SYLLABUS AS PER NEP 2020

FOR PG PROGRAMS

Department of Electronics
Faculty of Science
Deen Dayal Upadhyaya Gorakhpur University

Gorakhpur-273009

(2024-25)

PG PROGRAM
DEPARTMENT OF ELECTRONICS
(SESSION: 2024 – 2025)

The Department of Electronics offers PG program in M.Sc. Electronics with total duration of 4 semesters. The details of the program structure are as follows:

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, 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

Year	Semester	Course Code	Paper Title	Credits [T+P]
1st	I	**ELE 501N**	Network Analysis and Synthesis	**4+0**
		ELE 502N	Devices and Linear Integrated Circuits	**4+0**
		ELE 503N	Switching Theory and Digital Design	**4+0**
		ELE 504N	Advanced Microprocessor and Interfacing	**4+0**
		ELE 505N	Network, Devices, Digital and Microprocessor Lab	**0+4**
	II	**ELE 506N**	Control System	**4+0**
		ELE 507N	Digital Communication	**4+0**
		ELE 508N	Opto-Electronics	**4+0**
		ELE 509N	Electromagnetic Theory and Antenna	**4+0**
		ELE 510N	Control, Power Electronics , Digital Communication, Opto-Electronics, EM theory and Antenna lab	**0+4**
		ELE 511N	Computer Organization and Architecture *(Open Elective for other PG programmes)*	**4+0**

Year	Semester	Course Code	Paper Title	Credits [T+P]
nd	III	**ELE 512N**	IC Technology and VLSI Design	**4+0**
		ELE 513N	Digital Signal Processing	**4+0**
		Open Elective(Any One of the following)		
		ELE 514N	Hardware Description Language	**4+0**
		ELE 515N	Programming with MATLAB	**4+0**
		ELE 516N	Object Oriented Programming	**4+0**
		Subject Specialization Elective Course (Any one of the following)		
		ELE 517N	Data Communication and Computer Network	**4+0**
		ELE 518N	Nanoelectronics	**4+0**
		ELE 519N	Digital Image Processing	**4+0**
		ELE 520N	Embedded System	**4+0**
		ELE 521N	Artificial Intelligence	**4+0**
		ELE 522N	DSP, VLSI, Open Elective and Subject Specialization Lab	**0+4**
		ELE 523N	Industrial Training/ Survey/ Research Project	**0+4**
	IV	**ELE 524N**	Major Project Work	**0+16**
		ELE 525N	Seminar and Viva-Voce of Major Project Work	**4+0**
		ELE 526N	A General Seminar	**4+0**

DETAILED SYLLABUS OF M.Sc. ELECTRONICS

SEMESTER I

ELE 501N: NETWORK ANALYSIS AND SYNTHESIS **Credit 4+0**

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.

Syllabus

Unit I

Network Analysis: Circuit elements, Passive and Active circuit elements, concept ofideal 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

Network Theorems: Principle of Superposition, Tellegen‟s, Thevenin, Norton, Millmanand Maximum Power transfer theorem, T, π and L circuits.Two Port Networks: Two port parameters, Relationship of two port variables, Shortcircuit admittance parameter, the open circuit impedance parameter, transmission parameter, the h–parameters, Relationship between parameter sets, interconnections of two–port networks.

Unit III

Frequency Domain Analysis: Frequency domain analysis of RLC circuits, Phasediagram, 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 IV

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 502N: DEVICES AND LINEAR INTEGRATED CIRCUITS **Credit 4+0**

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.

Syllabus

Unit I

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

Unit II

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

Operational Amplifier: Op-Amp fundamentals (brief review of differential amplifier, currentmirror, 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

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

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 application ofVoltage regulator ICs.

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.

ELE 503N: SWITCHING THEORY AND DIGITAL DESIGN **Credit 4+0**

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.

Syllabus

Unit I

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

Analysis and Design of Combinational & Sequential 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

Analysis and Design of Sequential Circuit: State diagrams, characteristic equations of different flip-flops, conversion from one type to another type 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, Sequence detector. Introduction to Algorithmic state machines-construction of ASM chart and realization for sequential circuits.

Unit IV

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.

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.

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

ELE 504N: ADVANCED MICROPROCESSOR AND INTERFACING **Credit 4+0**

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. Interpret & solve various automation based problems using microprocessor and microcontroller.

Syllabus

Unit I

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

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

Unit III

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

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. 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.

CO2: illustrate how the different peripherals (8255, 8253 etc.) are interfaced with Microprocessor.

CO 3: distinguish and analyze the properties of Microprocessors.

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

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

ELE 505N: Network, Devices, Digital and Microprocessor Lab Credit 0+4

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.
7. Engineering Drawing
8. Application of Microsim or other circuit simulation software.
9. Experiments on Microprocessor and Microcontroller programming.

SEMESTER II

ELE 506N: CONTROL SYSTEM **Credit 4+0**

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.

Syllabus

Unit I

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

Time– Domain Analysis: Test input signal for transient analysis, Time domain performancecriterion, 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

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

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

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.

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

ELE 507N: DIGITAL COMMUNICATION **Credit 4+0**

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

Syllabus

Unit I

Signal Representation: Time domain and frequency domain representation, Fourier seriesand 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

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

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 andμ law companding; Encoding and Pulse Code Modulation, Band width of PCM, DPCM, DM, Idling noise and slope overload, ADM, Adaptive DPCM.

Unit IV

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. Information Theory: Concept of Information Measure, Entropy and Information 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 508N: OPTO– ELECTRONICS **Credit 4+0**

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.

Syllabus

Unit I

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

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

Unit III

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 IV

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, Photo receiver 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 509N: ELECTROMAGNETIC THEORY AND ANTENNA **Credit 4+0**

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 Maxwells 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.

Syllabus

Unit I

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

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

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

EM Wave Propagation and Antenna: 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 behaviour. **Antenna:** Radiation from an oscillating current element, Short monopole and dipole, Halfwave 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 6: 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 510N: Control, Power Electronics, Digital Communication, Opto-Electronics, EM theory and Antenna lab **Credit 0+4**

1. Experiments on Control System.
2. Experiments on Digital Communication.
3. Experiments on Power Electronics.
4. Experiments on application of Labview to Control System.
5. Experiments on application of MATLAB to Communication System.
6. Experiments on Data Acquisition System.
7. Experiments on EM Theory and Antenna.
8. Experiments on Turbo Assembler.
9. Experiments on Signal and System.
10. Experiments on Sensors and Transducer

ELE 511N: Computer Organization and Architecture (Open Elective) Credit 4+0

Course Objective:

1. To identify the elements of modern instructions sets and their impact on processor design.
2. Explain the organization of Control processing unit and various ways of addressing.
3. Identify different types of CPU architecture and represents floating point numbers.
4. Apply the concepts of Interrupts and interrupt structures and Direct Memory Access
5. To understand the design of the various functional units and components of computers.

Syllabus

Unit I

Computer Organization: Overview of computer organization – components and system buses; Concepts of assembly and machine language programs. Machine language program execution – instruction cycles, machine cycles and bus cycles. Overview of memory and I/O addressing.

Unit II

Computer System: CPU organization – components and subsystems, register banks, internal bus structure, information flow; Instruction set – characteristics and functions, types of operation and operands. Addressing modes – various ways of addressing memory and input-output devices and their timing characteristics.

Unit III

Memory: Memory hierarchy – main memory – types and interfacing; Cache memory – its organizations and operations, levels of caches; Memory management module – paging and segmentation, virtual memory; Disk memory, RAIDs. Back-up memory. Interrupts and interrupt structures – interrupt cycles, handling multiple simultaneous interrupts, programmable interrupt controllers; I/O interfacing and modes of I/O data transfer. Direct memory access – DMA controller;

Unit IV

Computer Architecture: CISC and RISC architectures – examples; ALU – flags, logical operations, fixed point number representations and arithmetic, floating point number representations and arithmetic, exceptions. Control Unit – how it operates, hardwired control unit, concepts of microprograms and microprogrammed control unit.

Course Outcomes:

Learner can:

CO 1: Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os

CO 2Analyze the performance of commercially available computers.

CO 3: develop logic for assembly language programming.

Books Recommended:

1) "Computer System Architecture", by M. Morris Mano (PHI)
2) "Computer Organization and Architecture – Designing for Performance", by William Stallings (Person)
3) "Computer Architecture and Organization", by John P. Hayes (McGraw Hill)
4) "Advanced Computer Architecture", by Kai Hwang and NareshJotwani (McGraw Hill)

SEMESTER III

ELE 512N: IC TECHNOLOGY AND VLSI DESIGN **Credit 4+0**

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 OP-Amp & its design.

Syllabus

Unit I

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

IC Fabrication Process: Kinetics of Silicon dioxide growth both for thick, thin and ultrathin 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

VLSI Design: Design hierarchy, layers of abstraction, integration density and Moore's law, VLSI design styles, packaging styles, design automation principles; Fabrication Technology: Basic steps of fabrication, bipolar, CMOS and Bi-CMOS fabrication processes, layout design rules; MOS and Bi-CMOS characteristics and circuits: MOS transistor characteristics, MOS switch and inverter, Bi-CMOS inverter, latch-up in CMOS inverter, super-buffers, propagation delay models, switching delay in logic circuits, CMOS analog amplifier; Logic Design: switch logic, gate restoring logic, various logic families and logic gates, PLA; Dynamic Circuits: Basic concept, noise considerations, charge sharing, cascading dynamic gates, domino logic, clocking schemes; Sequential Circuits: Basic regenerative circuits, bi-stable circuit elements, CMOS SR latch, clocked latch and flip-flops.

Unit IV

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 513N: DIGITAL SIGNAL PROCESSING **Credit 4+0**

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.

Syllabus

Unit I

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; 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 II

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 III

Frequency Analysis of Discrete Time 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. 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.

Unit IV

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 514N: HARDWARE DESCRIPTION LANGUAGE Credit 4+0

Course Objective:

1. To understand basics of hardware description languages.
2. Simulate and verify digital design on HDL platform.
3. To implement various examples of digital IC designs using hardware description languages.
4. Use computer-aided design tools to synthesize, map, place, routing, and download the digital designs on the FPGA board.

Syllabus

Unit I

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

Unit II

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.

Unit III

Use of Procedures, Tasks and functions, Memory Modelling, Examples of design using VHDL. Concurrent and sequential constructs, Sequential Circuit design, Finite State Machine Modeling. Synthesis of Combinational and Sequential circuits.

Unit IV

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 code describing basic logic elements of Combinational and Sequential logic.

CO 4: can code state machines in a hardware description language, logic pipelined machines and 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.
"IEEE std. 1364-95, Verilog Language Reference Manual", IEEE Press (NY, USA)

ELE 515N: PROGRAMMING WITH MATLAB **Credit 4+0**

Course Objective:

1. To understand basic MATLAB environment.
2. Being able to do simple calculations using MATLAB.
3. Being able to carry out simple numerical computations and analyses using MATLAB

Syllabus

Unit I

Introduction: MATLAB software and its History, Use of MATLAB, Key features, MATLAB window, Command window, Workspace, Command history, Setting directory, MATLAB user interface, Basic commands, Assigning variables, Operations with variables; Data Files and Data Types: Character and string, Arrays and vectors, Column vectors, Row vectors.

Unit II

Basic Mathematics and Operation on Matrix: BODMAS Rules, Arithmetic operations, Operators and special characters, Mathematical and logical operators, Solving arithmetic equations; Matrix : Crating rows and columns Matrix, Matrix operations, Finding transpose, determinant and inverse, Solving matrix; Other Operations: Trigonometric functions, Complex numbers, fractions, Real numbers, Complex numbers.

Unit III

M Files: Script tools, Writing Script file, Executing script files, The MATLAB Editor, Saving m files; Plots: Plotting vector and matrix data, Plot labelling, curve labelling and editing, Basic Plotting Functions, Creating a Plot, Plotting Multiple Data Sets in One Graph, Specifying Line Styles and Colors, Graphing Imaginary and Complex Data, Figure Windows, Displaying Multiple Plots in One Figure, Controlling the Axes; 3D Plot: Creating Mesh and Surface, About Mesh and Surface Visualizing, Subplots; GUI Design: Introduction of GUI, GUI Function Property, Component Design and Container, Writing the code of GUI Call back, Dialog Box, Menu Designing, Applications.

Unit IV

Matlab Simulink and Programming: Introduction Of Simulink, Simulink Environment & Interface, Study of Library, Circuit Oriented Design, Equation Oriented Design, Model, Subsystem Design, Connect Call back to subsystem, Application; Programming: Automating commands with scripts, Writing programs with logic and flow control, functions, Control statement and conditional statement; Loop and Conditional Statement: if, else, switch, for, while, continue, break, return; Functions: Writing user defined functions, Built in Function, Function calling, Return Value, Types of Functions, Global Variables.

Course Outcome:

Learner can:

CO 1. Understand the main features of the MATLAB development environment.

CO 2. Use the MATLAB GUI effectively.

CO 3. Design simple algorithms to solve various problems.

CO 4. Write simple programs in MATLAB to solve scientific and mathematical problems.

Books Recommended:

1) Won Y. Yang, Jaekwon Kim, Kyung W. Park, DonghyunBaek, Sungjoon Lim, JingonJoung, Suhyun Park, Han L. Lee, Woo June Choi, TaehoIm, “Electronic Circuits with MATLAB” John Wiley & Sons, Inc.
2) “Digital Filters using MATLAB “ SpringerInt.Publishing 2020.
3) R.K. Bansal, A.K. Goel, M.K. Sharma, “MATLAB and its Applications in Engineering” Pearson Publishing House, 2020.

ELE 516N: OBJECT ORIENTED PROGRAMMING **Credit 4+0**

Course Objective:

1. To understand basics of Object Oriented concepts that is Classes & Objects, Inheritance, and Polymorphism, Templates and C++ language.
2. To learn the syntax and semantics of the C++ programming language.
3. To develop logics which helps learner to create programs, applications.

Syllabus

Unit I

Object Oriented Programming and languages: fundamentals, necessity and advantages, Objects and Classes, Encapsulation. Data and method binding, access specification: private, protected and public; Inheritance: passing knowledge down. Single versus multiple inheritance, sub and super classes. Code reuse, inheritance and subtyping.

Unit II

Polymorphism: Simple (or static) polymorphism (in C++), method overloading, subtype polymorphism (extending a class) through method overriding, 'virtual' methods (in C++) and distinction with nonvirtual ones, abstraction through polymorphism, 'abstract' classes and methods, 'pure' virtual functions in C++.

Unit III

Interfaces: OOPLs allowing interfaces (like Java), interfaces versus multiple inheritance. Exception Handling: the 'try-catch-throw-finally' paradigm, catching and throwing errors, ensuring cleaning up using 'finally', exception classes and their hierarchy, error handling as a built-in feature (as in Java), exception specification, the 'throws' keyword and compiler behavior.

Unit IV

Templates: Introduction, simple generic classes & generic function, simple example programs. STL List, Vector, Array.

Course Outcome:

Learner can:

CO 1. Understand advantages of a high level language like C/C++, the programming process, and the compilation process**.**

CO 2. describe and use software tools in the programming process**.**

CO 3. apply good programming principles to the design and implementation of C/C++ programs

CO 3. design, implement, debug and test programs using the fundamental elements of C/C++

Books Recommended:

1. E.Balagurusamy, Object Oriented Programming With C++, McGraw-Hill Education
2. BjraneStroustrup, “C++ Programming language”,3rd edition, Pearson education Asia(1997)
3. LaforeR.”Object oriented Programming in C++”,4th Ed. Techmedia,New Delhi(2002).
4. YashwantKenetkar,”Let us C++”,1stEd.,Oxford University Press(2006)
5. B.A. Forouzan and R.F. Gilberg,CompilerScience,”A structured approach using C++” Cengage Learning, New Delhi.

ELE 517N: DATA COMMUNICATION AND COMPUTER NETWORK **Credit 4+0**

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.

Syllabus

Unit I

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

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

Unit III

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

Unit IV

Network layer: design issues, Routing algorithms, Congestion control algorithms, IP protocol, IP Address, Internet Control Protocol. 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 518N : NANOELECTRONICS **Credit 4+0**

Course Objective:

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

Syllabus

Unit I

Shrink-down approaches: Introduction, CMOS Scaling, short channel effects, The nanoscale MOSFET, FinFETs, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.), Resonant Tunneling Transistors.

Unit II

Atoms-up approaches: Molecular electronics involving single molecules as electronic devices, transport in molecular structures, molecular systems as alternatives to conventional electronics (advantages and limitations), Materials for nanoelectronics, nanostructures.

Unit - III

Nano-Fabrication and Characterization: Photolithography, Electron beam Lithography, Advanced Nano-Lithography, Thin-Film Technology, MBE, CVD, PECVD, Atomic Force Microscope, Electron Microscopy (TEM, SEM), Photon Spectroscopy.

Unit – IV

Carbon nanotube electronics, band structure & transport, Overview of Flexible/Printed Electronics: OLEDs, OFETs, Organic Solar Cells, spintronics devices.

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.

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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 519N: DIGITAL IMAGE PROCESSING **Credit 4+0**

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.

Syllabus

Unit – I

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

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

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

Wavelets and Image Compression: Wavelets, Sub band Coding, Multi resolution 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, Image Representation and Recognition.

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 520N: EMBEDDED SYSTEM **Credit 4+0**

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. Become aware of the design of embedded system.

Syllabus

Unit I

Introduction to Embedded Systems: Introduction to Embedded Systems , The build process for embedded systems, Structural units in Embedded processor , selection of processor & memory devices; DMA ,Memory management methods, Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

Unit II

Embedded Networking: Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers; Embedded Firmware Development Environment: Embedded Product Development Life Cycle objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

Unit III

RTOS Based Embedded System Design: Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems.

Unit IV

Embedded System Application Development: Design issues and techniques Case Study of Washing Machine- Automotive Application- Smart card System Application.

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 embedded networking and embedded firmware development aspects.

CO 3: Become aware of RTOS based embedded system design.

CO 4: Design real time embedded systems.

Books Recommended:

1) Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
2) Michael J. Pont, "Embedded C", Pearson Education , 2007.
3) Steve Heath, "Embedded System Design", Elsevier, 2005.
4) Muhammed Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second edition, 2007.
5) P.H. Dave, H.B. Dave, "Embedded Systems- Concepts Design and Programming", Pearson Publication.
6) ShibuKV,"Introduction to Embedded Systems", Tata McGraw Hill Publication.

ELE 521N: ARTIFICIAL INTELLIGENCE **Credit 4+0**

Course Objective:

1. To understand basic principles of Artificial Intelligence
2. To learn and design intelligent agents.
3. To understand the basic areas of artificial intelligence including problem solving, knowledge representation, reasoning, decision making, planning, perception and action.
4. To learn fundamentals of machine learning, mathematical framework and learning algorithms.

Syllabus

Unit I

Introduction: Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing; Introduction to Search : Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.

Unit II

Knowledge Representation & Reasoning: Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.

Unit III

Machine Learning : Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data - EM algorithm, Reinforcement learning.

Unit IV

Pattern Recognition : Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.

Course Outcome:

Learner can:

CO 1: Understand formal methods of knowledge representation, logic and reasoning.

CO 2: Understand foundational principles, mathematical tools and program paradigms ofAI.

CO 3: Understand the fundamental issues and challenges of machine learning: data, model selection, model complexity.

CO 4: Apply intelligent agents for Artificial Intelligence programming techniques.

Books Recommended:

1) Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education.
2) Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill.
3) E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education.
4) Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India.

ELE 522N: DSP, VLSI, Open Elective and Subject Specialization Lab **Credit 4+0**

1.Experiments on Digital Signal Processing

2. Experiments on VLSI.

3. Experiments on VHDL/MATLAB/C++.

4. Experiments on specialization Elective

ELE 523N: Industrial Training/ Survey/ Research Project **Credit 0+4**

Course Objective: The candidate can formulate and complete Industrial Training/ Survey/ Research Project in the emerging areas of electronics and allied discipline.

In the 3rd semester of PG programme, the candidate has to complete Industrial Training/ Survey/ Research Project related to his/her subject major. This course can be completed in the form of Industrial training/ Internship/ Survey work etc. It can be of interdisciplinary/ multi-disciplinary nature. This Industrial Training/ Survey/ Research Project will be completed under the supervision of a faculty member of the concerned subject. A co-supervisor can be taken from Industry/ company/ technical institution/ research organization if needed.

Course Outcome: The primary goal of this 4-credit course is to expose a student for developing research projects and skill development in the discipline.

SEMESTER IV

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

ELE 524N: Major Project Work   Credit 0+16

Course Objective:

The 16 credit course of Major project work is focussed on full time research and development activity to be performed by the students in the leading research institution/ organizations/ MNCs.

At the end of the course students will submit a thesis which is evaluated by external expert. The thesis report must show evidence of wide reading, understanding, critical analysis and/or appropriate use of advanced research techniques.

Course Outcomes

On completion of this course students should have developed the ability to:

CO1: Undertake a major original research project and demonstrate a sound technical knowledge of their project work.

CO 2: Integrate and apply disciplinary knowledge and skills to an independently generated research question and investigation.

CO3: Analyse and synthesise salient features and important theoretical, methodological and empirical trends in published literature and data.

CO 4: Present research findings in clear, concise and persuasive written and verbal forms.

ELE 525N: Seminar and Viva-Voce of Major Project Work **Credit 4+0**

Course Objective:
The major project work done by a student is presented in the form of thesis submitted by him. Based on his thesis, student has to present a seminar before the panel of examiner and defend a viva-voce thereon.

Course Outcome:
Students will get exposure to write and review research projects and will get motivated to choose research and development as a career.

ELE 526N: A General Seminar **Credit 4+0**

Course Objectives: During the six month of this semester students are supposed to do an exhaustive survey of current and emerging field of research (other than the area which was selected for the major project work) in electronics and allied fields. Students have to submit a review report and present a seminar based on it before the panel of examiners.

Course Outcomes:

Students will get exposure to writing and reviewing research projects and will get motivated to choose research as a career.