University of Pune

Two Year M.Sc. Degree Course in

Electronic Science

M.Sc. Electronic Science (Part II)

(Credit and Semester based Syllabus to be implemented from Academic Year 2014-15)

Second Year M.Sc. Electronic Science

M.Sc. Electronic Science - Course structure & Credits Distribution Semester

COURSE	UNIVERSITY THEORY	No. of Units	Credits
EL3UT09	Communication Electronics (Sem III)	4	4
EL4UT10	Control Systems (Sem IV)	4	4
	ELECTIVE THEORY (Sem III and Sem IV)		
ELDT01	Advanced Power Electronics	4	4
ELDT02	Advanced Embedded Systems	4	4
ELDT03	Digital Signal Processing	4	4
ELDT04	Mechatronics	4	4
ELDT05	Digital Image Processing	4	4
ELDT06	Optoelectronics and Fibre Optic Communication	4	4
ELDT07	Nanoelectronics and Devices	4	4
ELDT08	Programmable Logic Controllers and Applications	3	3
ELDT09	VLSI System Design	3	3
ELDT10	Robotics-Kinematics and Control	3	3
ELDT11	Wireless Sensor Networks	3	3
ELDT12	Digital Communication	3	3
ELDT13	Computational Methods for Electronics	3	3

Practical Courses: Sem III and IV

Course Code	Course Title	No. of Units	No. of credits
Sem III			
EL3UP07	Practical Course –VII	12 Practical Sessions	04
EL3UP08	Practical Course –VIII	12 Practical Sessions	04
EL3UP09	Practical Course – IX	Project Like Experiment	02
Sem IV			
EL4UP10	Project Practical Course –X	Project Course	10

Semester III: EL3UT09: Communication Electronics (4 Credits)

Objectives:

1. To learn anlog modulation techniques
2. To study basics of information theory and digital communication
3. To study various data digital communication systems
4. To learn fundamentals of radio wave propagation and Antennas
5. To make students aware of various communication technologies

Unit 1: Analog communication

Communication systems, Modulation, Bandwidth requirements, External and Internal noise, Noise figure

Theory of Amplitude modulation, Modulation index, side bands and frequency domain, Power distribution, Generation of AM, Suppression of carrier, suppression of unwanted side bands, Extensions of SSB, AM receivers

Theory of frequency and Phase modulation, sidebands and modulation index, Noise and frequency modulation, Generation of FM, FM receivers

Unit 2: Digital Communication

Information theory, Pulse modulation, Pulse amplitude modulation, Delta modulation, Adaptive delta modulation, Time division multiplexing, Frequency division multiplexing, Pulse-time modulation, Pulse systems

Digital technology, Fundamentals of data communication systems, Data sets and interconnection requirements, network and control considerations

Data link protocols: SDLC, HDLC, XMODM protocols, ASK, FSK, PSK, QAM, telephone modems, cable modems and DSL

Unit 3: Radio wave propagation and Antennas

Propagation in free space, tropospheric, ionospheric propagation, Surface wave, Low and very low, extremely low frequency propagation

Basic considerations, Wire radiations in space, Terms and definitions, Effects of ground on antennas, Antenna coupling at medium frequencies, Directional high frequency antennas, UHF and Microwave antennas, Wideband and special purpose antennas.

Smart antenna analogy, Cellular radio systems evolution, signal propagation, Smart antenna benefits and drawbacks

Unit 4: Communication Technologies

Local Loop, PSTN, ISDN, digital exchanges, satellite communication and VSAT

Wireless communication technologies: spread spectrum techniques, OFDM, Cellular phones, 3G wireless, IP telephony, Bluetooth, IrDA, CDMA

Principles of light transmission in fiber, Optical fiber and fiber cables, Losses in fiber, Fiber optic components and Fiber optic communication link, system testing and repair

Text / Reference Books

1. Electronic Communication Systems, George Kennedy and Bernard Davis Publ. Tata McGraw Hill.
2. Antenna theory analysis and design, Constantine A. Balanis
3. Electronic communications, Dennis Roddy and John Coolen, Pearson Publ.
4. Communication Electronics Principles and applications, Louis E. Frenzel, Tata McGraw Hill.
5. Digital data communication, Miller
6. Introduction to Fiber optics, A. Ghatak and K. Thyagarajan, Cambridge University press.
7. Advanced Electronic Communication systems, Tomasi W.

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Semester IV:EL4UT10: Control Systems (4 Credits)

Objectives:

1. To make student familiar with basic concepts of control theory
2. To understand different control strategies
3. To develop problem solving attitude
4. To impart information about control instrumentation
5. To make students familiar with latest trends in industrial control / production systems

Unit-1: Control system basics

Closed loop control and functional elements in it open-loop control, continuous and discrete state control, control strategies such as feedback, feed forward and adaptive control, steady state optional control concept of DCS, evolution of process control, SCADA supervisory control and data acquisition systems, Fuzzy logic direct digital control CDDC

Unit-2: Control system analysis

Mathematical models of systems, concept of transfer function and its use, method of obtaining transfer function, block diagram of control system, rules of block diagram reductions and examples thereof

Concept of stability, Routh stability criterion, Roth- Hurwitz criterion, Root locus steps in drawing root locus, Use of root locus and examples thereof. Frequency response methods of control system analysis, Bode plots method to plot and examples thereof, Nyquist plots, method to plot and examples thereof, process loop tuning and control system evaluation, Open loop transient response method, Zeigler- Nichols method.

Unit-3: Analog and Digital Controllers

Classification of controllers, Controller terms Discontinuous controllers: On-OFF Controller, three position controller

Continuous controllers: Proportional, Integral and Derivative control

Composite control modes: PI, PD and PID controllers. Derivative overrun and integral windup in PID control mode

Design of analog controller circuits for above modes characteristics and applications DCS hardware and software, distributed process control station (DPCS), SCADA hardware and software, applications

Unit-4: Control system components and system examples

Principle and characteristics of control values, synchro-servo motors, Solenoids, actuators, annunciators, alarms, recorders, Standard Graphics Symbols for Process Control and Instrumentation

Control system examples: Speed control system, position control systems, temperature and level control systems, reel drives, tension control system for paper

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Text / Reference Books:

1. Process control: Principles and applications, Surekha Bhanot, Oxford University Press 2nd Edition.
2. Control Engineering Noel. M. Morris, 3rd Edition Mac Graw Hill.
3. Process control instrumentation technology, C. D Johanson, PHI.
4. Control system engineering, Nagrath and Gopal, New age international limited.
5. Control Systems, U.A. Bakshi and V. U. Bakshi, Technical Publications Pune.
6. Modern Control engineering, Ogata, Prentice Hall, EEE.
7. Control engineering theory and practice, N.M. Bandhopadhyay, PHI.
8. Instrument Engineers' Handbook, Vol. 1: Process Measurement and Analysis, Bela G. Liptak, CRC Press.,

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Elective Theory (Semester III and IV)

ELDT01: Advanced Power Electronics (4 Credits)

Objectives:

1. To study the basic principles and applications of power electronics
2. To understand the solid-state devices required for power electronic circuits
3. To study and understand the power conversion and power transmission principles
4. To study the industrial and domestic applications

Unit-1: Introduction to Power Devices and Circuits

Comparison of Power Electronics and linear electronics, power devices, power circuits, concept of load, Application areas, and Basic concepts of electrical and magnetic circuits
Power diodes: I-V characteristics, switching characteristics, types, SiC diodes, Power BJT, MOSFET, IGBTs: Construction, working, steady state and switching characteristics, switching limits, base /gate drive circuits
Thyristors: SCR Characteristics, two-transistor model, turn-on and turn-off methods, thyristor types, gate drive circuits, Introduction to Power Integrated Circuits

Unit-2: Power Circuits

Rectifiers: single phase half-wave, center tapped full wave and bridge rectifiers performance parameters, three phase bridge rectifiers
Controlled rectifiers: Single phase and three phase – half-wave, semi-full waveand dual converters, Single phase series converters, 12-pulse converters, Powerfactor improvement techniques
AC voltage controllers: ON-OFF control, phase control, single phase Bidirectional controller, 3-phase Bi-directional controller and their types, PWM control, Single phase and 3- phase cycloconverter and their types
DC-DC converters: step-up and step-down converters, performance parameters, switch mode regulators: Buck, Boost, Buck-Boost and Cuk regulators
Inverters: Performance parameters, single-phase bridge inverter, 3 Phase inverters-120° and 180°conduction, voltage control methods for inverters, harmonic reduction, current source inverters, Introduction to resonant pulse inverters
Static Switches: Single phase and three phase AC switches, AC switches for Bus transfer, DC switches. Solid state and Microelectronic Relays

Unit-3: Applications of Power Electronics

DC power supplies: switch mode DC power supplies, flyback, forward, push pull, half bridge, full bridge-converters, resonant DC power supplies, resonant power supplies, bi-directional power supplies
AC Power supplies (UPS): switch mode AC Power supplies, resonant and bidirectional AC Power supplies
DC drives: Basic characteristics of DC motors, Operating modes, single phase and 3 phase drives, DC –DC converter Drives, Closed loop control of DC drives
AC drives: Induction motors drives-squirrel cage and wound rotor motor, Performance characteristics, control methods
Synchronous motor drives-cylindrical rotor, sailent pole, Reluctance, Permanent magnet, switched reluctance- motors, control methods

Brushless DC and AC Motors and Stepper Motor: types and Control
Electric Utility Applications: High voltage DC transmission, shunt and series VAr compensators, Flexible AC Transmission systems (FACTs),
Integral half cycle /cycle control, space heating and air conditioning, HF fluorescent lightning, Induction and capacitive heating, modern electric welding

Unit-4: Practical Design Considerations

Snubber circuits for diodes, SCRs and transistors, Turn-on and turn-off and over voltage snubbers, isolation methods
Control Circuits: Current mode and voltage mode PWM
Cooling and heat sinks, reverse recovery transients, supply and load side transients, Selenium diodes and MOVs for voltage protections, Current protection methods, EMI standards, sources and shielding methods

Text /Reference books:

1. Power Electronics: Circuits, Devices and Applications, Muhammad H. Rashid, 3rd Edition, Pearson.
2. Power Electronics: Converters, Applications, and Design, Ned Mohan, Tore M. Undeland, William P. Robbins, 3rd Edition, Wiley.
3. Power Electronics, P. C. Sen, Tata McGraw-Hill Education.
4. Power Electronics: A First Course, Ned Mohan, 2012.
5. Power Electronics Handbook, edited by Muhammad Rashid, Elsevier
6. Fundamentals of Power Electronics, Robert W. Erickson, Dragan Maksimovic, Springer
7. Power Electronics, Daniel Hart, Tata McGraw-Hill Education, 2011

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Elective Theory (Semester III and IV)

ELDT02: Advanced Embedded Systems (4 Credits)

Objectives:

1. To study the architecture of Advanced RISC machine (ARM7)
2. To learn assembly level programming of ARM-7 and interfacing hardware
3. To get acquainted to fundamentals of operating system
4. To get familiar with real time operating system (RTOS)
5. To introduce one of RTOS in detail

Unit-1: Advanced Risc Machine (ARM-7)

ARM7 CPU Core,Processor Architecture (32-bit), ARM Programmer's Model, ARM Development Tools, Introduction to ARM families, ARM7TDMI Features,Pipelining, Exepections, Interrupt Vector Table, ARM Instruction Set, Thumb Instruction
System Peripherals: Bus Structure, Memory Map, Register Programming, PLL
User Peripherals: GPIO, PWM Modulator, RTC, Watchdog Timer, UART, I2C, SPI, ADC, DAC, CAN
Writing and Optimizing ARM Assembly Code**:** Writing Assembly Code, Profiling and Cycle Counting, Instruction Scheduling, Register Allocation, Conditional Execution, Looping Constructs, Bit Manipulation, Efficient Switches
Overview of ARM Cortex M1, Cortex M2, Cortex M3

Unit-2 : Introduction to Operating Systems

Brief history of OS, Operating system basics and types of operating systems
The BIOS and Boot Process: BIOS Actions, Operating System, Boot Process
System calls, files, processes, design and implementation of processes, communication between processes
Memory Management: segmentation and paging
Memories: virtual, cache etc.
Introduction: mainframe, desktop, multiprocessor, distributed, clustered, real-time, handheld systems, computer system structures

Unit-3: Real Time Operating Systems (RTOS)

Concepts and Definitions: foreground / background systems, critical section of code, resources, shared resources, task, process and threads, multiprocessing and multitasking, task scheduling.IPC mechanismshared memory, context switches (or task switches), kernels schedulers, preemptive and non-preemptive kernels, reentrant functions, round-robin scheduling, priorities (task, static, dynamic), priority inversions, deadlock, semaphores, intertask communication, message mailboxes, message queues, interrupt, clock tick, real time system, issues in real time computing, structure of a real time system, hard real time system vs. soft real time system, advantage and disadvantages of real-time kernels

Case Studies of RTOS on any one platform:RT Linux, MicroC/OS-II, Vx Works, Embedded Linux,LynxOS, OSE, QNX, Windows CE, Xenomai and Basic Concepts of Android OS.

Unit-4: Embedded Real Time Systems

Host and target machines, Linker/locator for embedded software, Getting embedded software into the target systems, debugging techniques, testing on your host machine.
Kernel Structure: Critical Sections, Task Control Blocks, Task Level context Switch.
Task Management - Creating a task, Task Stacks, Stack Checking, Deleting a Task, Suspending a Task, Resume a Task.
Time Management - Delaying a Task, Resuming a Delayed Task, System time.
Semaphore Management- Creating a Semaphore, Deleting a Semaphore, Waiting on a Semaphore, Creating a Mutex, Deleting Mutex, Waiting on Mutex.
Message Mailbox Management- Crating a Mailbox, Deleting Mailbox, Waiting for a Message at a Mailbox
Porting an Operating System like µCOS / RT Linux / Free RTOS or any other equivalent on an Embedded Platform

Text / Reference Books:

1. "ARM System On Chip Architecture", By Steve Furber, Pearson
2. ARM System Developer"s Guide Designing and Optimizing Systems Software, by Andrew Sloss, Elsevier
3. The insider"s guide to the PHILIPLS ARM7 based Microcontrollers, An Engineer Introduction LPC2100 Series, Trevor Martin, Hitex ltd
4. LPC 214x User Manual
5. Operating System Concepts and Techniques,M. Naghibzadeh.
6. Operating Systems Concept, Galvin, John Willey and Sons
7. Operationg Systems by Achyut Godbole, TMH
8. MicroC/OS-II The Real-Time Kernel, Jean J. Labrosse, Elsevier

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Elective Theory (Semester III and IV)

ELDT03: Digital Signal Processing (4 Credits)

Objectives:

1. To get acquainted to fundamental aspects of Digital Signal Processing (DSP)
2. To become aware of mathematical background required for DSP
3. To learn design of digital filters and implementation on digital Signal Processor
4. To study DSP applications

Prerequisites: Laplace transform, z-transform (ZT), inverse z-transform (IZT), ROC, IZT methods - power series, partial fraction expansion, residue and their comparison

Unit-1: Signals and Systems

Classification of Signals and Systems: continuous time and discrete time, signal types, amplitude and phase spectrum, classification of systems
Real time DSP system and interfacing A-D conversion process, sampling, quantization and encoding, oversampling and antialiasing, one bit ADC, DAC conversion process, oversampling

Unit-2: Mathematical Tools for DSP

Fourier series, Fourier Transform (FT), discrete Fourier Transform (DFT) and its inverse DFT, properties of DFT, computational complexity, decimation-in-time, Fast Fourier Transform (FFT) algorithm, butterfly algorithm and its computational advantage
Inverse FFT, implementation of FFT, DIT and DIF algorithm
Correlation, convolution, types of convolution, deconvolution, implementation and application examples of convolution and correlation

Unit-3: Digital Filter Design

Frame work of digital filter design: introduction, types – infinite impulse response (IIR), finite impulse response (FIR)
FIR filter: features, filter design steps, design, filter specifications, coefficient calculation methods, window method, optimal method, frequency sampling method, realization structure for FIR filter, finite word length effects, and implementation of FIR filters
IIR Filter: basic features, design steps, coefficient calculation, poles-zeros placement, impulse invariant method, bilinear transform, Matched z-transform, Nyquist effect, realization structure for IIR filter, finite word length effects, implementation of IIR filters
Multirate digital signal processing, sampling rate reduction/Increase, conversion, software implementation and decimator and interpolator

Unit-4: DSP Processor and Application Areas

Complete architecture for signal processing, fixed time digital signal processors, floating time digital signal processors, implementation of DSP algorithm for FIR, IIR filtering, FFT and multirate processing, processor and application areas

Text /Reference Books:

1. Digital Signal Processing: A Practical Approach, Emmanuel Ifeachor, Barrie Jervis, Prentice Hall.
2. Digital Signal Processing: S. Salivahan, A. Valuraj, C.Gnanapriya, Tata McGraw Hill, Pub. Co. Ltd. Edn. 2006.
3. Digital Signal Processing: A Hands on Approach: Charles Schuller, Mahesh Chugani, Tata McGraw Hill Pub. Co. Ltd. Edn. 2006.
4. Digital Signal Processing: - Principles, Algorithms and Applications: John G Proakis, Dimitris G Monolkis, and Pub. Person 2005.Operating Systems Concept, Galvin, John Willey and Sons.
5. Digital Signal Processing and Applications with the C6713 and C6416 DSK, Rulph Chassaing, a John Wiley & Sons, Inc.
6. The Scientist and Engineer's Guide toDigital Signal Processing, Steven W. Smith Second Edition California Technical Publishing.

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Elective Theory (Semester III and IV)

ELDT04: Mechatronics (4 Credits)

Objectives:

1. To introduce the students of Electronic Science to the subject of mechatronics
2. To review the concepts of sensors, transducers and actuators, with a view to use them in mechatronic systems
3. Enable the learner to acquire basic knowledge of mechanical systems to be used with electronic systems
4. To introduce the concept of models for electrical and mechanical systems and their combinations for building system models for predicting the behavior of electromechanical systems
5. To provide a quick overview of the communication systems and protocols used in mechatronics

Unit-1: Introduction to Mechatronics, Sensors and Transducers

Introduction to Mechatronics: what is mechatronics, an overview of - the design process, various systems in mecharonics such as embedded systems, modeling systems, measurement systems, control systems, examples of mechatronic systems

Sensors and Transducers: Introduction to sensors and transducers, sensitivity analysis, effect of component variation, measurement of motion, digital sensors for motion measurement,force, torque and tactile sensors,vibration- acceleration sensors, flow measurement, temperature sensors and devices, applications of sensors

Unit-2:Mechanical and Electrical Actuation Systems

Mechanical actuation systems: mechanisms and their role in mechatronic systems, translational and rotational motion – degrees of freedom, kinematic chains – examples of links, toggle linkage, slider-crank etc. cams, gears – types, gear trains, gear ratios, uses ofrotation-to-translational motion – rack and pinion, ball screw and links, Ratchet and pawl, belt and chain drives, bearings– types and uses, consideration of moment of inertia and torque for motor selection

Electrical actuation systems: Relays and applications with driver circuits,
Solid state switches- diodes, thyristors, BJTs and MOSFETs and their applications as switches and driver circuits, solenoids
DC Motor-: types, basic construction and working, brushed and brushless DC motor driver circuits, and speed control
AC motors- basic idea of single phase and three phase motors and their speed control
Stepper motors- types, construction, features, specifications, control of drives.

Unit-3: System Models and Dynamic responses of systems

Basic system models: Mechanical (translational and rotational) system building blocks, electrical system building blocks, electrical and mechanical analogies and their use in analysis,basic idea of fluid system building blocks and thermal system building blocks
System models- Engineering system models, rotational-translational systems, electromechanical systems, linearity

Dynamic responses of systems: modeling dynamic systems, terminology of first order and second order system, performance measures for second order system, system identification

Unit-4: Mechatronic System Design

Artificial intelligence-basic ideas, meaning, perception and cognition, reasoning and learning
Communication Systems- meaning of centralized hierarchical and distributed control. Parallel and serial data transmission, modes of serial data transmission, types of networks and methods of network access control
Meaning of and basic elements of protocols, open systems interconnection communication model, serial communication interfaces, parallel communication interfaces, wireless protocols
Mechatronic systems - Mechatronic designs and case studies

Text / Recommended Books:

1. Mechatronics by W.Bolton, 4th Edition, Pearson.
2. Mechatronics System Design, by DevdasShetty and Richard Kolk, 2nd Edition, Cengage Learning.
3. Robotics Engineering – An integrated approach. By Richard W. Klafter, Thomas A. Chmielewski and Michael Negin, PHI Learning Pvt. Ltd.

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Elective Theory (Semester III and IV)

ELDT05: Digital Image Processing (4 Credits)

Objectives:

1. To make the students aware of basic mathematics required for image processing
2. To make students familiar with different image processing algorithms
3. To provide the students with the knowledge of practically implementing the algorithms for various applications

Unit-1: Introduction to Digital Image Processing

Introduction to DIP, examples of application fields that use image processing e.g. Gamma ray imaging, X-ray imaging, UV band imaging, visible and IR band imaging etc., components of an image processing system, introduction to image sensing and acquisition, digital camera working principal, image storage, processing, communication and display, overview of image representation and modeling techniques

Light and electromagnetic spectrum, elements of visual perception, luminance, brightness, contrast, hue, saturation, mach band effect, color image fundamentals-RGB, HIS models, basic concepts of sampling and quantization and companding in imaging, two dimensional sampling theory, practical limitations in sampling (aliasing effect), digital image representation, spatial and intensity resolution, image interpolation, relationship between image pixels- neighbours, logical and arithmetic operation on images

Unit-2: Image Enhancement, Image Filtering and restoration

Some basic intensity transformation function, histogram processing, fundamentals of spatial filtering, spatial operations like smoothing and sharpening spatial filters, multispectral image enhancement, false color and pseudo color, color image processing, typical example for image enhancement and spatial filtering.

Basic concepts of Fourier transform and Fourier series, 2D Fourier transform and 2D discrete fourier transform, basics of filtering in frequency domain, image smoothing (LP), sharpening (HP), selective filtering (BP and BR) in frequency domain & their implementation(Using Image processing Tools),, homo morphic filtering. Image observation and noise Models, image restoration in presence of noise using spatial filtering, periodic noise reduction by frequency domain filtering, estimating the degrading function, inverse filtering, Least squares filtering, geometric mean filter, image reconstruction from projections, typical example for frequency domain filtering

Unit-3: Image Analysis and Computer Vision

Spatial and Transform Features extraction-image pyramids, sub band coding, the Haar transform, Hough transform,, multi resolution expansion, Image Segmentation: - fundamentals, point, line and edge detection, edge detection, thresholding, region based segmentation, segmentation using morphological watersheds, the use of motion in segmentation, region representation and description:- boundary extraction, boundary representation, region representation, moment representation, structure, shape features, textures, scene matching and detection, classification techniques, image understanding, typical examples illustrating above algorithms

Unit-4: Image compression, MATLAB implementation and case studies

Pixel and data redundancy, fidelity criteria, information theory, error free coding, lossy compression, transform coding (DCT and wavelet)
Image file formats, TGA, GIF, TIFF, BMP, JPEG, CDR
Applications and case studies: feature enhancement using equalization methods, salt and pepper noise removal using spatial as well as frequency domain filters, study of a biometric system for finger print reading covering the points like the sensor device, data quality assessment, comparison and matching, database etc, applications of digital image processing in medical spectroscopy

Text / Reference Books:

1. Rafel.C.Gonzalez, Richard .E.Woods, “Digital Image Processing”, Pearson Third Edition, 2008.
2. Rafel.C.Gonzalez, Richard .E.Woods and Steven L. Eddins “Digital Image Processing usind MATLAB”, Pearson 2004.
3. Anil.K.Jain, “ Fundamentals of Digital Image Processing”, Pearson, 2002.
4. Keenneth R Castleman, "Digital Image Processing", Pearson Education, 1995.

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Elective Theory (Semester III and IV)

ELDT06: Optoelectronics and Fiber Optic Communication (4 Credits)

Objectives:

1. To become aware of different optoelectronic devices and systems
2. To acquire Knowledge of optical fiber communication system
3. To study optical fiber sensors and their applications

Unit-1: Light Sources

Light Emitting Diodes: Variable band gap semi-material idea of hetero–junction, simple and double hetero-structure light sources, quantum efficiency, internal and external quantum efficiency, expression for total and internal quantum efficiency, reasons for external quantum efficiency to be less than internal quantum efficiency, intensity distribution of LED, Lambertial sources, encapsulation of LED's, types of LED's surface and edge emitting, Burus LED

LASER:LASER as an amplifier of light and necessary conditions for amplification, special properties of LASER-monochromatic, coherent and light power nature, directionality, divergence and attenuation of LASER beam, study of three level LASER(Ruby LASER), four level laser, tunable laser, semiconductor laser and applications of high power, low power continuous wave and pulse lasers

Unit-2: Light detectors

Idea of light detectors and their basic types, natural and specialized light detectors, type of specialized light detectors, thermal, quantum light detectors, types of quantum photo detectors, photo resistive, photovoltaic, photo emissive detectors. Study of quantum detectors-photoelectric cell, photomultiplier tube, photodiode, important characteristics of light detector-spectral response, viewing angle, efficiency, and material used for photo-detectors

Unit-3: Optical Fiber –Theory and Applications

Action of optical fiber as wave guide, advantages of optical fiber communication over normal medium, necessary conditions for wave guiding mechanisms of optical fibers, construction of optical fiber cable, role of strength of material, types of optical fibers. Step index and graded index fibers, comparison of wave guiding action of both expression for angle of acceptance and cone of acceptance, numerical aperture, time dispersion, splicing and fiber connections - what is splicing, requirements of splicing, practical methods of splicing, various types of optical fiber connectors, losses in optical fiber communication, Losses due to fibers, intrinsic and extrinsic losses, intrinsic losses due to atomic scattering and molecular absorption. Expression for loss factor, extrinsic losses due to mechanical effects, micro bends, cracks etc. losses due to connectors, core longitudinal, angular misalignment, mismatch of rate indices of fiber material etc., comparison between losses due to splicing and connectors, Expression for Electromagnetic wave guided by fiber, modes of transmission, expression to 'V' number and number of maximum modes of transmission, dispersion in optical fibers, wavelength and time dispersion, internodes dispersion, double crucible and chemical deposition methods of manufacturing of optical fibers

Unit-4: Measurements on Optical Fibre and Optical Fibre Systems

Optical fibre experimental setup, launching light into fiber, detection etc
Fiber attenuation measurement, dispersion measurement profiles measurement, numerical aperture measurement, diameter measurement
Optical transmitter / receiver circuits, driver circuits for LED, detector circuit design using photodiode, phototransistors, and fiber choice
Communication special fibers – DS fiber, NZDS fiber, integrated optics, slab and strip wave-guide, and Electro-optic devices – phase shifters, interferometer modulators, use of optical fibers as sensors

Text / Reference Books:

1. Optoelectronics, Kaiser, TMH(1992)
2. Optical fiber communication – Principles and practice, J.M. Senior, PHI (1990)
3. An introduction to fiber optics: Ajoy Ghatak, K. Thygarajan, Cambridge University Press (1998)
4. Fiber optics and Optoelectronics, R.P. Khare, Oxford University Press.

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Elective Theory (Semester III and IV)

ELDT07: Nanoelectronics and Devices (4 Credits)

Objectives:

1. To become awareof basics of quantum and statistical techniques
2. To study various growth techniques of nanomaterials
3. To studycharacterization techniquesof nanomaterials
4. To become aware of namomateials and some nanostructured devices

Unit-1: Introductory Quantum and Statistical Techniques for Nano-electronics

The Schrodinger time dependent and time independent wave equations, wave equation of particles, atoms and atomic orbital's, concept of tunnelling
Gaussian, Poisson, Maxwell – Distribution functions, Fermi-Dirac, Bose Einstein MaxwellBoltzmann - statistics,statistics of electronics in solids and nanostructures, Fermi levels in intrinsic and extrinsic semiconductor, density of states at low dimensional structure, electrontransport in nanostructures(Qualitative approach)

Unit-2: Growth Techniques of Nanomaterials

Top-down and bottom-up techniques, lithographic process and its limitations, non-lithographictechniques, plasma arc discharge, sputtering, evaporation, chemical vapour deposition (CVD), pulse laser deposition, molecular beam epitaxy (MBE), sol-gel techniques, electro-deposition

Unit-3: Characterization tools of Nanomaterials

Basic concepts ofscanning probe microscopy (SPM), general concept and defining characteristics of Atomic Force Microscope (AFM,) Scanning Electron Microscope(SEM), Transmission electronmicroscope (TEM), thickness measurement techniques,contact-step height, optical–reflectance and ellipsometry, atomic force microscope, practical implementation of XRD / AFM / SEM / TEM results

Unit-3:Nanoelectronic Devices

Fundamentals of logic devices, requirements, dynamic properties, threshold gates,physical limit to computation, carbon nanotubes, fullerence, types of nanotubes, concept of logic devices classification, two terminal devices, field effect devices, coulomb blockade devices, spintronics, quantum computing, DNA computers
Nanostructured devices: tunneling diode, resonant tunneling diode, single electron-transistor, molecular electronic devices simulation and circuit design fabrication, MEMs, robot, random access devices, flash memory

Text / Reference Books:

1. Introduction to Nanoelectronics Science, Nanotechnology, Engineering and Applications, Vladimir V. Mitin, Viatchaelslav A. Stroscio, Cambridge University press.
2. Foundations of Nanomechanics from Solid -State Theory to Device Applications, Andrew N. Cleland , Springer International Edition.
3. Nanotechnology: Basic Science and Emerging Technology, Raguse , Chapman Hall/CRC,2002.
4. Understanding Nanoscience and Nanotechnology, T. Pradeep TMH, 2007.
5. Nanoelectronics and Infromation Technology Advanced Electronic Materials and Novel Devices, Rainer Waser Wiley, VCH, 2003.
6. Introduction to Nanoscience and Nanotechnology, K.K. Chattopadhayay, A.N. Banergee, PHI Learning Private Limited, 2012.
7. Solid State Electronics Devices, 6^{th} Edn, Ben G. Streetman, S. Banergee.

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Elective Theory (Semester III and IV)

ELDT08: Programmable Logic Controllers and Applications (3 Credits)

Objectives:

1. To make the students aware of programmable logic controllerhardware
2. To introduce students to PLC programming
3. To study some case studies using PLC and introduce distributed control systems

Unit 1: Programmable logic controllers

Historical background, programmable controller and features, principle of operation, architecture, memory, Input/output module with reference tosink or source, output module-relay, transistor, triac, power supply, signal conditioning, remote connections, networks, PLC verses other control e.g. relay logic, PC, PLC product application range,selection of PLC, documentation of PLC, Examples of applications

AC mains interfaces, PLC wiring, device wiring, 24V DC input interfaces, sourcing devices, sinking devices,output interface configurations and wiring

Unit 2: PLC Programming

Programming methods- ladder diagrams, function blocks, statement list, programming a PLC,programming terminals, ladder relay instructions, ladder relay programming (digital gates, boolean expression, flip flop), timers, counters and shift registers: types of timers, programming timers, off-delay timers, pulse timers, programming examples, forms of counter, programming, up and down counting, timers with counters, sequencer, data handling: registers and bits, data handling, arithmetic functions, closed loop control shift registers, ladder programs

Unit 3: Case studies and Introduction to Distributed Control Systems (DCS)

Program development, safe systems, commissioning, fault finding, system documentation programs- temperature control, valve sequencing, conveyor belt control, control of a process, traffic lights, controller, alarm monitor program, parking garage counter, vending machine, automatic stacking program, AC motor drive interface, elevator, water level controller

SCADA system and DCS architecture, local control unit, programming language, communication facilities, operator interface, engineering interfaces

Text /Reference Books:

1. John W. Webb and Ronald A. Reis, “Programmable Logic Controllers Principles and Applications“, Fifth Edition, Prentice Hall Publication, New Delhi, 2002.
2. L.A. Bryan, E.A. Bryan, “Proghrammable controllers theory and Implementations” second edition, An Industrial Text Company Publication.
3. W.Bolton, “Programmable Logic Controllers”, Fifth Edition, Elsevier Publication
4. Gary Dunning, “Introduction To Programmable Logic Controllers”, Third Edition.
5. John R. Hackworth, Frederick D. Hackworth, “Programmable Logic Controllers Programming Methods and Applications”, Pearson Publication.
6. Frank D. Petruzella, “Programmable Logic Controllers”, Third Edition, Tata McGraw Hill Education Private Limited, 2010.
7. John F. Kennedy “Programmable Controllers An engineer’s guide” 3rd Newnes Publications
8. Hugh Jack “Automating Manufacturing Systems with PLCs”

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Elective Theory (Semester III and IV)

ELDT09: VLSI System Design (3 Credits)

Objectives:

1. To study MOS transistor, its characteristics, MOS models
2. To study the various MOS technologies used for VLSI
3. To learn VLSI design and layout design rules
4. To design simple combinational and sequential digital logic circuits

Unit-1: Basic Electrical Properties of MOS and CMOS Circuits

MOS transistor – threshold voltage, threshold voltage equations, MOS device equations, basic DC equations, second order effects
MOS Models, small signal AC characteristics, NMOS inverter, depletion mode and enhancement mode pull ups, CMOS inverter–DC Characteristics, inverter delay,pass transistor, transmission gate, power consumption in CMOS gates, static dissipation, dynamic dissipation

Unit-2: Layout Design Rules

Need for design rules, Mead Conway design rules for the silicon gate NMOS process, CMOS based design rules, simple layout examples, sheet resistance, area capacitance, wiring capacitance, driving large capacitive loads

Unit-3: Digital Logic Design

Switch logic, pass transistor and transmission gate based design, gate logic, inverter, two input NAND gate–NOR gate, other forms of CMOS logic, clocked CMOS, Logic, recharged Domino CMOS Logic, Structured design
Simple combinational logic design examples:parity generator, multiplexers,
Clocked sequential circuits: two phase clocking, charge storage, dynamic shift register semi static register, JK flip flop circuit

Text / Recommended Books:

1. Kamran Eshraghian, Douglas A Puknel and Sholeh Eshraghian, “Essentials of VLSI.
2. “Circuits and Systems,” prentice Hall of India, New Delhi, 2005.
3. Neil H.E West and Kamran Eshranghian, “Principles of CMOS VLSI Design: A system perspective “, Addison-Wesley, 2nd Edition, 2004.
4. Sung-Mo Kang and Yusuf Leblebici,” CMOS Digital integrated circuits”, Tata McGraw Hill 3rd Edition, New Delhi, 2008.
5. Jan M Rabaey, Chandrasekaran A and Nikolic B, “Digital Integrated Circuits,” Pearson Education, 3rd edition, 2004.
6. Amar Mukharjee, “Introduction to NMOS and CMOS VLSI System,” Prentice Hall, USA, 1986.
7. Wayne wolf,” Modern VLSI Design : System on chip design”, Pearson Education Inc., 3rd Edition, Indian Reprint, 2007.
8. Allen Holberg, “Analog CMOS Design”, Oxford University Press.
9. Randall L. Geiger, Phillip E. Allen “VLSI Design techniques for Analog and Digital Circuits” McGraw Hill International Editions

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Elective Theory (Semester III and IV)

ELDT10: Robotics-Kinematics and Control (3 Credits)

Objectives:

1. To familiarize the learner with terminologies used in robotics.
2. To provide a background of representations of axis rotations, homogeneous transformations and their use in kinematics.
3. To introduce robot dynamics and robot joint control systems

.

Unit-1: Introduction and Transformations

Brief history of robots, types of robots– components and structure, kinematic arrangements (configurations), classification of robots based on various methods of classification such as control method, power source, applications and coordinate systems, Application areas of robots

Rigid Motions: Rotations – coordinate transformations relating to representation of a point in two different frames, composition law for rotational transformations, rotation about an arbitrary axis, representing an arbitrary rotation using only three independent quantities using axis/angle representation, Euler angle representation and roll-pitch-yaw representation

Homogeneous transformation matrices, skew symmetric matrices, angular velocity and angular acceleration, addition of angular velocities

Unit-2: Kinematics

Forward kinematics: kinematic chains, homogeneous transformations of kinematic chains. Denavit-Hartenberg (D-H) representation, examples

Inverse kinematics: difficulty in obtaining inverse kinematic solutions, kinematic decoupling – inverse position and inverse orientation, examples

Velocity Kinematics: Deriving Manipulator Jacobian, finding angular velocity and linear velocity to determine Jacobian

Singularities – decoupling of singularities, wrist singularities and arm singularities

Unit-3: Dynamics and Robot Control

Dynamics: deriving dynamical equations of a manipulator by deriving Euler–Lagrange equations by forming Lagrangian of a system

Trajectory planning and generation, joint space schemes, Joint space schemes with via points. Cartesian straight line motion and circular motion, trajectory planning for orientation, difficulties in trajectory planning

Independent Joint Control: basic structure of feedback control system, dynamics of PMDC motor, DC motor control system, set-point tracking using PD and PID compensator, Drive-train dynamics,trajectory interpolation

Force control– static force / torque relationships, natural and artificial constraints, stiffness and compliance

Text / Recommended Books:

1. Robot Dynamics and Control, Spong and M. Vidyasagar, Wiley Student Edition
2. Robotics: Fundamental Concepts and Analysis, Ashitava Ghoshal, Oxford Higher Education
3. Robotic Engineering: An integrated approach, Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, Prentice-Hall India

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Elective Theory (Semester III and IV)

ELDT11: Wireless Sensor Networks (3 Credits)

Objectives:

1. To familiarize with wireless sensor network.
2. To provide a background of single-node architecture and wireless networking protocols
3. To study currently available sensor platforms and tools

.

Unit-1: Introduction and Overview of Wireless Sensor Networks

Introduction,background of sensor network technology, challenges and hurdlesExamples of WSN applications: home control, industrial automation, medical applications. Radio technology primer: propagation and propagation impairments, modulation, ISM band, Specifications of WSN devices

Unit-2: Architecture Considerations and Networking Sensors

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts
Physical Layer and Transceiver Design considerations, Introduction to protocols, Overview of Communication Protocols for Sensor Networks, wireless networking protocols (IEEE 802.11, 802.15, 802.16, GPRS, MAC protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing

Unit-3: Infrastructure formation, Available Sensor Platforms and Tools

Introduction to the RF Modules, architecture of the Zigbee module, on-chip resources of the Zigbee Pro, programming the Zigbee, designing of WSN with Zigbee modules
Topology Control, Clustering, Time Synchronization, Localization.
Hardware platforms – Berkeley Motes or equivalent, Programming Challenges,
Introduction to Simulators: NS2, OPNET, OMNET, WSN Planner Tool etc.
Case studies

Text / Recommended Books:

1. Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology-Protocols and Applications", John Wiley & Sons, 2007.
2. Ananthram Swami, Qing Zhao, Yao-Win Hong, Lang Tong, "Wireless Sensor Networks-Signal Processing and Communications Perspectives" John Wiley & Sons,2009
3. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", ELSEVIER publications, 2005.
4. Kaveh Pahlavan and Prashant Krishnamurthy, "Principle of Wireless network- A unified approach", Prentice Hall, 2006.
5. "Theoretical and algorithmic aspects of sensor, Ad Hoc Wireless and Peer to Peer Networks", Edited by Jie Wu, Auerbach Publications.
6. Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems, CRC PRESS Publication, Edited by Mohammad Ilyas and Imad Maugoub.

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Elective Theory (Semester III and IV)

ELDT12: Digital Communication (3 Credits)

Objectives:

1. To provide a background of signals, their characteristics and mathematical representations and noise in signals
2. To introduce various digital modulation techniques
3. To study get introduced with information and coding theory of digital communication

.

Unit-1: Signals and Noise

Fourier series and Fourier transform, autocorrelation and cross correlation, cross correlation of energy and power signal.
Noise: Sources of noise, signal to noise ratio, noise figure, noise temperature, Sampling theorem, Rayleigh energy theorem, probability theory, Gaussian Process

Unit-2: Digital Modulation Techniques

Quantization, pulse Code Modulation (PCM), PCM generation and receiver, companding in PCM, Delta Modulation, Adaptive Delta Modulation, Differential PCM,
ASK, PSK, FSK, MSK, QPSK, BPSK, detection ofbinary modulation techniques in the presence of noise, error probability in ASK, PSK, FSK

Unit-3: Information and Coding Theory

Concept of information and entropy, Shannon Theorem, channel capacity, self information, discrete and continuous entropy, mutual and joint information, redundancy
Coding Theory - Source encoding andchannel encoding, error detection and correction, variouscodes for channel coding, rate distortion function
Error Control Code: Introduction to block coding and optimal decoding, binary hamming code,structure of linear code, decoding of linear block code, Reed Mulercode, structure of cyclic code, Bose Chaudhary Hocquenghem (BCH) codes, cyclic Hamming Code

Text / Recommended Books:

1. Digital communication, J. G. Proakis, Tata McGraw-hill (TMH) Publication, 3rd edition, 1990.
2. Digital Modulation and Coding, S.G.Wilson, PHI, 1996.
3. Digital communications: Fundamentals and applications, Bernard Sklar, PHI, 2003.
4. Communication System, Simon Hawkins, John Wiley, 3rd edition, 2004.

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Elective Theory (Semester III and IV)

ELDT13: Computational Methods for Electronics (3 Credits)

Objectives:

1. To learn with the help of relevant illustrations in electronics.
2. Use of MATLAB and other software tools be made while discussing the importance of each of the topics.
3. Activities based on the survey and use of online sources available on internet be given to the students.

Unit-1: Errors and Statistical Techniques

Different types of errors, significant figures, data types, measures of central tendency-mean, mode, median, variance, concept of probability, probability distribution functions, Gaussian, Poisson and binomial distribution functions

Unit-2: Matrices

Solving linear equations AX + B = C, LU factorization, Gauss Seidal method, Gauss elimination method, inverse of a matrix, Applications of matrices in electronic circuit analysis

Unit-3: Numerical methods

Roots of an algebraic equation: bisection method, Newton- Raphson Method, secant method, applications to stability of control system
Interpolation, Finite differences, Newton Forward difference and backward difference formulae, Lagrange's interpolation
Curve fitting techniques: linear regression, cubic spline, exponential curve fitting, polynomial curve fitting, application to smoothen the data by reduction in noise, linearization of electrical systems
Solution of Ordinary and partial differential equations, two dimensional Laplace equation, Poisson equation-application to diode, wave equation,
Integration: Trapezoidal and Simpson's $1/3^{rd}$ and $3/8^{th}$ rules, R-K method

Text / Reference Books:

1. Computer Oriented Numerical Methos, V. Rajaraman, PHI Learning.
2. Introductory Mthods of Numerical Analysis, S. S. Shastry, Prentice Hall of India.
3. Numerical Recipies in C, The art of Scientific Computing, William H.P, S.A. Teukolsky, Second Edition, Cambridge University Press.
4. Getting Started with MATLAB: a Quick introduction for Scientists and Engineers, Rudra Pratap, Oxford University Press.
5. MATLAB and Introduction with applications, Amos Gilat, Wiley Student edition.

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EL3UP07: Practical Course –VII (4 Credits)

General Electronics + Special Laboratory: Any 10 Practicals from following sections

EL3UT09: Communication Electronics

1. Design of AM transmitter and receiver
2. Design of FM transmitter and receiver
3. Delta modulation
4. Design PCM encoder and decoder system
5. Design of ASK / FSK transmitter and receiver
6. Time division Multiplexing
7. Telemetry Applications
8. Varactor diode characteristics and its application in FM

EL4UT10: Control Systems and Process Instrumentation

1. Signal conditioning circuits for analog controller
2. Design and implement ON-OFF Controller
3. Design and implement P / PI / PID controller
4. To study the position / velocity control of dc servo motor
5. Study of stability of process control system
6. Study of time domain performance of control system
7. Problem solving using root locus method
8. Flow control using solenoid valve

ELDT01: Advanced Power Electronics

1. Designing of testing of Boost converter and Buck Boost converter.
2. Stepper motor control using current mode PWM
3. AC motor speed control
4. DC power supply using fly back / forward / half bridge / full bridge converter
5. Emergency light control
6. Measurement of transformer parameters
7. DC motor speed control using PWM
8. Design and study of Integral half cycle/full cycle control.
9. Study of synchronous motor drive

ELDT04: Mechatronics

1. Study of a DC servo motor
2. Study of BLDC motor, its speed control/position control
3. Study of PMDC motor toque speed characteristics
4. Study of AC servo motor, its speed control/position control
5. Set up a flow control system using suitable flow sensor and actuator
6. Implementation of velocity profile of servo control

ELDT06: Optoelectronics and Fiber Optic Communication

1. Optical Fiber parameter testing
2. Measurement of mode field diameter
3. Measure and plot LASER beam Profile
4. Ploting and study of LED profile
5. Study of optical position encoder

6. Setting up fiber optic voice link
7. Design Build and test digital data communication system

ELDT07: Nanoelectronics and Devices

1. Processing and development of nanoparticle gas sensor
2. Magnetic separation / identification studies of thermally-blocked nanoparticles
3. Electrodeposition and corrosion behavior of nanostructured composite film
4. Photocatalytic activity of nanomaterials

ELDT10: Robotics-Kinematics and Control

1. Build a mobile robot that responds to light intensity and moves towards/away from light
2. Build a robot that responds to voice commands
3. Test a robotic gripper that is pressure sensitive
4. Build a mobile robot that detects a object and moves away from object

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EL3UP08: Practical Course –VIII (4 Credits)

Computer - Microcontroller Laboratory: Any 10 Practicals from following sections

ELDT02: Advanced Embedded Systems

1. Interfacing Alphanumeric LCD to 16/32 bit microcontroller
2. Interfacing key board to 16/32 bit microcontroller
3. Programming ADC of 16/32 bit microcontroller
4. Programming DAC of 16/32 bit microcontroller
5. Interfacing external interrupt.
6. Programming RTC / EEPROM / I2C of 16/32 bit microcontroller
7. Programming UART of 16/32 bit microcontroller
8. Creating Process / Tasks / Threads and display their PIDs
9. Implementation of priority based execution of 3 task using RTOS
10. Implementation of Semaphore using RTOS
11. Interfacing of LCD and SSD to ARM using RTOS for counter aplication

ELDT03: Digital Signal Processing

Simulation using Matlab

1. Generation of signals
2. Impulse, Step, Exponential and Ramp functions
3. Design of FIR filter
4. Design of IIR filter
5. Linear and circular convolution
6. Concept of Aliasing

On DSP Board

1. DFT computations
2. FFT Computations
3. Convolution of two discrete signals
4. Waveform generation
5. FIR Filter design
6. IIR filter design

ELDT05: Digital Image Processing

1. Implementation of image enhancement techniques in MATLAB
2. Implementation of histogram processing techniques in MATLAB
3. Build a GUI in MATLAB for image noise filtering & edge detection technique in MATLAB
4. Study & implementation of a segmentation algorithm in MATLAB
5. Development of Photoshop type application for image processing

ELDT07: Nanoelectronics and Devices

1. Process and Device Simulation of Single-Electron Transistor (SET)
2. SOI based nanowire single-electron transistor - Design, simulation
3. Simulation study of nanowire TFET device.
4. Process and device simulation of Silicon Nanowire FinFET device

ELDT08: Programmable Logic Controllers and Applications

1. Relay programming (all logic gates, boolean equation like multiplexer, demultiplexer, encoder, decoder, latch etc.)
2. Temperature controller
3. Conveyor belt control

4. Alarm monitor program
5. Car parking System
6. Vending machine
7. AC motor drive programming Elevator
8. Water level controller

ELDT09: VLSI System Design

To design following logic, calculate W/L ratios, prepare layout in multi metal layers and simulate Assume suitable technology, load capacitance, free running frequency, switching timings etc.

1. CMOS Inverter.
2. CMOS NAND, NOR.
3. 2:1 MUX by conventional method and by transmission gates
4. CMOS Combinational logic for minimum 4 variables
5. RS latch, D latch
6. Edge triggered D register
7. Clock divider
8. Synchonous Counter/ Shift register

ELDT11: Wireless Sensor Networks

1. Study of 802.15.4-interfacing and configuration
2. Setting up communication between 2 zigbee nodes
3. Home automation- related experiments
4. Study of effect of various modes of Microcontrollers on Network performance.
5. Experiments on crossbow or equivalent platform:
   a. Study of network topology,
   b. Study of various sensors on the nodes,
   c. Interfacing external sensor to the node,
   d. Study of other networking parameters of the hardware platform.
6. Simulation study of WSN to
   a. Plan a network for given area and given range with various deployment strategies (Random, Cartesian, Radial, Hexagonal)
   b. Find critical nodes in the network under consideration
   c. Study the effect of obstacles on the network.

ELDT12: Digital Communication

Experiments using MATLAB

1. Study of DM & ADM systems.
2. Generation and reception of BPSK
3. Generation and reception of FSK
4. Generation and reception of QPSK
5. Continuous Phase FSK
6. Coherent FSK-Demodulation
7. Quadrature-Amplitudemodulation (QAM)
8. Phase shift keying (PSK)
9. Generation of Hamming codes
10. Huffman coding

ELDT13: Computational Methods for Electronics

1. Estimate the error in surface and volume density of charge
2. Estimation of probability of an event using Poisson and Gaussian distribution
3. Solution of state equations for a given electrical circuit
4. Roots of Bessel's function of kind of 1^{st} order
5. Estimation of average electric power of different signals
6. Eigen values and eigen vectors of matrix
7. Solution of 2 dimensional boundary value problem using Laplace equation
8. Fit a polynomial of order 1 / 2/ 3 for a given data
9. Exponential curve fitting for discharging of a capacitor
10. Estimation of a function at a given point using Lagrange's interpolation

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EL3UP09: Practical Course –IX PLE (2 Credits)

Candidate should carry out a Project Like Experiment (PLE). PLE is a small project equivalent to 6 practical experiments. PLE of this semester can be a part of final semester project. A project report should be submitted to the department. Log book of the continuous progress of the work should be maintained by candidate.The guidelines of the assessment of the project for in-semester examination as well as end-semester examination are as follows

Sr. No.	Performance Criteria	Max. %	Rating (%)				
			Excel-lent	Very Good	Good	Fair	Poor
1.	Quality of Performance	10	10	8	6	4	2
2.	Regularity of Work carried	10	10	8	6	4	2
3.	Self Expression, Presentation Communication Skill and Demonstration	10	10	8	6	4	2
4.	Viva-Voce	10	10	8	6	4	2
	TOTAL	40	40	32	24	16	8

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EL3UP10: Practical Course X Project (10 Credits)

Candidate should carry out a Project equivalent to 10 credits in the semester IV. The student should report about a progress of a project to the guide at least twice in the week. Log book of the continuous progress of the work should be maintained by candidate. A one copy of project report should be submitted to the department. The assessment of the project work is a continuous process. The guidelines of the assessment of the project for in-semester examination as well as end-semester examination are as follows

Sr. No.	Performance Criteria	Max. %	Rating (%)				
			Excel-lent	Very Good	Good	Fair	Poor
1.	Selection of Project	10	10	8	6	4	2
2.	Planning and Implementation	20	20	16	12	8	4
3.	Quality of Performance	20	20	16	12	8	4
4.	Regularity of Work carried	10	10	8	6	4	2
5.	Report Writing Skills	10	10	8	6	4	2
6.	Self Expression, Communication Skill and Presentation	10	10	8	6	4	2
7.	Viva-Voce	20	20	16	12	8	4
	TOTAL	100	100	80	60	40	20

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