4
ELE204	Digital Communication	Core Course	100	4
	Total		400	16

Practical

Paper Code		Marks	Credit
ELE205	Lab Course III: Experiments on Control System, Data Acquisition System, Communication System, and Power Electronics	100	4
	Lab Course IV: Experiments on Microprocessor (8085 & 8086), Microcontroller and its Interfacing	100	4
ELE 206	Mini Project and Seminar	25	1
	Total	225	9

M.Sc. Final (Electronics)

(Effective from Session 2020-2021)

The M.Sc. Final (Electronics) examination will consist of two semesters, called as third and fourth semesters. The examination of third semester will be held in the months of December. In third semester examination, there will be three compulsory papers and one elective paper. Each paper will be of three hours duration (maximum marks70), except where stated otherwise. Besides this, there will be an internal evaluation consisting of 30 marks in each paper based on following parameters:

1. Attendance 10 Marks
2. Class Test/Assignment 10 Marks
3. Seminar 10 Marks

Semester III

Theory

Paper Code	Title	Type	Marks	Credit
ELE301	IC Technology and VLSI Design	Core Course	100	4
ELE302	Opto-Electronics	Core Course	100	4
ELE303	Digital Signal Processing	Core Course	100	4
Any one from the following (E-1, E-2, E-3, E-4, E-5)				
ELE304 E-1	Data Communication and Computer Networking	Elective Course	100	4
ELE304 E-2	Nanoelectronics	Elective Course	100	4
ELE304 E-3	Digital Image Processing	Elective Course	100	4
ELE304 E-4	Embedded System Design	Elective Course	100	4
ELE304 E-5	Hardware Description Languages	Elective Course	100	4
	Total		400	16

Practical

Paper Code		Marks	Credit
ELE305	Lab Course V: Experiments on Digital Signal Processing (MATLAB Simulation) and Experiment on VLSI	100	4
	Lab Course VI: Experiments on Opto-Electronics and experiments on selected Elective course.	100	4
ELE 306	Mini Project and Seminar	25	1
	Total	225	9

Semester IV

There will be no theory paper in fourth semester. The students are required to do a full time major project work for duration of six months in the institution assigned to them by Department. The examination and credit system will consists of the following:

	Paper	Marks	Credit
ELE-401	A Major Project Work	425	17
ELE-402	Seminar and Viva-Voce Relating to Major Project Work	100	4
ELE-403	A General Seminar other than the Major Project Work	100	4
	Total	625	25

Master of Science in Electronics
Teaching Work Load per Week

Class	Theory Paper/ Practical	Teaching Scheme				Credits
		Lecture L	Tutorial T	Practical P	Total	
M.Sc. I For One semester	I	3	1		4	4
	II	3	1		4	4
	III	3	1		4	4
	IV	3	1		4	4
	Pract I			8	8	4
	Pract II			8	8	4
	Seminar	2			2	1
	Total	18		16	34	25

Class	Theory Paper/ Practical	Teaching Scheme				Credits
		Lecture L	Tutorial T	Practical P	Total	
M.Sc. II For One semester	I	3	1		4	4
	II	3	1		4	4
	III	3	1		4	4
	IV	3	1		4	4
	Pract I			8	8	4
	Pract II			8	8	4
	Seminar	2			2	1
	Total	18		16	34	25

DETAILED SYLLABUS OF M.Sc. ELECTRONICS

SEMESTER – I

ELE101 : NETWORK ANALYSIS AND SYNTHESIS **Credit 4 [L = 3, T = 1]**

Course Objective:

1. To develop knowledge of basic circuital law and simplify the network using reduction techniques
2. Analyze the circuit using Kirchhoff's law and Network theorems
3. Infer and evaluate transient response, Steady state response, network functions using transformation techniques.
4. Develop understanding of frequency domain analysis of different networks.
5. Synthesis of one port and two networks.

Unit I [12 contact hours]

Network Analysis: Circuit elements, Passive and Active circuit elements, concept of ideal voltage and current sources, graph theory, KCL, KVL, node/ cut set, mesh/ tie-set analysis, Transient response of DC and AC networks: Differential equation approach (first and higher order differential equations), initial conditions in networks. Laplace Transformation: Introduction to the Laplace transform approach, partial fraction expansion, Heaviside's expansion theorem, Relation between impulse response and system function.

Unit II [12 contact hours]

Network Theorems: Principle of Superposition, Tellegen's, Thevenin, Norton, Millman and Maximum Power transfer theorem, T, π and L circuits.

Unit III [12 contact hours]

Two Port Networks: Two port parameters, Relationship of two port variables, Short circuit admittance parameter, the open circuit impedance parameter, transmission parameter, the h–parameters, Relationship between parameter sets, interconnections of two–port networks.

Unit IV [12 contact hours]

Frequency Domain Analysis: Frequency domain analysis of RLC circuits, Phase diagram, magnitude of phase response curve in s–plane; poles and zeros, relation between location of poles, time response and stability, frequency response and bode plots, interrelation between frequency response and time response, convolution integral.

Unit V [12 contact hours]

Network Synthesis: Positive real function, Hurwitz polynomials, reliability condition of network, Synthesis of one port network,Synthesis of LC, RC and RL network , Foster and Cauer forms; Two port synthesis by ladder network.

Course Outcomes

Learner can:

CO 1: apply the knowledge of basic circuital law and simplify the network using reduction techniques

CO 2: analyze the circuit using Kirchhoff's law and Network simplification theorems

CO 3: infer and evaluate transient response, Steady state response, network functions

CO 4: evaluate two-port network parameters.

CO 5: synthesize one port network using Foster and Cauer Forms.

CO 6: This course prepares learner for various national level competitive examination.

Books recommended:

1) Network Analysis and Synthesis by Franklin F. Kuo
2) Network Analysis by M.E. Valkenberg
3) Network Synthesis by M.E. Valkenberg
4) Network and System by D. Roy Choudhury
5) Network Analysis by Atre
6) A Course in Electrical circuit Analysis by Soni& Gupta

ELE 102 : DEVICES AND LINEAR INTEGRATED CIRCUITS   Credit 4 [L = 3, T = 1]

Course Objective:

1. Review of basic concepts of semiconductor physics and devices.
2. To develop in-depth knowledge of operational amplifier and its applications.
3. Knowledge of analog arithmetic circuits.
4. Analysis & Synthesis of various analog wave generators and different analog MUX and DEMUX.
5. To understand the basic concepts of IC OTA .

Unit I [12 contact hours]

Semiconductor Physics: Basic features of metals, Semiconductor, Insulator, energy band/E-k diagram, degenerated and non-degenerated semiconductor, Drift and diffusion currents, Continuity equation.

Unit II [12 contact hours]

Semiconductor Devices: P-N junction: barrier potential, depletion width, I-V characteristics and junction capacitance, Transistor:structure, characteristics and parameters, Ebber–Moll model, JFET, MOSFET, CMOS, C–V characteristics.

Unit III [15 contact hours]

Operational Amplifier: Op-Amp fundamentals (brief review of differential amplifier, current mirror, active load, level shifter, output stage, ac and dc characteristics). Basic building blocks using Op-Amps; Inverting/ Non-inverting VCVS, Integrator, Differentiators, CCVS and VCCS, Instrumentation Amplifiers, Active Filter (LP, HP, BP and Notch); Oscillators; Voltage regulators: Op-Amp regulators, IC regulators, Fixed voltage regulators (78/79XX), 723 IC regulators (Current limiting, Current foldback); SMPS; IC Timer (555) applications; Phase Locked Loop (PLL): Principle, Definition and Applications.

Unit IV [12 contact hours]

Logarithmic Amplifiers: Log/ Antilog Modules, Precision rectifier, Peak detector, Sample and Hold (S/H) circuits, Op-Amp as comparator, Schmitt Trigger, Square and Triangular wave generator, Multivibrator, IC Analog multiplier application, Analog Multiplexer and Demultiplexer.

Unit V[09 contact hours]

IC OTA: Basic Building Blocks using OTA, Electronically Programmable Functional Circuit examples.

Course Outcomes

Learner can:

CO 1: apply the knowledge of basic semiconductor material physics.

CO 2: analyze the characteristics of various electronic devices like diode, transistor etc., and able to classify and analyze the various circuit configurations of Transistor and MOSFETs. Illustrate the qualitative knowledge of Power electronic Devices

CO 3: infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques. Elucidate and design the linear and non-linear applications of an OPAmp and special application ICs

CO 4: illustrate the function of application specific ICs such as Voltage regulators, OTA, PLL and its application.

Books Recommended:

1) Physics of Semiconductor Devices by S.M. Sze
2) Transistor by D.L. Croissete
3) Integrated Electronics by Millman and Halkias
4) Electronics Devices and Circuit Theory by R.L. Boylestad& L. Nasheisky
5) Op-Amp and Linear Integrated Circuits by Ramakant A. Gayakwad.

ELE103 : SWITCHING THEORY AND DIGITAL DESIGN **Credit 4 [L = 3, T = 1]**

Course Objective:

1. To review basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
2. To implement logical operations using combinational logic circuits
3. To design sequential logic circuits and to understand faults and hazards therein.
4. Design of sequential circuits and analysis of sequential systems in terms of state machines and implementation of synchronous state machines using flip-flops.
5. To review the concept of microprocessor.

Unit I [09 contact hours]

Review of Introductory Concepts: Switching Networks, Number system and inter-conversion,Review of Logic Families, Boolean Algebra and its application, Positive and Negative Logic, Minterm and Maxterm, 5 and 6 variable K-Map Reduction.

Unit II [12 contact hours]

Analysis and Design of Combinational Circuit: Realization of Boolean functions using two level NAND-NAND, NOR-NOR logic, multiplexers, decoders, ROM, PLA; Interfacing of logic families: open- collector, totem-pole and tri-state outputs, TTL-CMOS interfacing, CMOS-TTL interfacing, loading rules, fan-out.

Unit III [15 contact hours]

Analysis and Design of Sequential Circuit:State diagrams, characteristic equations of different flip-flops, conversion from one type to anothertype of flip flops, State Machine:Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, Sequencedetector. Introduction to Algorithmic state machines-construction of ASM chart and realization forsequential circuits.

Unit IV [09 contact hours]

Fault Diagnosis and Hazards: Fault detection and fault location of single fault by fault table method, Path sensitizing method, method of Boolean difference and SPOFF method, Two level circuit fault detection and multilevel circuit fault detection.

Unit V [15 contact hours]

Microprocessor Architecture and System Operation: Architecture of a basic microcomputer, some general microprocessor system concepts: I/O ports and buses, internal architecture of a microprocessor, Microprocessor fetches, decode, execute cycle memory mapped and I/O mapped ports, I/O controls.

Course Outcomes

Learner can:

CO 1: manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, gray, and BCD.

CO 2: solve Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.

CO 3: design and analyze combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.

CO 4: design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.

CO 5: understand function of Microprocessor.

Books Recommended:

1) Fundamentals of Logic Design by Charles H. Roth
2) Digital System Design and Microprocessor by John P Hayes
3) Digital Fundamental by Floyd
4) An Engineering Approach to Digital Design by William I. Fletcher
5) Digital Design by M. Morris Mano
6) Digital Logic and Computer Design by M. Morris Mano

ELE104 : INTRODUCTION TO COMPUTER &PROGRAMMING Credit 4 [L = 3, T = 1]

Course Objective :

1. Knowledge of organization of computer system and to create algorithms to solve simple programming problems..
2. Design, implement, test and debug C programs that use loops and arrays.
3. Design, implement, test and debug C programs that use functions.
4. Design, implement, test and debug C programs that use arrays for character strings and that use pointers for character strings.
5. Analyze programming problems to choose when regular loops should be used and when recursion will produce a better program.
6. Design, implement, test and debug programs that use different data types, such as simple variables, arrays, and structures.

Unit I [09 contact hours]

Overview: Introduction to computer based problem solving, requirements of problem solving by computer, problem definition, problem solving strategies, program and algorithm, construction of loops, Basic programming constructs, Programming language classification: Machine language, Assembly language, high level language, assemblers, compilers, interpreters.

Unit II [15 contact hours]

An Overview of C: The origin of C language, middle level language, structure of C language, storage class specifiers and data types, constructs and variables, declaration of variables, operator and expression.

Program Control Statements: True and False in C, C Statements, conditional statements, if switch, for, while, do-while, break, exit(), continue, labels and goto.

Basic I/O: Formatted input/ output, unformatted input/ output.

Functions: return statements, local and global variables, scope rule of functions, function arguments, arguments to main(), parameter passing – call by value, call by reference, function prototypes, call function with array, recursion, implementation issues.

Arrays: Array declaration, one and two dimensional arrays, multidimensional arrays.

Unit III [12 contact hours]

Advance Features in C: Pointers, pointer variables, pointer operators, pointer expression, near, far and hige pointers, dynamic allocation function – malloc(), free(), calloc(), alloca(), realloc(), Initializing pointers, pointers to function, pointers and arrays.

Structures, Unions and User defined variables: Basic of structures, declaration of a structure, array of structure, passing structure to function, structure pointer, array structure within structure, Bitfield, Union declaration, enumeration, typedef.

Unit IV [12 contact hours]

File management: Stream and files, console I/O, File pointer, file management functions fseek(), Iseek() and random access files.

The Preprocessors: #define, #error, include, conditional compilation, #undef, #line, #pragma, #and ##preprocessors, predefined macro names.

Unit V [12 contact hours]

Memory models, ROM, BIOS and direct access color graphics: The 8086 family of processors, address calculation, memory models, segment specifiers, a memory display and change programs, register for passing arguments to BIOS routines, function int86(), some function using BIOS routines, the PC video adopters and models of operations, the text screen functions, graphic function.

Course Outcomes:

Learner can:

CO 1: implement the algorithms and flowcharts for solving Mathematical and Engineering problems.

CO 2: demonstrate an understanding of computer programming language concepts with development of C program.

CO 3: design and develop C programs, analyzes, and interprets the concept of pointers, declarations, initialization, operations on pointers and their usage. Able to define data types and use them in simple data processing applications also learner must be able to use the concept of array and structures.

CO 4: define union and enumeration user defined data types. Develop confidence of self learning ability needed for different Computer language.

Books Recommended:

1) Programming with ANSI and Turbo C by Kamthane
2) Let Us C by YashwantKanitkar
3) C – How to Program by Deitel
4) The C Programming Language by Ritchie

ELE 105: Practicals Credit 9 [P = 16, T = 2]

Lab Course I [8 Contact hours]

1. Experiments on Network Theorem.
2. Experiments on Network Synthesis.
3. Experiments on OP-AMP.
4. Experiments on Electronic Devices
5. Experiments on Combinational logic Design
6. Experiments on Sequential Logic Design

Lab Course II [8 Contact hours]

1. Engineering Drawing
2. Application of Microsim.
3. Experiments on C Language.

SEMESTER – II

ELE 201 : CONTROL SYSTEM AND DATA ACQUISITION SYSTEM Credit 4 [L = 3, T = 1]

Course Objective:

1. Analysis of different types of control system and identify a set of algebraic equation to represent and model complicated control system in simplified form.
2. Employ time domain analysis to predict and diagnose transient performance parameters of control system for standard input functions.
3. Formulate different types of analysis in frequency domain to explain the nature of stability of the system.
4. To understand the operation and applications of PID System.
5. Knowledge of data acquisition system and different forms of signal conditioning, different methods of A/DI and D/A conversion.

Unit I [12 contact hours]

Input/ Output Relationship: Introduction to open loop and closed loop control system, Mathematical representation of Physical Systems, Transfer Function, Block diagram and its reduction, Signal flow graph, Reduction Algebra, Mason's gain formula.

Unit II [12 contact hours]

Time– Domain Analysis: Test input signal for transient analysis, Time domain performance criterion, Transient response of first order, second order and higher order systems, Error analysis: Static and dynamic error coefficients, Error criterion, Introduction to system optimization.

Unit III [12 contact hours]

Frequency Domain Analysis: Polar and inverse polar plots, Bode – Plot, Frequency domain specifications, Relative stability: Gain margin and Phase margin, correlation with time domain, M and N circles, Stability Theory: Concept of stability, Asymptotic and conditional stability, Routh- Hurwitz criterion, Nyquist Stability criterion, Root locus plots.

Unit IV [12 contact hours]

PID System: Proportional, Integral and Derivative control, PI, PID control, Compensation technique: Concept of Lag, Lead, Lag and Lead Networks, Design of closed loop systems using compensation technique.

Unit V [12 contact hours]

Data Acquisition System: Operation and application of sensors; Temperature, Pressure, Flow, Level etc. Analog signal acquisition and conditioning, Analog switches and Multiplexers, Sample and Hold, Digital to analog and Analog to digital converters.

Course Outcomes:

Learner can:

CO 1: Translate physical phenomena into corresponding mathematical descriptions, and application of appropriate tools to analyze the behavior of systems.

CO 2: deploy graphical tools to analyze and design control systems in time-domain.

CO 3: understands that the frequency domain is a complementary point of view, and learns to design control systems in frequency-domain.

CO 4: implement modern Data Acquisition system.

Books Recommended:

1) Automatic Control System by B.C. Kuo
2) Modern Control Engineering by K. Ogata
3) Control System Engineering by I.J. Nagrath
4) Modern Control System by Doff and Bishop
5) Modern Electronic Instrumentation and Measurement Technique by Cooper

ELE202: ELECTROMAGNETIC THEORY AND ANTENNA Credit 4 [L = 3, T = 1]

Course Objective:

1. Knowledge of basic mathematical concepts related to electromagnetics.
2. Understanding the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.
3. Apply Maxwell's equations to solutions of problems relating to transmission lines and uniform plane wave propagation.
4. To understand the EM wave propagation in wave guide and different modes of propagation through it.
5. Define various antenna parameters and analyze and evaluate radiation patterns of antennas for given specifications.
6. Illustrate techniques for antenna parameter measurements and discuss radio wave propagation.

Unit I [12 contact hours]

Electromagnetics: Continuity equation, Displacement current, Maxwell's equation, Boundary conditions, Plane wave equation and its solution in conducting and non-conducting media, Phasor notation, Phase velocity, Group velocity, depth of penetration, Conductors and Dielectrics, Impedance of conducting medium, Polarization, Reflection and refraction of plane wave at plane boundaries, Poynting vector and Poynting Theorem.

Unit II [12 contact hours]

Transmission Line: Propagation of EM wave through Line, Differential equation of the line and their steady state solution; Distortion –less lines, Input impedance of a lossless line, Open and short circuited lines, Reflection coefficient and Standing Wave Ratio; Smith chart and their uses; Impedance matching.

Unit III [12 contact hours]

Wave Guide: Propagation of EM wave through waveguide, Wave equation and its solution for boundary medium, Propagation characteristics of TE and TM mode in rectangular wave guide, Idea of circular wave guide, Waveguide components.

Unit IV [12 contact hours]

EM Wave Propagation through Free Space: Ground wave propagation, Surface and space wave propagation, Sky wave propagation, Ionosphere, Virtual heights, Critical frequency of layers, Skip distance and maximum usable frequency, Abnormal Ionospheric behavior.

Unit V [12 contact hours]

Antenna: Radiation from an oscillating current element, Short monopole and dipole, Half wave dipole, Radiation pattern, Power radiated, Radiation resistance, Isotropic radiator, Directive gain, Power gain, Efficiency, Effective area, Effective length, Band width, Beam width and Polarization, Directional patterns, Directives, Effective length, Antenna impedance; Uniform arrays-Broadside, End-Fire, Pattern multiplication. VHF and UHF antennas: Folded dipoles, Yagi, Corner reflector. Microwave antennas: Parabolic reflector, feed system, Lens antennas.

Course Outcomes:

Learner can

CO 1: derive and discuss the Maxwell's equations.

CO 2: be expected to be familiar with Electromagnetic wave propagation and wave polarization

CO 3: classify the Guided Wave solutions -TE, TM, and TEM, analyze and design rectangular waveguides and understand the propagation of electromagnetic waves.

CO 4: analyze the transmission lines and their parameters using the Smith Chart.

CO 5: apply the knowledge to understand various planar transmission lines.

CO 5: select the appropriate portion of electromagnetic theory and its application to antennas. Antenna arrays and mathematically analyze the types of antenna arrays.

Books Recommended:

1) Electromagnetic waves and Radiating System by E.C. Jorden, D.G. Balmein
2) Engineering Electromagnetics by W.H. Hayt
3) Antenna Theory by Krauss
4) Electromagnetics by J.F.D. Krauss

ELE 203: ADVANCED MICROPROCESSOR AND INTERFACING Credit 4[L = 3, T = 1]

Course Objective:

1. Explain the architecture, pin configuration of 8086/8088 microprocessors and Interfacing ICs .
2. Identify various addressing modes and assembly language programming techniques to perform various microprocessor based programs.
3. Apply the concepts of 8086 programming like interfacing, interrupts, stacks & subroutines.
4. Concepts of 8051 microcontroller programming
5. Interpret & solve various automation based problems using microprocessor and microcontroller.

Unit I [12 contact hours]

Introduction to Microprocessors: Evolution of microprocessors, Register structure, ALU, Bus organization, Timing and control, Architecture: Architecture of 8086/ 8088, Intel organization, Bus cycle.

Unit II [12 contact hours]

Assembly Language Programming: Addressing modes, Data transfer instructions, Arithmetic and logic instructions, Program control instructions (Jumps, Conditional jumps, Subroutine call), Loop and String instructions, Assembler Directives, Parameter passing and Recursive procedures.

Unit III [12 contact hours]

CPU Module Design: Signal descriptions of pins of 8086 and 8088, Clock generation, Address and data bus, Demultiplexing; Memory organization, Read and write cycle, Timing, Interrupt structures, Minimum mode CPU module, Maximum mode operation (Coprocessor configuration), Features of numeric processor 8087.

Unit IV [15 contact hours]

Interfacing: Programmed I/O, Interrupt driven I/O, DMA, Parallel I/O (8255-PPI), Serial I/O (8251/ 8250, RS-232 Standard), 8259 – Programmable Interrupt Controller, 8237 DMA controller, 8253/ 8254 – Programmable Timer/ Counter, A/D and D/A conversion.

Unit V [09 contact hours]

Advanced Microprocessor and Microcontrollers: Architecture and application of 8051 microcontroller,Protected mode memory addressing, Protected virtual addressing mode (PVAM), architecture, Special features and overview of 80286, 80386 and 80486, Pentium Pro processors, Superscalar architecture, MMX (Multimedia Extension) and SIMD (Single Instruction Multiple Data) technology.

Course Outcomes :

Learner can

CO 1: identify a detailed s/w & h/w structure of the Microprocessor.

CO 2: illustrate how the different peripherals (8255, 8253 etc.) are interfaced with Microprocessor.

CO 3: distinguish and analyze the properties of Microprocessors & Microcontrollers.

CO 4: analyze the data transfer information through serial & parallel ports.

CO 5: understand feature of microcontroller and its application to real time system.

Books Recommended:

1) Advanced Microprocessor and Interfacing by D.V. Hall
2) Microprocessor Systems: The 8086/ 8088 family Architecture, Programming and Design by Yu-Chehg Liu and Gibson
3) The Intel Microprocessor Architecture Programming and Interfacing by Barry B Brey
4) The 8051 Microcontroller by Ayala

ELE 204: DIGITAL COMMUNICATION **Credit 4 [L = 3, T = 1]**

Course Objective :

1. Knowledge of statistical theory of communication and explain the conventional digital communication system.
2. Apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise.
3. Describe and analyze the digital communication system.
4. Design as well as conduct experiments, analyze and interpret the results to provide valid conclusions for digital modulators and demodulator using hardware components and communication systems using CAD tool.
5. To elaborate the concept of Information theory and coding

Unit I [12 contact hours]

Signal Representation: Time domain and frequency domain representation, Fourier series and Fourier transform, Numerical computation of FT, Properties of Fourier transform; Linearity, Symmetry, Folding, Delay, Frequency shift. Cosine and Sine transform, Transforms of derivatives, Convolution theorem, Dirac Delta function, energy signal and Power signal, Energy spectral density, Power spectral, Cross – correlation, Auto – correlation function, Parseval's theorem.

Unit II [12 contact hours]

Noise: External and internal source of noise, Voltage and current models of a noisy resistor, Calculation of thermal noise in RC circuit, Shot noise, Noise figure, Noise temperature, Equivalent noise bandwidth, Calculation of noise figure for the cascaded network. Review of Analog Communication System: Amplitude and Angle Modulation, Noise in DSB-Sc, SSB-SC and AM system, Noise in FM and PM, FM Threshold and its extension, Pre – Emphasis and De – Emphasis in FM.

Unit III [12 contact hours]

Digital Modulation System: Sampling Theorem, Signal reconstruction in Time Domain, Practical and flat-top sampling, sampling of band pass signal; types of analog pulse modulation, method of generation and detection of PAM, PWM and PPM, spectra of pulse modulated system; Discretization in time and amplitude, Linear quantizer, Quantization noise power calculation, Signal to quantization noise ratio, non-uniform quantizer, A-law and μ law companding; Encoding and Pulse Code Modulation, Band width of PCM, DPCM, DM, Idling noise and slope overload, ADM, Adaptive DPCM.

Unit IV [12 contact hours]

Digital Modulation Technique:: Fundamental of TDM, Electronic Commutator, Types of Digital Modulation, Waveform for ASK, FSK, and PSK, Differential Phase Shift Keying, QPSK and MSK.

Unit V [12 contact hours]

Information Theory: Concept of Information Measure, Entropy andInformation rate, conditional entropy and redundancy, Source coding, Fixed and variable length codes, Source coding theorem, Shannon–Fano and Huffman coding for 1^{st}, 2^{nd} and 3^{rd} order extension, Mutual information and channel capacity of discrete memory less channel, Hartley – Shannon Law.

Course Outcomes

Learner can:

CO 1: apply the knowledge of statistical theory of communication and explain the conventional digital communication system.

CO 2: apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise.

CO 3: apply the knowledge of digital electronics and describe the error control codes like block code, cyclic code.

CO 4: describe and analyze the digital communication system with spread spectrum modulation.

CO 5: design as well as conduct experiments, analyze and interpret the results to provide valid conclusions for digital modulators and demodulator using hardware components and communication systems.

Books Recommended:

1) Modern Analog and Digital Communication by B.P. Lathi
2) Principle of Communication System by Taub and Schilling

3) Communication System by Haykin
4) Electronic Communication System by W. Tomasi
5) Digital Communication by J. G. Prokis
6) Electronic Communication System by J. F. Kennedy
7) Digital Communication by Simon Haykin

ELE 205: Practicals Credit 9 [P = 16, T = 2]

Lab Course III [8 Contact hours]

1. Experiments on Control System.
2. Experiments on Digital Communication.
3. Experiments on Data Acquisition System.
4. Experiments on EM Theory and Antenna.
5. Experiments on Power Electronics.
6. Experiments on application of Labview to Control System.
7. Experiments on application of MATLAB to Communication System.

Lab Course IV [8 Contact hours]

1. Experiments on Microprocessor (8085 & 8086) and its Interfacing.
2. Experiments on TurboAssembler.
3. Experiments on Microcontroller.
4. Experiments on Embedded System.

M.Sc.Final Year

SEMESTER – III

ELE301: IC TECHNOLOGY AND VLSI DESIGN **Credit 4 [L = 3, T = 1]**

Course Objective:

1. Understand the steps of IC fabrication, Crystal Growth and Wafer Preparation.
2. Study the Epitaxy, Diffusion, Oxidation, Lithography, Etching and metallization.
3. Understanding the basic Physics and Modelling of MOSFETs and basics of Fabrication and Layout of CMOS Integrated Circuits.
4. Study and analyze the performance of CMOS Inverter circuits on the basis of their operation and working.
5. Study CMOS OPAmp & its design.

Unit I [12 contact hours]

Introduction to IC Technology:Basic fabrication steps and their importance. Environment of IC Technology: Concepts of clean room and safety requirements, Wafer cleaning processes, Etching techniques. Impurity Incorporation: Solid State diffusion modeling and technology; Ion Implantation modeling, technology and damage annealing, characterization of Impurity profiles.

Unit II [15 contact hours]

IC Fabrication Process: Kinetics of Silicon dioxide growth both for thick, thin and ultra thin films, Oxidation technologies in VLSI and ULSI, Characterization of oxide films, High k and low k dielectrics for ULSI. Photolithography, E-beam lithography and modern lithography techniques for VLSI/ULSI, Mask generation. Chemical Vapor Deposition Techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon: modeling and technology. Metal Film Deposition: Evaporation and sputtering techniques, Failure mechanisms in metal interconnects Multi-level metallization schemes. Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI.

Unit III [12 contact hours]

MOS technology:MOS, CMOS fabrication, The p-well process, The n-well process, the twin –tube process,, BiCMOS Technology, Basic Electrical Properties of MOS, CMOS &BiCMOS Circuits: I_{ds} –V_{ds}relationships, Threshold Voltage V_T, G_m, $G_{ds}$and ω_o, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Z_{pu}/Z_{pd}, MOSTransistor circuit model, Latch-up in CMOS circuits.

Unit IV [09 contact hours]

CMOS Digital Circuit Modeling: MOS Inverter, Static and dynamic Characteristics, $\beta n/\beta p$ ratio, Noise Margin, Combinational CMOS Logic Circuits.

Unit V [12 contact hours]

CMOS Amplifiers: Difference Amplifier, Cascode Amplifiers, CMOS Op-Amp; Design methodologies: Stick diagram, Design rules and layout, Floor plan, Design Flow, Design Styles, Design quality, Packing techniques.

Course Outcome

Learner can:

CO 1: describe the importance of wafer fabrication process and integrated circuits and apply their applications in modern technology

CO 2: describe the structure and operation of MOSFETs

CO 3: describe the techniques used for VLSI fabrication, design of CMOS logic circuits, switches and memory.

CO 4: describe the techniques used the design of CMOS logic circuits, switches and memory in VLSI.

CO 5: generalize the design techniques and analyze the characteristics of VLSI circuits such as area, speed and power dissipation.

Books Recommended:

1) VLSI Fabrication Principles by S. Gandhi
2) VLSI Technology by S.M. Sze
3) The Science and Engineering of Microelectronic Fabrication by Campbell
4) Basic VLSI Design by Pucknell
5) Principles of CMOS VLSI Design by Weste
6) CMOS Digital Integrated Circuits Analysis and Design by Kang and Leblebici
7) CMOS Analog Circuit Design by Allen and Holberg

ELE 302: OPTO– ELECTRONICS **Credit 4 [L = 3, T = 1]**

Course Objective :

1. To create fundamental physical and technical base of Optoelectronic systems.
2. To apply basic laws and phenomena that define behavior of optoelectronic systems.
3. Analyze various premises, approaches procedures and results related to optoelectronic systems.
4. Application of optical fiber equipment, and data transfer using optical fiber.
5. Study of components, devices and equipment of optoelectronic systems.
6. Formation of Optical Fiber Communication System.

Unit I [09 contact hours]

Optical Sources: Principle of laser action, types of lasers, fabrication and characteristics of semiconductor lasers and LEDs.

Unit II [12 contact hours]

Optical Detectors: Types of photo detectors, Characteristics of photo detector, Principle of APD and PIN diodes, Noise in Photo detectors, Photo transistors and Photo conductors.

Unit III [15 contact hours]

Optical Fiber: Structure of optical wave guide, Light propagation in optical fiber, Ray and Wave Theory, Modes of optical fiber, Step and Graded index fibers. Transmission characteristics of optical fibers: Signal degradation in optical fibers; Attenuation, Dispersion and Pulse broadening in different optical fibers.

Unit IV [15 contact hours]

Fiber Joints and Couplers: Fiber Alignments and Joint loss, Fiber Splices, Fiber Connectors. Optical Fiber Communication: Components of an optical fiber communication system, Modulation formats, Digital and Analog optical communication systems, Analysis and performance of optical receivers, System design for optical communication.

Unit V [09 contact hours]

Optical Fiber Communication: The fiber as a communication link, Transmitters and Receivers, Interaction of light with semiconductor materials: absorption and electroluminescence. Semiconductor and fiber optical amplifiers. Optical Link Design: System Considerations, Photoreceiver noise, Bit error rates for attenuation and dispersion limited systems, Link Power Budget, Rise-Time Budget, Line Coding. Optical Networking and Switching: General Network Concepts, SONET/SDH, Optical Ethernet, Network Management, WDM light wave systems and WDM components.

Course Outcomes:

Learner can:

CO 1: recognize and classify the structures of Optical fiber and types.

CO 2: discuss the channel impairments like losses and dispersion.

CO 3: analyze various coupling losses.

CO 4: classify the Optical sources and detectors and to discuss their principle.

Books Recommended:

1) Optical Electronics by Ghatak and Thyagrajan
2) Optical Fiber Communication byGerd Keiser
3) Optical Fiber Communication by J.M. Senior
4) Optical Communication by Gower
5) An Introduction to Electro Optic Devices by Kaminov
6) Optical Information Processing by FTS Yu

ELE 303: DIGITAL SIGNAL PROCESSING Credit 4 [L = 3, T = 1]

Course Objective:

1. Interpret, represent and process discrete/digital signal and system.
2. Thorough understanding of frequency domain analysis of discrete time signals using various transformation techniques.
3. Ability to design & analyze DSP systems like FIR and IIR Filter etc.
4. Implementation issues such as computational complexity, hardware resource limitations as well as cost of DSP systems or DSP Processors.
5. Understanding of spectral analysis of the signals.

Unit I [09 contact hours]

General Concepts of Digital Signal Processing: Block diagram of a possible digital processing system, important tools for modern digital signal processing e.g. digital filters and fast Fourier transform.

Unit II [12 contact hours]

Discrete Time Signals and Systems: Example of discrete signal, discrete time LTI systems, impulse response, casual and stable system, linear constant coefficient equation, structure of discrete time system, Solution of Difference Equation.

Unit III [12 contact hours]

Z – Transform: Definition, region of convergence, property of z – transform, inverse z – transform, multidimensional z – transform. Transfer function of discrete time systems: Poles, zeros and stability concept, realization of FIR and IIR filters, canonic and non canonic forms, quantization and round off error.

Unit IV [12 contact hours]

Frequency Analysis of Discrete System: Fourier transform and frequency response, Discrete Fourier transform and their properties, DFT as a linear transformation, computation of DFT, FFT, decimation in time and frequency.

Unit V [15 contact hours]

Design of Digital Filters: The Theory and Approximation of Finite Impulse Response Digital Filters (Issues in Filter Design), Characteristics of FIR filter with Linear phase and its frequency response, Positions of Zeros of linear phase FIR filters, Design techniques-windowing, Rectangular window, Generalized Heming window, Kaiser window, Examples of Window Low-Pass Filter, Issues with windowing and Solution for optimization.

Theory and Approximation of Infinite Impulse Response Digital Filter, Some Elementary properties of IIR filters-Magnitude squared Response, Phase Response, Grouped Delay, Impulse invariant Transformation, Bilinear Transformation, Matched Z-Transformation, optimization method for designing IIR Filter.

Course Outcome:

Learner can:

CO 1: analyze discrete-time systems in both time & transform domain and also through pole-zero placement.

CO 2: analyze discrete-time signals and systems using DFT and FFT.

CO 3: design and implement digital finite impulse response (FIR) filters.

CO 4: design and implement digital infinite impulse response (IIR) filters.

CO 5: understand and develop multirate digital signal processing systems.

Books Recommended:

1) Discrete Time Signal Processing by A.V. Oppenheim and Schafer
2) Digital Signal Processing: Principles, Algorithm and Application by Prokis and Manolakis
3) Introduction to Digital Signal Processing by J.R. Johnson
4) Digital Signal Processing by Mitra
5) Digital Signal Processing by Ifeachor and Javis
6) Digital and Analog Signal Processing by Amberdhar

ELE 304 E-1: DATA COMMUNICATION AND NETWORKING Credit 4 [L = 3, T = 1]

Course Objective :

1. Recognize and Describe the working of Computer Networks.
2. Illustrate reference models with layers, protocols and interfaces.
3. Summarize functionalities of different Layers.
4. Combine and distinguish functionalities of different Layers.
5. Model the LAN and WAN configuration using different media.
6. Examine problems of a computer networks and its security.

Unit I [12 contact hours]

Introduction: Network Hardware, Software, Reference Models, OSI and TCP/IP models; Example networks: Internet, ATM, Ethernet and Wireless LANs, Physical layer, Theoretical basis for data communication, guided transmission media

Unit II [12 contact hours]

Wireless transmission: Communication Satellites, Telephones structure, local loop, trunks and multiplexing, switching, Data link layer: Design issues – error detection and correction.

Unit III [12 contact hours]

Elementary data link protocols: sliding window protocols, Data Link Layer in the Internet, Medium Access Layer, Channel Allocation Problem,Multiple Access Protocols.

Unit IV [12 contact hours]

Network layer: design issues, Routing algorithms, Congestion control algorithms, IP protocol, IP Address,Internet Control Protocol.

Unit V [12 contact hours]

Transport layer: design issues, Connection management, Addressing, Establishing & Releasing a connection, Simple Transport Protocol, Internet Transport Protocol (TCP), Network Security: Cryptography.

Course Outcome:

Learner can:

CO 1: compare and examine, OSI and TCP/IP protocol stacks

CO 2: categorize services offered by all layers in TCP/IP protocol stack

CO 3: analyze a network under congestion and propose solutions for reliable data transfer

CO 4: examine the protocols operating at different layers of TCP/IP model

CO 5: assess the cryptographic techniques.

CO 6: manage a network and propose solutions under network security threats.

Books Recommended:

1) Data and communications, 6th Edn., W. Stallings, Prentice Hall, 2000
2) Computer networks: A systems approach, 2nd Edn., Peterson and Davie, Morgan Kaufman
3) Computer Networks, 4th Edn., A. S. Tanenbaum, Pearson Education
4) Introduction to Data Communications in Networking, B. Forouzan, Tata McGraw Hill, New Delhi
5) Data Communications, Computer Networks and Open Systems, F. Halsall, Addison Wessley.
6) Data Networks, D. Bertsekas and R. Gallagher, Prentice hall of India, New Delhi.
7) Communication Networks, Lamarca, Tata McGraw Hill, New Delhi.

ELE 304 E-2: NANOELECTRONICS **Credit 4 [L = 3, T = 1]**

Course Objective:

1. Understand the underlying operating principles of quantum devices.
2. Study of operating principle of Nano electronic devices.
3. Demonstrate specialized practical and theoretical knowledge in the use of particular Nano devices in its context.
4. Understand the inter-relation between different technologies in the design of integrated devices operational principles of MOSFET's and advanced MOSFET .
5. Study of electronic and optoelectronic property of molecular electronic devices.
6. Simulation and modeling techniques of nano devices.

Unit I [12 contact hours]

Quantum Devices: Charge and spin in single quantum dots- Coulomb blockade– Electrons in mesoscopic structures - single electron transfer devices (SETs) – Electron spin transistor – resonant tunnel diodes, tunnel FETs - quantum interference transistors (QUITs) - quantum dot cellular automata (QCAs) - quantum bits (qubits).

Unit II [12 contact hours]

Nanoelectronic Devices: Electronic transport in 1,2 and 3 dimensions- Quantum confinement - energy subbands - Effective mass - Drude conduction - mean free path in 3D - ballistic conduction - phase coherence length - quantized conductance - Buttiker-Landauer formula- electron transport in pn junctions - short channel NanoTransistor – MOSFETs - Advanced MOSFETs - Trigate FETs, FinFETs - CMOS.

Unit - III [12 Contact hours]

Molecular Nanoelectronics: Electronic and optoelectronic properties of molecular materials - Electrodes & contacts – functions – molecular electronic devices - elementary circuits using organic molecules- Organic materials based rectifying diode switches – TFTs- OLEDs- OTFTs – logic switches.

Unit - IV [12 Contact hours]

Spintronics: Spin tunneling devices - Magnetic tunnel junctions- Tunneling spin polarization - Giant tunneling using MgO tunnel barriers - Tunnel-based spin injectors - Spin injection and spin transport in hybrid nanostructures - spin filters -spin diodes -

Magnetic tunnel transistor - Memory devices and sensors - ferroelectric random access memory- MRAMS -Field Sensors - Multiferro electric sensors- Spintronic Biosensors.

Unit – V [12 Contact hours]

Nanoelectronic Architectures And Computations: Architecture Principles: Mono and Multi-processor systems–Parallel data processing–Power Dissipation and Parallelism–Classic systolic arrays - Molecular devices-properties-Self-organization–Size dependent-limitations. Computation: Monte Carlo Simulations- Computational methods and Simulations from ab initio to multiscale Modeling- Modeling of Nanodevices.

Course Outcome:

Learner can:

CO 1: Explain the fundamental science and quantum mechanics behind nanoelectronics and the concepts of a quantum well, quantum transport and tunnelling effects.

CO 2: Differentiate between microelectronics and nanoelectronics. Describe the superposition of eigenfunctions and probability densities.

CO 3: Describe the spin-dependant electron transport in magnetic devices and calculate the energy levels of periodic structures and nanostructures.

CO 4: Calculate the characteristics of nanoelectronic devices and summarise the applications of nanotechnology and nanoelectronics.

Books Recommended:

1) V. Mitin, V. Kochelap, M. Stroscio, —Introduction to Nanoelectronics‖, Cambridge University Press.
2) Rainer Waser, —Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices‖, Wiley.
3) Karl Goser, Peter Glosekotter, Jan Dienstuhl, —Nanoelectronics and Nanosystems‖, Springer.
4) SadamichiMaekawa, —Concepts in Spin Electronics‖, Oxford University Press.
5) L. Banyai and S.W.Koch, —Semiconductor Quantum Dots‖, World Scientific .
6) Edward L. Wolf, —Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience‖, Wiley.

ELE 304 E-3: DIGITAL IMAGE PROCESSING **Credit 4 [L = 3, T = 1]**

Course Objective:

1. Understand the fundamental of Digital Image Processing.
2. Understand the need for image transforms different types of image transforms and their properties and develop any image processing application.
3. Study of different techniques employed for the enhancement of images.
4. Different causes for image degradation and overview of image restoration and segmentation techniques.
5. Need for image compression and spatial and frequency domain techniques of image compression.
6. Learn different feature extraction techniques for image analysis and recognition

Unit – I [12 Contact hours]

Digital Image Fundamental: Introduction, Origin, Steps In Digital Image Processing, Components, Elements Of Visual Perception, Image Sensing And Acquisition, Image Sampling And Quantization, Relationships Between Pixels, Color Models.

Unit – II [12 Contact hours]

Image Enhancement: Spatial Domain, Gray Level Transformations – Histogram Processing – Basics Of Spatial Filtering–Smoothing And Sharpening Spatial Filtering – Frequency Domain: Introduction To Fourier Transform – Smoothing And Sharpening Frequency Domain Filters – Ideal, Butterworth And Gaussian Filters.

Unit – III [12 Contact hours]

Image Restoration and Segmentation: Noise Models, Mean Filters, Order Statistics, Adaptive Filters, Band Reject Filters, Band Pass Filters, Notch Filters, Optimum Notch Filtering, Inverse Filtering, Wiener Filtering Segmentation: Detection Of Discontinuities, Edge Linking And Boundary Detection, Region Based Segmentation, Morphological Processing- Erosion And Dilation.

Unit – IV [12 Contact hours]

Wavelets and Image Compression: Wavelets – Subband Coding – Multiresolution Expansions – Compression: Fundamentals – Image Compression Models – Error Free

Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards.

Unit –V [12 Contact hours]

Image Representation and Recognition: Boundary Representation – Chain Code – Polygonal Approximation, Signature, Boundary Segments – Boundary Description – Shape Number – Fourier Descriptor, Moments- Regional Descriptors –Topological Feature, Texture – Patterns And Pattern Classes – Recognition Based On Matching.

Course Outcome:

Learner can:

CO 1: understand fundamental concepts of a digital image processing system.

CO 2: analyze images in the frequency domain using various transforms.

CO 3: evaluate the techniques for image enhancement and image restoration.

CO 4 : categorize various compression techniques.

CO 5: interpret Image compression standards.

CO 6 : interpret image segmentation and representation techniques.

Books Recommended:

1) Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education
2) Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata McGraw Hill Pvt. Ltd.
3) Anil Jain K. “Fundamentals Of Digital Image Processing”, PHI Learning Pvt. Ltd.
4) Willliam K Pratt, “Digital Image Processing”, John Willey
5) Malay K. Pakhira, “Digital Image Processing And Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd.

ELE 304 E-4: EMBEDDED SYSTEM DESIGN **Credit 4 [L = 3, T = 1]**

Course Objective:

1. Understand the basic principle of embedded system, difference between the general computing system and the embedded system, classification of embedded systems.
2. Object oriented Programming concept and its application to embedded system.
3. Become aware of microcontroller and its application in design of embedded system.
4. Architecture of PIC microcontroller & its programming.
5. Analyze various examples of embedded systems based on AVR microcontroller.

Unit I [12 Contact hours]

Embedded system introduction:Embedded system architecture, classifications of embedded systems, challenges and design issues in embedded systems, fundamentals of embedded processor and microcontrollers, CISC vs. RISC, fundamentals of Vonneuman/Harvard architectures, types of microcontrollers, selection of microcontroller.

Unit II [12 Contact hours]

Object oriented programming: Differences between C and C++,Fundamentals of object oriented programming; OOP vs.Procedure oriented programming, OOP concepts:classes, objects, abstraction, polymorphism, inheritance, data binding and encapsulation. Basics of C++: features of C++, data types, standard I/O, arrays and strings in C++. Classes in C++, instantiation, creating objects and object scope, data abstraction, data encapsulation, constructors and destructors, methods and access modifiers, function and operator overloading Inheritance-Base and Derived classes, Inheritance types, Scope Resolution operator; polymorphism and virtual functions, exception handling.

Unit III [12 Contact hours]

Microcontroller 8051: Overview of Microcontroller 8051, Architecture, Register Banks, Special purpose registers and Stack, On-chip RAM Space, Addressing Modes, Instruction Set. Assembly language programming of 8051,Timer Programming in Assembly, 8051 Serial communication using USART protocol and Programming.

Unit IV [12 Contact hours]

PIC Architecture and Programming: Introduction to PIC microcontrollers, PIC architecture, comparison of PIC with other CISC and RISC based systems and microprocessors, memory mapping, assembly language programming, addressing modes, instruction set. PIC I/O ports, I/O bit manipulation programming, timers/counters, programming to generate delay and wave form generation, I/O programming, LEDs, 7segment led’s, LCD and Keypad interfacing.

Unit I [12 Contact hours]

AVR Microcontroller: Integrated Development Environment (IDE) for Embedded Systems, Introduction to AVR family of Microcontrollers, AVR CPU, System Clock and Clock option.

Course Outcome:

Learner can:

CO 1: Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems..

CO 2: Become aware of the architecture of the PIC microcontroller and its programming aspects.

CO 3: Become aware of interrupts, hyper threading and software optimization.

CO 4: Design real time embedded systems.

CO 5: Analyze embedded systems based on AVR microcontroller.

Books Recommended:

1) P.H. Dave, H.B. Dave,“Embedded Systems- Concepts Design and Programming”, Pearson Publication.
2) ShibuKV,“Introduction to Embedded Systems”, Tata McGraw Hill Publication.
3) M.A. Mazidi, J. G. Mazidi, R.D. McKinlay,“The 8051 Microcontroller and Embedded Systems”, Pearson Publication.
4) M.A. Mazidi, S.Naimi, S.Naimi,“The AVR Microcontroller and Embedded Systems”, Pearson Publication.
5) Programming PIC microcontrollers with PIC basic by chuck helebuyck
6) PIC microcontrollers-programming in basic by Milan verle.
7) The C programming Language by Brian W.kernighan and Dennis M.Ritchie
8) Let Us C by YashvantP.kanetkar 6. Object-Oriented Programming With C++ by E Balaguruswami

ELE 304 E-5: HARDWARE DESCRIPTION LANGUAGES Credit 4 [L = 3, T = 1]

Course Objective:

1. Model digital systems in HDL at different levels of abstraction.
2. Partition a digital system into different subsystems.
3. Simulate and verify digital design on HDL plateform.
4. Design moderately complex digital circuitry using programmable logic devices and CPLDs.
5. Transfer a design from a version possible to simulate to a version possible to synthesize.
6. Use computer-aided design tools to synthesize, map, place, routing, and download the digital designs on the FPGA board.

Unit I [12 Contact hours]

Introduction: Basic concepts of hardware description languages, Hierarchy, Concurrency, logic and delay modeling, Structural, Data-flow and Behavioral styles of hardware description, Architecture of event driven simulators.

Unit II [12 Contact hours]

VHDL: VHDL Fundamentals, Syntax and Semantics of VHDL, Variable and signal types, arrays and attributes, Operators, expressions and signal assignments, Entities, architecture specification and configurations, Component instantiation,Concurrent and sequential constructs, Use of Procedures and functions, Examples of design using VHDL.

Unit III [12 Contact hours]

Verilog: Syntax and Semantics of Verilog, Variable types, arrays and tables, Operators, expressions and signal assignments, Modules, nets and registers, Concurrent and sequential constructs, Tasks and functions, Examples of design using Verilog, Synthesis of logic from hardware description.

Unit IV [12 Contact hours]

Programmable Logic Devices:Introduction, Evolution: PROM, PLA, PAL, Architecture of PAL's, Applications, Programming PLD's, Design Flow, Programmable

Interconnections, Complex PLD's (MAX - 7000, APEX), Architecture, Resources, Applications, Tools.

Unit V [12 Contact hours]

FPGA's: Introduction, Logic Block Architecture, Routing Architecture, Programmable Interconnections, Design Flow, Xilinx Virtex-II (Architecture), Altera Stratix, Actel 54SX Architecture, Boundary Scan, Programming FPGA's, Constraint Editor, Static Timing Analysis, One hot encoding, Applications, Tools, Case Study, Xilinx Virtex II Pro, Embedded System on Programmable Chip, Hardware-software co-simulation, Bus function models, BFM Simulation, Debugging FPGA Design.

Course Outcome:

Learner can:

CO 1: apply logic fundamentals using hardware description languages.

CO 2: understand the difference between procedural programming and hardware description languages.

CO 3: write synthesizable VHDL/ verilog code describing basic logic elements a. Combinatorial logic. b. Sequential logic.

CO 4: can code state machines in a hardware description language, logic pipelined machines, basic programmable logic architectures

CO 5: understand the impact of routing and circuit parasitic.

Books Recommended:

1) Douglas Perry, "VHDL", McGraw Hill International (NY), The Institute of Electrical and Electronics Engineers.
2) Navabi," VHDL Analysis & Modeling of digital systems", McGraw Hill .
3) S. Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Prentice Hall (NJ, USA).
4) J. Bhaskar, "Verilog HDL Synthesis - A Practical Primer", Star Galaxy Publishing, Allentown, PA)
5) Stefan Sjoholm&LennartLindth,"VHDL for Designers", Prentice Hall.
6) Peter J Ashenden, "The Designer's Guide to VHDL ", Morgan Kaufmann Publishers.
7) "IEEE std 1364-95, Verilog Language Reference Manual", IEEE Press (NY, USA)

ELE 305: Practical **Credit 9** **[P = 16, T = 2]**

Lab Course V **[8 Contact hours]**

1. Experiments on Digital Signal Processing (MATLAB Simulation)
2. Experiments on VLSI

Lab Course VI **[8 Contact hours]**

1. Experiments on Opto-Electronics and Optical Fiber Communication.
2. Experiments on selected elective course

General Guidelines for Practical Examination of Semesters I, II, and III.

- A set of one internal and one external examiner will be appointed to conduct the practical examination of each semester.
- For each semester practical examination, students will be required to perform two practicals - practical I and practical II, one from each lab course. The duration of each practical will be four hours.
- Practicals will be based on the theory papers, prescribed in each semester.
- At the time of examination, students will have to submit the practical record book, duly signed by the concerned teacher and certified by the Head of the department.
- Practical examination of each semester will be of 225 marks or 9 credits. The distribution of marks will be as described under:
- The distribution of marks in practical examination of semester I, II and III will be as follows:

	Regular Student	Ex-Student
One Practical from each lab course of corresponding semester	40+40 = 80	140
Record of each lab course	15+15 = 30	--
Viva-voce of practical corresponding to each lab course	15+15 = 30	60
Internal Assessment	30+30 = 60	--
Seminar	25	25
Total	225	225

Guidelines: Mini Project / Seminar for all semesters

- Each student has to prepare an activity based mini-project on topics from the theory papers, practical of the concerned semester and preparePPT/OHP presentation to deliver a seminar on their mini-project of about half an hours.
- The seminar carries 25 marks or 1 credit. The record of the performance of the student will be maintained at the department and the copy certified by the Head should be provided at the time of examination.

General Guidelines for the Examination of Semester IV

- A set of one internal and one external examiner will be appointed to evaluate the major project work and to take viva-voce examination.
- Another set of one internal and one external examiner will be appointed for the evaluation of seminar presented by the students.

Pass Percentage

- As per the rules and regulations of D.D.U. Gorakhpur University.

Promotion Criterion

- As per the rules and regulations of D.D.U. Gorakhpur University.

Division Criterion

- As per the rules and regulations of D.D.U. Gorakhpur University.

Span Period

- As per the rules and regulations of D.D.U. Gorakhpur University.

Attendance Requirement

- As per the rules and regulations of D.D.U. Gorakhpur University