

**Programme Objective (PO's)**  
**B. Tech Electronics and Communication Engineering**

- PO1:** To prepare students to excel in higher level research and academic programmes or to succeed in industry profession through global education.
- PO2:** To give more emphasis on understanding and analysis of all courses of electronics and communication engineering to develop strong understanding of advance Electronics and Communication engineering with analytical capability at higher levels of Academics and R&D activities.
- PO3:** To give more emphasis on application and synthesis in all courses related to design of electronics circuit and their simulation along with optimization.
- PO4:** Provide ability to design and conduct experiments as well as to analyze and interpret data.
- PO5:** An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
- PO6:** To provide students with academic environment composed of excellence, leadership, ethical codes and guidelines.

**Programme Specific Outcomes (PSO's)**  
**B. Tech Electronics and Communication Engineering**

- PSO1:** An ability to apply knowledge of mathematics, science and engineering fundamental concepts appropriate to the discipline of Electronics and Communication engineering.
- PSO2:** To prepare the students for Higher Education in the field of Engineering and Management.
- PSO3:** An ability to design, implement and evaluate electronics and Communication systems for public for public health and safety, cultural, societal and environmental considerations.
- PSO4:** An ability to design electronics circuits and conduct investigations, as well as to analyze and interpret data.

  
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**PSO5:** To be able to create, select and apply appropriate techniques, resources and modern Engineering and IT tools including simulation and modeling of modern power and energy systems, electronics derive system and control of process.

**PSO6:** To be able to demonstrate knowledge and understanding of the engineering and management principles and apply these to ones on work as a member and leader in team to manage projects and in multidisciplinary environments.

### **Course Outcomes (CO's)**

#### **B. Tech Electronics and Communication Engineering**

##### **B. Tech 1<sup>ST</sup> Semester**

##### **Chemistry (BSC-102)**

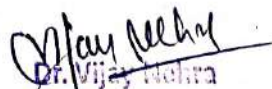
- CO1: Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- CO2: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- CO3: Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- CO4: List major chemical reactions that are used in the synthesis of molecules.

##### **Mathematics- I: Calculus and Linear Algebra (BSC-103)**

- CO1: Able to apply differential and integral calculus to notions of curvature and to improper integrals. Apart from various applications, they will have a basic understanding of Beta and Gamma functions.
- CO2: Understand the essential tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.

##### **Programming for problem solving (ESC-103)**

- CO1: To formulate simple algorithms for arithmetic and logical problems.
- CO2: To translate the algorithms to programs (in C language).
- CO3: To test and execute the programs and correct syntax and logical errors.
- CO4: To implement conditional branching, iteration and recursion.
- CO5: To apply programming to solve simple numerical method problems, namely not finding of function, differentiation of function and simple integration.

  
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### **English (HSMC-101)**

- CO1: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

### **B. Tech 2<sup>nd</sup> Semester**

#### **Semi-Conductor Physics (BSC-101-A)**

- CO1: Understand different types of electronic materials, metals, semiconductors, and insulators.  
CO2: Understand the concept of diffusion and drift.  
CO3: Understand p-n junction, absorption, spontaneous emission, and stimulated emission.

#### **Mathematics-II: Probability and Statistics (BSC-104)**

- CO1: Familiarize with statistical techniques.  
CO2: Understand the concepts and tools at an intermediate to advanced level towards tackling various problems in the discipline.

#### **Basic Electrical Engineering (ESC-101)**

- CO1: Understand and analyze basic electric and magnetic circuits.  
CO2: Understand the working principles of electrical machines and power converters.  
CO3: Familiarize with the components of low voltage electrical installations.

#### **Engineering Graphics & Design (ESC- 102- P)**

- CO1: Understand all phases of manufacturing or construction, design concepts with the basic line language of graphics.  
CO2: Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software.

#### **Introduction to Electromagnetic Theory (BSC-101-B)**

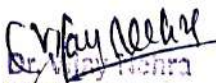
- CO1: Understand the basic concept of divergence, gradient and curl of electrostatic field.  
CO2: Understand Laplace's and Poisson's equations for electrostatic potential.  
CO3: Understand Maxwell's equations and their representations.

#### **Introduction to Mechanics (BSC-101-C)**

- CO1: Understand the forces in Nature, Newton's laws and its completeness.  
CO2: Understand Harmonic oscillator and damped harmonic motion.  
CO3: Understand three-dimensional rigid body motion

#### **Quantum Mechanics for Engineers (BSC-101-D)**

- CO1: Understand the basic principle of Quantum Mechanics, wave functions and eigenvalue problems.

  
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- CO2: Understand numerical solution of for one-dimensional and three-dimensional problems for different potentials.
- CO3: Understand free electron theory of metals and Fermi level.

#### **Oscillations, waves and optics (BSC-101-E)**

- CO1: Understand the basic concept of Electromagnetic theory.
- CO2: Understand simple harmonic motion, working of damped and forced simple harmonic oscillator
- CO3: Understand the concept of propagation of light and geometric optics.

#### **Semiconductor Optoelectronics (BSC-101-E)**

- CO1: Understand the review of semiconductor physics, semiconductor light emitting diodes.
- CO2: Understand the working and characteristics of semiconductor laser.
- CO3: Understand the types and working principles of semiconductor photo detectors, -p-n junction.

#### **Optics, Optical Fiber, Magnetism and Quantum Mechanics (BSC-101-E)**

- CO1: Bragg's Law and introduced to the principles of lasers, types of lasers and applications
- CO2: Various terms related to properties of materials such as, permeability, polarization, etc.
- CO3: Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials
- CO4: Simple quantum mechanics calculations

### **B. Tech 3<sup>rd</sup> Semester**

#### **Electronics Devices (ECL-231)**

- CO1: Understand the working of switching devices and apply the same in designing complex circuits with fewer devices.
- CO2: Design amplifier and other complex circuits with the help of special semiconductor devices which will further increase real time applications and reduce runaway situations.
- CO3: Apply the mathematical modelling for the electronic devices and circuits in turn helps in improvement in design in terms of size, power requirement and ease of use.
- CO4: Use variety of electronic devices for designing society friendly electronic gadgets used for security and other useful purposes.

#### **Digital System and Design (ECL-232)**

- CO1: Understand binary codes, binary arithmetic, minimization techniques and their relevance to digital logic design.
- CO2: Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder and sequential logic circuits.
- CO3: Understand finite state machines and develop a digital logic to find out sustainable solution of a real-life problem.

  
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- CO4: Understand and implement various digital integrated circuits using different logic families and simple systems composed of PLDs.

#### **Signal and System (ECL-233)**

- CO1: Understand basics types of signals and systems.  
CO2: Understand properties of systems, time invariant systems and frequency analysis of systems.  
CO3: Laplace Transform for LTI systems.  
CO4: Z transform and Inverse Z transform for various signals and ROC.  
CO5: Determine state variable techniques and state space representation of Discrete -Time LTI Systems.

#### **Network Theory (ECL-234)**

- CO1: Understand basics electrical circuits with nodal and mesh analysis.  
CO2: Appreciate electrical network theorems.  
CO3: Apply Laplace Transform for steady state and transient analysis.  
CO4: Determine different network functions.

#### **Engineering Economics and Management (BSC 231-A)**

- CO1: Learn basic economics concept, laws and implications.  
CO2: Learn basic management concepts  
CO3: Learn how production is done and will also get familiar with the basic concept of market and promotion of product.

#### **Electronic Equipment and Maintenance (ESC-231-B)**

- CO1: Understand the concept of troubleshooting.  
CO2: Study basic preparatory topics of components and their testing.  
CO3: Understand the troubleshooting procedures.

#### **Data Structure (CSC 231-C)**

- CO1: Analyze the algorithms to determine the time and computation complexity and justify the correctness.  
CO2: Implement search problem (Linear Search and Binary Search).  
CO3: For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.  
CO4: Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity and will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

  
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### **Start Up Course for Engineers (BSC-232-A)**

- CO1: Receive an official Startup India and Invest India Certification.
- CO2: Get step by step insights in creating a Business Plan for your venture.
- CO3: Understand the concept of Idea Identification and Assessment.
- CO4: Understand the fundamentals of finance & accounting comprising of financial statements, break-even analysis etc.
- CO5: Understand an investor's mindset on matters of company valuation, fundraising, equity dilution among other things.

### **Computer Hardware and Troubleshooting (CSC-232-B)**

- CO1: Get an in-depth knowledge of computer hardware.
- CO2: To create a confidence in using and assembling PC.
- CO3: Setup and upgrade personal computer systems; diagnose and isolate faulty components; optimize system performance and install / connect peripherals.

### **Quantitative and Reasoning-1 (BSC-232-C)**

- CO1: Build a strong base in the fundamental mathematical concepts.
- CO2: Grasp the approach to solve problem with speed and accuracy.
- CO3: Gain appropriate skill to succeed in preliminary selection process of recruitment.
- CO4: Collectively solve problem in team and group.

### **Skill Set for Competitive Exam (BSC-232-D)**

- CO1: Acquire Inter Personal Skills and Be an Effective Goal Oriented Team Player.
- CO2: Develop Professionalism with Idealistic, Practical and Moral Values.
- CO3: Acquire Communication Skill and Problem-Solving Skills.
- CO4: Re-Engineer Their Attitude and Understand Its Influence on Behavior.

### **Constitution of India (BSC-233)**

- CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- CO2: Discuss the intellectual origins of the framework of argument that informed the Conceptualization of social reforms leading to revolution in India.
- CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- CO4: Discuss the passage of the Hindu Code Bill of 1956.

## **B. Tech 4<sup>th</sup> Semester**

### **Analog and Digital Communication (ECL-241)**

- CO1: Familiarize with basic concepts like AM, FM, PM and digital modulation.

  
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- CO2: Differentiate between the working of transmitter and receiver of various analog and digital modulation techniques.
- CO3: Design and rectify various communication gadgets and remove/reduce effects of noise on their working.
- CO4: Suggest up gradation in the existing communication systems with lesser radiation output and better signal quality for the betterment of human kind.

#### **Analog Circuits (ECL-242)**

- CO1: Apply knowledge of electronic devices to construct electronic circuits with better applications for our real time causes.
- CO2: Handle higher power capacity devices which will enhance the existing power handling capacity of electronic circuits.
- CO3: Design various power supplies for different circuit requirements in turn help in reducing size of batteries.
- CO4: Able to design electronic circuits with operational amplifier with higher gain and easy design facilities.

#### **Microprocessor & Microcontroller (ECL-243)**

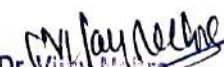
- CO1: Understand the architecture & Instruction set of 8086 microprocessor and will be able to do assembly language programming.
- CO2: Understand the architecture & Instruction set of X86 family microprocessors and will be able to do assembly language programming.
- CO3: Understand the features of advance Microprocessors.
- CO4: Be able to do interfacing design of peripherals.

#### **Design and Simulation Tools (ESC-241)**

- CO1: Focus on autonomous and active "learning by doing" using engineering problem solving methodology steps for simulation of various Electronics and Communication system.
- CO2: Design and simulation the various Electronics and Communication system block circuits using like textual and graphical programming environment.
- CO3: Use open-source environment to simulate various Electronics and Communication system.

#### **Numerical Methods (MSC-241)**

- CO1: The students will understand to find the solutions of various kinds of first order ordinary Differential equations.
- CO2: The student will understand second order differential equations and to find their solutions along with variable coefficients, power series, Legendre's and Bessel's equations.
- CO3: The students will learn to solve polynomial, algebraic and Transcendental equations by various Methods, interpolations, Numerical Differentiation and numerical Integration.

  
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- CO4: The students will be able to find numerical solutions of Ordinary Differential Equations of first and second order and of Partial Differential Equations by various methods.

#### **Entrepreneurship (BSC-241)**

- CO1: Learn importance of studying entrepreneurship development.  
CO2: Learn how their own business can be started.  
CO3: Learn how the government helps SSI for their growth and developments.

#### **Quantitative Reasoning-II (BSC-242)**

- CO1: Build a strong base in the fundamental mathematical concepts.  
CO2: Grasp the approach to solve problem with speed and accuracy.  
CO3: Gain appropriate skill to succeed in preliminary selection process of recruitment.  
CO4: Collectively solve problem in team and group.

#### **Computer Organization & Architecture (CSC-242)**

- CO1: Understand the basic principles computer system, architecture and instruction execution pipelining, parallelism and microprogramming.  
CO2: Understand the current state of art in memory system design.  
CO3: Understand I/O devices are accessed and its principles.

### **B. Tech 5<sup>th</sup> Semester**

#### **Electromagnetic Waves (ECL-351)**

- CO1: Understand characteristics and wave propagation on high frequency transmission lines.  
CO2: Use sections of transmission line for realizing circuit elements.  
CO3: Calculate reflection and transmission of waves at media interface.  
CO4: Understand principle of radiation and radiation characteristics of an antenna and analyze wave propagation on metallic waveguides in modal form.

#### **Linear Integrated Circuits (ECL-352)**

- CO1: Understand the fundamentals of integrated circuits and designing electronic circuits using it.  
CO2: Develop the skill of analysis and design of various circuits using operational amplifiers.  
CO3: Develop design skills to design various circuits using different data conversion systems.  
CO4: Able to design simple circuits like amplifiers using op-amps, waveform generating circuits, filter circuits for particular application.

#### **Microwave Engineering (ECL-353)**

- CO1: Analyze wave propagation in metallic waveguides and tubes.  
CO2: Understand working principle of microwave components along with characteristics and applications.

  
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- CO3: Able to calculate S-matrix for microwave components.
- CO4: Understand the working principle of various types of radar.

#### **Digital Signal Processing (ECL-354)**

- CO1: Utilize the design techniques for digital IIR and FIR filters.
- CO2: Analyze signals mathematically in time and frequency domain and obtain the response of an LTI system to different signals.
- CO3: Design of different types of digital filters for various applications.

#### **CMOS Design (ECL-355-A)**

- CO1: Design different CMOS circuits using various logic families along with their circuit layout.
- CO2: Use of different tools for VLSI IC design.

#### **Power Electronics (ECL-355-B)**

- CO1: Build and test circuits using power devices such as SCR
- CO2: Analyze and design-controlled rectifier, DC to DC converters, DC to AC inverters etc.
- CO3: Learn how to analyze these inverters and some basic applications.
- CO4: Understand the designing of SMPS.

#### **Optical Network (ECL-355-C)**

- CO1: Understand optical network architecture and WDM network design.
- CO2: Implement simple optical network and understand further technology developments for future enhanced networks.

#### **Nano Electronics (ECL-355-D)**

- CO1: Understand various aspects of nano-technology and the processes involved in making nano components and material.
- CO2: Leverage advantages of the nano-materials and appropriate use in solving practical problems.
- CO3: Understand various aspects of nano-technology and the processes involved in making nano components and material.
- CO4: Leverage advantages of the nano-materials and appropriate use in solving practical problems.

#### **ICT in Agriculture Development (ECL-356-A)**

- CO1: Understand the initiatives of ICT in agriculture development in India.
- CO2: Recognize the role of ICT in Sustainable development.
- CO3: Understand ICT design and implementations applications in agriculture and ICT infrastructure requirements.

  
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### **Remote Sensing and GIS (ECL-356-B)**

- CO1: Understand fundamental concept of remote sensing and geographic information systems.
- CO2: Learn GIS, and map projections & co-ordinate systems.
- CO3: Learn different data sources; data inputs, data quality, and database concepts.
- CO4: Hands on technology and instruments using hardware and software concepts.

### **PC Interfacing and Data Acquisition (ECL-356-C)**

- CO1: Understand basic concept of PC interfacing and data acquisition.
- CO2: Learn concept of memory and mass storage devices.
- CO3: Understand concept of buses of communications.
- CO4: Learn concept of interfacing.

### **Wireless Sensor Networks (ECL-356-D)**

- CO1: Understand the design of wireless sensor networks for a given application.
- CO2: Understand emerging research areas in the field of sensor networks.
- CO3: Understand MAC protocols used for different communication standards used in WSN and explore new protocols for WSN.

## **B. Tech 6<sup>th</sup> Semester**

### **Control Systems (ECL-361)**

- CO1: Ability to characterize a system and find its steady state behavior.
- CO2: Investigate stability of a system using different tests.
- CO3: Design various controllers Solve linear, non-linear and optimal control problems.

### **Computer Network (ECL-362)**

- CO1: Understand the concepts of networking thoroughly.
- CO2: Design a network for a particular application.
- CO3: Analyze the performance of the network.

### **VHDL Based Digital System Design (ECL-363)**

- CO1: Design and analyze combinational logic circuits.
- CO2: Acquire basic knowledge of digital logic families & semiconductor memories.
- CO3: Design & analyze synchronous sequential logic circuits.
- CO4: Use VHDL & appropriate EDA tools for digital logic design and simulation.

### **Information Theory and Coding (ECL-365)**

- CO1: Understand the concept of information and entropy
- CO2: Understand Shannon's theorem for coding
- CO3: Understand the calculation of channel capacity and apply coding techniques.

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### **Introduction to MEMS (ECEL-367)**

- CO1: Understand the underlying working principles of MEMS and NEMS devices.
- CO2: Able to design and model MEM devices.

### **Bio-Medical Electronics (ECEL-369)**

- CO1: Understand the application of the electronic systems in biological and medical applications.
- CO2: Understand the practical limitations on the electronic components while handling bio-substances.
- CO3: Understand and analyze the biological processes like other electronic processes.

### **Scientific Computing (ECEL-361)**

- CO1: Understand the significance of computing methods, their strengths and application areas.
- CO2: Perform the computations on various data using appropriate computation tools.

### **Statistical Information Processing (ECOE-365)**


- CO1: Characterize and apply probabilistic techniques in modern decision systems, such as information systems, receivers, filtering and statistical operations.
- CO2: Demonstrate mathematical modeling and problem solving using such models.
- CO3: Comparatively evolve key results developed in this course for applications to signal processing, communications systems.
- CO4: Develop frameworks based in probabilistic and stochastic themes for modeling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.

### **Telecommunication System Modeling and Simulation (ECOE-366)**

- CO1: Understand the fundamental concept of system modelling and simulation.
- CO2: Understand the fundamental concept of telecommunication system modelling and simulation.
- CO3: Hands on software's for modeling and simulation.

### **Modern Radar System (ECOE-368)**

- CO1: Understand the basic principle of radar equation.
- CO2: Understand different types of radars; CW, MTI, Pulse Doppler, and Tracking Radars.
- CO3: Understand the use of Doppler frequency shift to detect moving target in stationary clutter.
- CO4: Understand radar detection and parameter estimation using statistical decision theory.

  
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### **Wireless and Mobile Communication (ECOE-362)**

- CO1: Familiarize with various generations of mobile communications, basic concept, channel assignments etc.
- CO2: Knowledge of IS-95 CDMA mobile communication standard, its architecture, logical channels, advantages and limitations.
- CO3: Understand multicarrier communication systems, indoor and outdoor propagation models.

### **Essence of Indian Traditional Knowledge (HSL-366)**

- CO1: Understand the concept of Traditional knowledge and its importance and apply knowledge in preserving and protecting traditional knowledge.
- CO2: Develop knowledge and skills to streamline systems and patents for our indigenous traditional knowledge.
- CO3: Understand philosophy of Indian culture and philosophy of ancient, medieval and modern India.

## **B. Tech 7<sup>th</sup> Semester**

### **Optical Communication System (ECL-407)**

- CO1: Understand the basic theory of optical fibers and principle of various components used in optical communication system.
- CO2: Understand various optical fiber modes, optical sources and optical detectors and their use in the optical communication system.

### **Microwave Theory and Techniques (ECL-471-A)**

- CO1: Understand various microwave system components and their properties.
- CO2: Understand various microwave devices IMPATT, TRAPATT and diodes Gunn diode, varactor diode, pin diode etc.
- CO3: Understand S-matrix of various microwave components and their applications.

### **Fiber Optic Communication (ECL-471-B)**

- CO1: Understand the principles fiber-optic communication, the components and the bandwidth advantages.
- CO2: Understand the properties of the optical fibers and optical components and operation of lasers, LEDs and detectors.
- CO3: Analyze system performance of optical communication systems and understand non-linear effects in optical fiber.

### **Adaptive Signal Processing (ECL-471-C)**

- CO1: Understand the non-linear control and the need and significance of changing the control parameters with respect to real-time situation.

  
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- CO2: Understand the mathematical representation of the adaptability requirement.  
CO3: Understand the mathematical treatment for the modeling and design of the signal Processing systems.

#### **Antennas and Propagation (ECL-472-A)**

- CO1: Understand the use of antennas, principle of operation and working.  
CO2: Understand various types of antennas and their applications.  
CO3: Understand the basic concepts of smart antennas.

#### **Mobile Communication and Networks (ECL-472-B)**

- CO1: Understand the working principles of the mobile communication systems.  
CO2: Understand the relation between the user features and underlying technology.  
CO3: Analyze mobile communication systems for improved performance.

#### **Digital Image & Video Processing (ECL-472-C)**

- CO1: Mathematically represent the various types of images and analyze them.  
CO2: Process these images for the enhancement of certain properties or for optimized use of the resources.  
CO3: Develop algorithms for image compression and coding.

#### **Mixed Signal Design (ECL-473-A)**

- CO1: Understand the practical situations where mixed signal analysis is required.  
CO2: Analyze and handle the inter-conversions between signals.  
CO3: Design systems involving mixed signals

#### **Wireless Sensor Networks (ECL-473-B)**

- CO1: Understand the design of wireless sensor networks for a given application.  
CO2: Understand emerging research areas in the field of sensor networks.  
CO3: Understand MAC protocols used for different communication standards used in WSN.

#### **Satellite Communication (ECL-473-C)**

- CO1: Visualize the architecture of satellite systems as a means of high speed, high range communication system.  
CO2: Understand various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.  
CO3: Able to solve numerical problems related to orbital motion and design of link budget for given parameters and conditions.

#### **Robotics and Automation (ECL-473-D)**

- CO1: Understand basic operation of robots along with applications.

  
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- CO2: Exposure to hands on robotics and automation through programming.
- CO3: Able to understand latest advancements in the field of robotics.

#### **Optimization Techniques (OEL-471-A)**

- CO1: Understand various optimization techniques classical, linear programming, transportation problem, simplex algorithm, dynamic programming
- CO2: Constrained and unconstrained optimization techniques for solving and optimizing an electrical and electronic engineering circuits design problems in real world situations.
- CO3: Understand the concept of Dynamic programming and its applications to project implementation.

#### **Programming Using Python (OEL-471-B)**

- CO1: Understand python programs to solve simple business problems.
- CO2: Create python applications that are robust and multithreaded.
- CO3: Able to write simple GUI interfaces for a program to interact with users and event-based also.

#### **Biomedical Instrumentation (OEL-471-C)**

- CO1: Understand the basic principle of instrumentation systems and applications to various industries.
- CO2: Understand the working of various instruments used in the field of biomedical.
- CO3: Understand electrical safety in medical environment and shock hazards.

#### **Renewable Energy Sources (OEL-471-D)**

- CO1: Understand the fundamental concepts and advantages of using renewable energy sources.
- CO2: Understand various renewable energy technologies.
- CO3: Understand general power scenario and recent technological development.

### **B. Tech 8<sup>th</sup> Semester**

#### **High Speed Electronics (ECL-481-A)**

- CO1: Understand significance and the areas of application of high-speed electronics circuits.
- CO2: Understand the properties of various components used in high-speed electronics
- CO3: Design High-speed electronic system using appropriate components.

#### **CAD and VLSI Circuits (ECL-481-B)**

- CO1: Understand various physical design methods, design rules and routing techniques used in VLSI.
- CO2: Understand the use of simulation techniques at various levels in VLSI design flow
- CO3: Understand the concepts of various algorithms used for floor planning placement and routing techniques.

  
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## Biomedical Signal Processing (ECL-481-D)

- CO1: Understand the application of signal processing methods to biomedical systems.  
CO2: Understand the basic concepts of signal processing with real-life biomedical examples.  
CO3: Understand the basic design concept of filters.

## Embedded Systems (ECL-482-A)

- CO1: Understand the concept of real time operating systems and software used for the design of embedded systems.
- CO2: Understand the concept of memory management.
- CO2: Understand the working principle and architecture of advanced microcontrollers along with applications.

## Error Correcting Codes (ECL-482-B)

- CO1: Understand the properties and various types of antennas.  
CO2: Analyze the properties of different types of antennas and their design.  
CO3: Operate antenna design software tools and come up with the design of the antenna of

## Industrial Electronics (ECL-482-C)

- CO1: Understand the working of different semiconductor switches and their selection based on the application need.
- CO2: Analyse various triggering circuits used for different semiconductor switches.
- CO3: Acquire knowledge of various power electronic converter for real time applications.

## Operations Research (ECL-482-D)

- CO1: Able to apply the dynamic programming to solve problems of discrete and continuous variables.
- CO2: Able to apply the concept of non-linear programming.
- CO3: Understand the concept scheduling and sequencing.

## Internet of Things (OEL-481-A)

- CO1: Understand the interconnection and integration of the physical world and the cyber space.  
CO2: Understand the design & development of IoT Devices and wireless sensor networks.  
CO3: Understand the concept of Ipv4 and IPV6, IT Act 2000 and scope for IoT legislation.

**Soft Computing (OEL-481-B)**

- CO1: Understand the concept of Soft Computing and Fuzzy logic.
- CO2: Understand biologically inspired algorithm such as neural networks, genetic algorithms, ant colony.
- CO3: Understand hybrid systems of neural network, genetic algorithms and fuzzy systems optimization and bee colony optimization.

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### **Mobile Application Development (OEL-481-C)**

- CO1: Learn the basics of Android platform and get to understand the application lifecycle.
- CO2: Understand to write apps for Android devices.

### **Intelligent instrumentation for Engineering (OEL-481-D)**

- CO1: Learn the fundamentals and practices of basic knowledge of Intelligent Instruments.
- CO2: Understand the design and analysis of active filters, PLL, A/D & D/A converter.
- CO3: Understand the analysis and design of various linear integrated circuits.

### **Web Designing (OEL-482-A)**

- CO1: Understand basic principles and architecture of web site design.
- CO2: Understand best practices in navigation, usability in website design.
- CO3: Design of website adhering to current web standards (HTML, XML, CSS).

### **Research Methodology and IPR (OEL-482-B)**

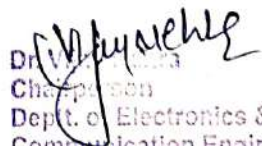
- CO1: Understand the basic concept of research and research process.
- CO2: Able to conduct research work and formulating research synopsis.
- CO3: Able to develop data analytics skills and meaningful interpretation to the data sets.

### **Waste to Energy (OEL-482-C)**

- CO1: Understand the operations of Waste to Energy Plants.
- CO2: Analyze the various aspects of Waste to Energy Management Systems.
- CO3: Carry out Techno-economic feasibility for Waste to Energy Plants.
- CO4: Apply the knowledge in planning and operations of Waste to Energy plants.

### **Solar Photovoltaic System and Technology (OEL-482-D)**

- CO1: Understand fundamentals, design and application of solar photovoltaic systems.
- CO2: Understand power generation on small- and large-scale electrification.
- CO3: Understand the manufacturing process of PV Cells and design of PV Systems.
- CO4: Understand different types of PV systems and components.

  
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**Course Curriculum  
and  
Scheme of Examination  
for  
Bachelor of Technology  
in  
Electronics and Communication Engineering  
(w.e.f academic session 2018-19)  
Offered by  
Department of Electronics and Communication Engineering  
1<sup>st</sup> Semester to 8<sup>th</sup> Semester**



**Bhagat Phool Singh Mahila Vishwavidyalaya  
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*(Signature)*

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**Scheme of studies & Examinations of B.Tech (Electronics and Communication Engineering) 1<sup>st</sup> Year (Semester 1) Choice Based Credit Scheme w.e.f (2018-19).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	BSC-102	Chemistry – I	3	1	0	4	20	80	100
2.	BSC-103	Mathematics– I:Calculus and Linear Algebra	3	1	0	4	20	80	100
3.	ESC103	Programming For Problem Solving	3	0	0	3	20	80	100
4.	HSMC-101	English	2	0	0	2	10	40	50
Lab									
5.	HSMCP-101	English Language Lab	0	0	2	1	10	40	50
6.	ESC-104-P	Workshop/ Manufacture Practices	1	0	4	3	20	80	100
7.	ESC-103-P	Programming For Problem Solving Lab	0	0	4	2	10	40	50
8.	BSC-102-P	Chemistry Lab	0	0	3	1.5	10	40	50
9.		Induction program (Mandatory)	0	0	0	0	0	0	0
Total			12	02	13	20.5	120	480	600

**Total Contact Hours = 27**

**Note: Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.**

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**Scheme of studies & Examinations of B.Tech (Electronics and Communication Engineering) 1<sup>st</sup> Year (Semester 2) Choice Based Credit Scheme w.e.f (2018-19).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	*	Physics	3	1	0	4	20	80	100
2.	BSC-104	Mathematics-II: Probability and Statistics	3	1	0	4	20	80	100
3.	ESC-101	Basic Electrical Engineering	3	1	0	4	20	80	100
Labs									
4.	BSC-101-P	Physics Lab	0	0	3	1.5	10	40	50
5.	ESC-102-P	Engineering Graphics and Design	1	0	4	3	20	80	100
6.	ESC-101-P	Basic Electrical Engineering Lab	0	0	2	1	10	40	50
Total			10	3	9	17.5	100	400	500

**Total Contact Hours = 22**

**Note:** Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.

**\*Physics (choose any one subject)**

Subject Code	Subject
BSC-101	Semiconductor Physics
BSC-101A	Introduction to Electromagnetic Theory
BSC-101B	Introduction to Mechanics
BSC-101C	Quantum Mechanics for Engineers
BSC-101D	Oscillation, Waves and Optics
BSC-101E	Semiconductor Optoelectronics
BSC-101F	Optics, Optical Fiber, Magnetism and Quantum Mechanics

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**Scheme of studies & Examinations of B. Tech (Electronics and Communication Engineering) 2<sup>nd</sup> Year (Semester 3) Choice Based Credit Scheme w.e.f (2018-19).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	ECL-231	Electronics Devices	3	0	0	3	20	80	100
2.	ECL-232	Digital system and design	3	0	0	3	20	80	100
3.	ECL-233	Signal and system	3	0	0	3	20	80	100
4.	ECL-234	Network theory	3	0	0	3	20	80	100
5.	*	BS/ES/HS-3	3	0	0	3	20	80	100
6.	**	BS/ES/HS-4	3	0	0	3	20	80	100
Labs									
7.	ECP-231	Electronics Devices Lab	0	0	2	1	10	40	50
8.	ECP-232	Digital system and design Lab	0	0	2	1	10	40	50
9.	BSC-233	Constitution of India	3	0	0	0	0	0	0
10.	BSC234	Foreign Language-1	3	0	0	0	10	40	50
Total			24	0	4	20	140	560	700

**Total Contact Hours = 28**

**Constitution of India (BSC-233): shall mandatory and qualifying course.**

**Foreign Language-1(BSC234): The Marks shall not be counted in grand total.**

**Note: Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject. Student will be permitted to opt for BS/ES/HS-3 & \*\*BS/ES/HS-4 subject course as given.**

<b>*BS/ES/HS-3</b>			<b>**BS/ES/HS-4</b>	
Subject Code	Subject		Subject Code	Subject
BSC 231-A	Engineering economics and management		BSC-232-A	Start up course for engineers
ESC-231-B	Electronic equipment and maintenance		CSC-232-B	Computer hardware and troubleshooting
CSC 231-C	Data Structure		BSC-232-C	Quantitative and reasoning-1
			BSC-232-D	Skill set for competitive exam

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**Scheme of studies & Examinations of B. Tech (Electronics and Communication Engineering) 2<sup>nd</sup> Year (Semester 4) Choice Based Credit Scheme w.e.f (2018-19).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	ECL-241	Analog and digital communication	3	0	0	3	20	80	100
2.	ECL-242	Analog circuits	3	0	0	3	20	80	100
3.	ECL-243	Microprocessor and Microcontroller	3	0	0	3	20	80	100
4.	*	BS/ES/HS-5	4	0	0	4	20	80	100
5.	**	BS/ES/HS-6	4	0	0	4	20	80	100
Labs									
6.	ECP-241	Analog and digital communication Lab	0	0	2	1	10	40	50
7.	ECP-242	Analog circuits Lab	0	0	2	1	10	40	50
8.	ECP-243	Microprocessor and Microcontroller Lab	0	0	2	1	10	40	50
9.	MC-233	Environmental science	3	0	0	0	20	80	100
Total			20	0	6	20	130	520	650

**Total Contact Hours: 26**

Environmental science (MC-233) shall be non credit, mandatory and qualifying paper.

The Marks of qualifying paper will not be counted in grand total.

**Note:** Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.

*BS/ES/HS-5		**BS/ES/HS-6	
Subject Code	Subject	Subject Code	Subject
ESC-241	Design and Simulation Tools	BSC-242	Quantative and Reasoning-II
MSC-241	Numerical Methods	CSC-242	Computer organization and architecture
BSC-241	Entrepreneurship	FSC-242	Foreign Language-II

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**Scheme of studies & Examinations of B. Tech (Electronics and Communication Engineering) 3<sup>rd</sup> Year (Semester 5) Choice Based Credit Scheme w.e.f (2020-21).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	ECL-351	Electromagnetic waves	3	0	0	3	20	80	100
2.	ECL-352	Linear integrated circuits	3	0	0	3	20	80	100
3.	ECL-353	Microwave engineering	3	0	0	3	20	80	100
4.	ECL-354	Digital signal processing	3	0	0	3	20	80	100
5.	*	Program elective-I	3	0	0	3	20	80	100
6.	**	Open elective-I	3	0	0	3	20	80	100
Labs									
7.	ECP-352	Linear integrated circuits lab	0	0	2	1	10	40	50
8.	ECP-354	Digital signal processing lab	0	0	2	1	10	40	50
9.	ECP-357	Professional training -I	0	0	0	2	100	0	100
Total			18	0	4	22	240	560	800

**Total Contacts Hours: 22.**

**Student will be opt program elective and open elective subjects as given:**

<b>*PROGRAM ELECTIVE-I</b>		<b>** OPEN ELECTIVE</b>	
Subject Code	Subject	Subject Code	Subject
ECL-355-A	CMOS design	ECL-356-A	ICT in Agriculture development
ECL-355-B	Power electronics	ECL-356-B	Remote sensing and GIS
ECL-355-C	Optical network	ECL-356-C	PC interfacing and data acquisition
ECL-355-D	Nano electronics	ECL-356-D	Wireless sensor network

**Note: Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.**

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*[Signature]*



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**Scheme of studies & Examinations of B. Tech (Electronics and Communication Engineering) 3<sup>rd</sup> Year (Semester 6) Choice Based Credit Scheme w.e.f (2020-21).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	ECL-361	Control Systems	3	0	0	3	20	80	100
2.	ECL-362	Computer Network	3	0	0	3	20	80	100
3.	ECL-363	VHDL Based Digital System Design	3	0	0	3	20	80	100
4.	*	Program Elective-II	3	0	0	3	20	80	100
5.	**	Open Elective-II	3	0	0	3	20	80	100
6.	HSL-366	Essence Of Indian Traditional Knowledge	3	0	0	0	20	80	100
Labs									
7.	ECP-362	Computer Networks Lab	0	0	4	2	10	40	50
8.	ECP-366	Electronic Measurement Lab	0	0	2	1	10	40	50
9.	ECP-367	Mini Project/Electronic Design Workshop	0	0	4	2	10	40	50
Total			18	0	10	20	130	520	650

**Total Contact Hours = 28**

Essence of Indian Traditional Knowledge (HSL-366) will be non credit, mandatory and qualifying course. Marks of Indian Traditional Knowledge (HSL-366) will not be counted in grand total.

**Student will be opt program elective and open elective subjects as given:**

<b>*Program Elective-II</b>		<b>** Open Elective-II</b>	
Subject Code	Subject	Subject Code	Subject
ECEL-365	Information Theory and Coding	ECOE-363	Statistical Information Processing
ECEL-367	Introduction to MEMS	ECOE-366	Telecommunication System Modeling and Simulation
ECEL-369	Bio-Medical Electronics	ECOE-368	Modern Radar System
ECEL-361	Scientific computing	ECOE-362	Wireless and mobile communication

**Note: Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.**

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**Scheme of studies & Examinations of B. Tech (Electronics and Communication Engineering) 4<sup>th</sup> Year (Semester 7) Choice Based Credit Scheme w.e.f (2020-21).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	*	Program Elective-3	3	1	0	3	20	80	100
2.	**	Program Elective-4	3	1	0	3	20	80	100
3.	***	Program Elective-5	3	0	0	3	20	80	100
4.	****	Open Elective-3	3	0	0	3	20	80	100
Labs									
5.	ECL-407	Optical Communication System	4	0	0	4	20	80	100
6.	ECP-471	Project Stage-I	0	0	8	4	20	80	100
7.	IPT-471	Industrial Practical Training-II	0	0	0	1	100	0	0
Total			16	2	8	21	220	480	700

**Total Contact Hours = 26**

**Student will be opt program elective-3 and program elective-4 subjects as given:**

<b>*Program Elective-3</b>		<b>**Program Elective-4</b>	
Subject Code	Subject	Subject Code	Subject
ECL-471-A	Microwave Theory and Techniques	ECL-472-A	Antennas and Propagation
ECL-471-B	Fiber Optic Communications	ECL-472-B	Mobile Communication and Networks
ECL-471-C	Adaptive Signal Processing	ECL-472-C	Digital Image & Video Processing

**Student will be opt program elective-5 and open elective-4 subjects as given:**

<b>***Program Elective-5</b>		<b>****Open Elective-3</b>	
Subject Code	Subject	Subject Code	Subject
ECL-473-A	Mixed Signal Design	OEL-471-A	Optimization Techniques
ECL-473-B	Wireless Sensor Networks	OEL-471-B	Programming Using Python
ECL-473-C	Satellite Communication	OEL-471-C	Biomedical Instrumentation
ECL-473-D	Robotics and Automation	OEL-471-D	Renewable Energy Sources

**Note: Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.**

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**Scheme of studies & Examinations of B. Tech (Electronics and Communication Engineering) 4<sup>th</sup> Year (Semester 8) Choice Based Credit Scheme w.e.f (2020-21).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	*	Program Elective-6	3	0	0	3	20	80	100
2.	**	Program Elective-7	3	0	0	3	20	80	100
3.	***	Open Elective-4	3	0	0	3	20	80	100
4.	****	Open Elective-5	3	0	0	3	20	80	100
Labs									
5.	ECP-481	Project Stage-II	0	0	16	6	20	80	100
6.	IHT-482	In House Training	0	0	2	1	100	0	0
Total			12	0	18	19	200	400	600

**Total Contact Hours = 30**

**Student will be opt Program Elective-3 and Program Elective-4 subjects as given:**

<b>*Program Elective-6</b>		<b>**Program Elective-7</b>	
Subject Code	Subject	Subject Code	Subject
ECL-481-A	High speed electronics	ECL-482-A	Embedded systems
ECL-481-B	CAD-for VLSI Circuits	ECL-482-B	Error correcting codes
ECL-481-C	Audio Video Processing	ECL-482-C	Industrial electronics
ECL-481-D	Biomedical signal processing	ECL-482-D	Operation Research

**Student will be opt Open Elective-4 and Open Elective-5 subjects as given:**

<b>***Open Elective-4</b>		<b>**** Open Elective-5</b>	
+Subject Code	Subject	Subject Code	Subject
OEL-481-A	Internet of Things	OEL-482-A	Web Designing
OEL-481-B	Soft Computing	OEL-482-B	Research Methodology and IPR
OEL-481-C	Mobile Application Development	OEL-482-C	Waste to Energy
OEL-481-D	Intelligent Instrumentation for Engineering	OEL-482-D	Solar Photovoltaic System And Technology

**Note: Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.**

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**General Note**

- 1 Some lab experiment across the Electronics and Communication Engineering curricula in each laboratory along with hardware/trainer kit must be performed using any general purpose textual and graphical programming package and dedicated simulation environment e.g. Scilab/Matlab/Simulink/Xcos/LabView/PSPICE/Multisim/NGspice/LTSpice/MULTISIM/Orcad/Proteus or other open source PCB design tools etc.
- 2 The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
- 3 Electronic gadgets, including cellular phones are not allowed in the examination.
- 4 **Each faculty member in Electronics and Communication Engineering Department involved as Coordinators/Teachers associated with evaluation work of Project stage-I&II will be assigned 2 hours load per week per semester.**
- 5 Industrial Practical Training I&II report submitted by the students should be typed on both sides of the paper.
- 6 The students will submit a synopsis at the beginning of the semester for approval from the departmental project committee in a specified format, thereafter she will have to present the progress of work through seminar and progress report.
4. **Guidelines for Industrial Practical Training- I & II**
  - a. Each student has to undergo Professional Training (Industrial Practical Training I) of at least 4 weeks from the industry/institute/research lab/training center/In-house electronics workshop/PCB making and assembling/use of CAD software etc. during summer vacation after fourth semester; however, viva-voce for evaluation of Professional Training (Industrial Practical Training-I) will be conducted in fifth semester.
  - b. Assessment of Professional Training (Industrial Practical Training-I), undergone at the end of IV Semester, will be based on seminar, viva-voce, report and certificate of the Professional Training obtained by the student from the industry, institute, research lab, training center etc. The evaluation of Professional Training (Industrial Practical Training-I) Seminar will be conducted in fifth semester.
  - c. Each student has to undergo Industrial Practical Training-II (Professional Training -II) of at least 4 weeks from the industry/institute/research lab/training center/In-house electronics workshop/Design and Simulation tool etc. during summer vacation after sixth semester; however, viva-voce for evaluation of Industrial Practical Training-II shall be carried out in the VII Semester.
  - d. Assessment of Industrial Practical Training-II, undergone at the end of VI Semester, will be based on seminar, viva-voce, report and certificate of the Professional Training obtained by the student from the industry, institute, research lab, training center etc. The viva-voce for evaluation of Industrial Practical Training Seminar-II will be conducted in 7<sup>th</sup> semester.
5. **Guidelines for Program and Open Elective paper**
  - a. Students will be permitted to opt for any one elective run by the other department. However, the department shall offer those elective for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise.

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- b. Program Elective-II and Open Elective-II paper will be offered in 6<sup>th</sup> Semester, if atleast two third of the total students opt for the same. It is advised that decision about Elective subject for 6<sup>th</sup> Semester is done before the 15<sup>th</sup> November before end of 5<sup>th</sup> semester.
  - c. Program Elective-3, 4, 5 and Open Elective-3 paper will be offered in 7<sup>th</sup> Semester, if atleast two third of the total students opt for the same. It is advised that decision about Elective subject for 7<sup>th</sup> Semester is done before the 15<sup>th</sup> April before end of 6<sup>th</sup> semester.
  - d. Program Elective-6, 7 and Open Elective-4, 5 paper will be floated in 8<sup>th</sup> Semester, if atleast two third of the total students opt for the same. It is advised that decision about elective subject for 7<sup>th</sup> Semester is done before the 15<sup>th</sup> November before end of 7<sup>th</sup> semester.
  - e. New Electives may be added as per requirement after getting it duly approved by BOS and AC respectively.
6. There will be one end semester examination of 3 hours duration in each theory based subject.
  7. There will be nine questions in theory paper in total from all four units of syllabus. First question is compulsory and set from all four units and contain five subparts. Students will have to attempt any five questions in all selecting at least one question from each unit.
  8. Evaluation and grading for all theory/practical/viva voce etc. wherever applicable evaluation shall be 20% internal and 80% external. The minimum passing marks for any subject (paper) shall be 40% in the external examination and 40 % in the aggregate of internal and external examinations of that subject instead of old minimum pass percentage of 50%. In case a student(s) fails to acquire 40% in the aggregate of internal and external of subject (paper), she will be awarded re-appear in the external examination of that paper.
  9. There will be no re-appear in internal examination. Marks obtained in internal examination/assessment shall be carried forwarded in case of re-appear (either less than 40% in external or less than 40% in aggregate of internal and external). Candidate has to obtain passing marks in external assessment and in total of external and internal assessment. It was further resolved that if a candidate even after obtaining passing marks in external examination failed to acquire passing marks in the total of internal and external assessment she has reappear in the external papers only to improve her result.
  10. Weightage for internal assessment (examination)

S.No	Component	Marks
1	*Internal test	10% of the total marks 100 i.e 10 marks
2	**Assignment/seminar/quiz/group disc etc	5% of the total marks 100 i.e 5 marks
3	Attendance-	5% of the total marks 100 i.e 5 marks
3(a)	Less than 75%	00 marks
3(b)	75% and above and less than 80%	02 marks
3(c)	80% and above and less than 85%	03 marks
3(d)	85% and above	05 marks

\* Lab performance of students in case of lab practical's

\*\*file record and sample prepared in lab practical's

  
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11. As per resolution no (2) of I<sup>st</sup> meeting of Departmental Committee held on 28/09/2015 each faculty members of the department will display the attendance records of students on the notice board in the devised prforma on monthly basis in first week of every month under intimation to the office of department. At the end of semester each faculty member will display a consolidated list of attendance of whole semester on the notice board taking into consideration the attendance condoned by the Chairperson, if any.

12. **Role and responsibility of project coordinator for B.Tech programme**

The following role and responsibilities of project coordinator are approved as per resolution no (2) of I<sup>st</sup> meeting of departmental committee held on 28/09/2015:

- a. The coordinators will distribute the students among faculty as per procedure resolved by departmental committee, invite the synopsis and hold the presentation of students for the same duly approved by the respective mentor immediately within a week after commencement of the academic session under intimation to the office of department.
- b. The coordinator will display a list of approved projects/dissertation on the notice board for information of students and staff immediately containing students name , roll no, project title and supervisor.
- c. The coordinator will give a chance and hold the presentation of leftover students and display a list of approved projects/dissertation of left over students on the notice board for information of students and staff immediately.
- d. The coordinator will compile the requirement of consumables and Electronic Component of projects immediately as submitted by the respective students groups duly approved by the supervisor.
- e. Moreover, separate Technical and Laboratory Staff is assigned to minor/major project of each programme. The technical staff of department will assist the project coordinator and provides hands on activities to the students as needed and keep a record of all above stated activities in letter and spirit. The concerned technical staff and Lab attendant stay whole time in project lab and assist the students in compilation of their project work. Finally, the concerned technical staff appointed in the lab will maintain a record entry of the all consumables issued to students and details of project dissertation completed in department in each academic session.
- f. The project coordinator ensures the timely submission of all project and dissertation as per approved guidelines, layout and award marks as per criteria laid down in Syllabi and Scheme of Examination.

The B.Tech Minor and Major projects coordinator will ensure and maintain a record of student's attendance as per provision contained in UG ordinance.

13. As per Resolution No.-3 of 13<sup>th</sup> Academic Council Meeting minutes received vide reference no. BPSMV/Acad/14/1-25 dated 02/01/2015 promotion policy is as follows:

- a) For promotion to 7<sup>th</sup> semester, if completed all papers of 1<sup>st</sup> and 2<sup>nd</sup> semester

  
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14. Grand Total of marks and Credits for the B.Tech Electronics and Communication Engineering is as follows:

S.No	Semester	Total contact Hours	Credits	Marks
1	I	27	20.5	600
2	II	22	17.5	500
3	III	28	20	700
4	IV	26	20	650
5	V	22	22	800
6	VI	28	20	650
7	VII	26	21	700
8	VIII	30	19	600
<b>Total</b>		<b>209</b>	<b>160</b>	<b>5200</b>
<b>All end examinations (Theory &amp; Practical) are of three hours duration</b>				

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**Department of Electronics and Communication Engineering**  
**Bhagat Phool Singh Mahila Vishwavidyalaya,**  
**Khanpur Kalan (Sonepat), Haryana-131305**

Office No. 01263-283124, [www.bpswomenuniversity.ac.in](http://www.bpswomenuniversity.ac.in)

**Scheme of studies & Examinations of B. Tech (Electronics and Communication Engineering) 3<sup>rd</sup> Year (Semester 5) Choice Based Credit Scheme w.e.f (2020-21).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	ECL-351	Electromagnetic waves	3	0	0	3	20	80	100
2.	ECL-352	Linear integrated circuits	3	0	0	3	20	80	100
3.	ECL-353	Microwave engineering	3	0	0	3	20	80	100
4.	ECL-354	Digital signal processing	3	0	0	3	20	80	100
5.	*	Program elective-I	3	0	0	3	20	80	100
6.	**	Open elective-I	3	0	0	3	20	80	100
Labs									
7.	ECP-352	Linear integrated circuits lab	0	0	2	1	10	40	50
8.	ECP-354	Digital signal processing lab	0	0	2	1	10	40	50
9.	ECP-357	Professional training - I	0	0	0	2	100	0	100
Total			18	0	4	22	240	560	800

**Total Contacts Hours: 22**

**Student will be opt program elective and open elective subjects as given:**

<b>*PROGRAM ELECTIVE-I</b>		<b>** OPEN ELECTIVE</b>	
Subject Code	Subject	Subject Code	Subject
ECL-355-A	CMOS design	ECL-356-A	ICT in Agriculture development
ECL-355-B	Power electronics	ECL-356-B	Remote sensing and GIS
ECL-355-C	Optical network	ECL-356-C	PC interfacing and data acquisition
ECL-355-D	Nano electronics	ECL-356-D	Wireless sensor network

**Note: Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.**

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## ELECTROMAGNETIC WAVES

ECL-351

L T P

3 0 0

Course Objectives

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

To enable the students to understand the fundamentals of electromagnetic waves.

1. To understand characteristics and wave propagation on high frequency transmission lines
2. To carryout impedance transformation on Transmission Line
3. To use sections of transmission line sections for realizing circuit elements
4. To characterize uniform plane wave
5. To calculate reflection and transmission of waves at media interface
6. To analyze wave propagation on metallic waveguides in modal form
7. To understand principle of radiation and radiation characteristics of an antenna

### Unit I

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

### Unit II

Maxwell's Equations- Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface. Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group polarization at media interface, Reflection from a conducting boundary. Wave propagation velocity, Power flow and Poynting vector, Surface current and power loss in a conductor

### Unit III

Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave in parallel planewaveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

### Unit IV

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna.

### Text/Reference Books:

R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005  
E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India  
Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.  
David Cheng, Electromagnetics, Prentice Hall

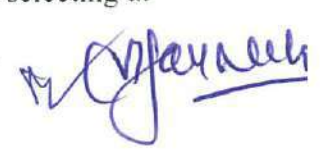
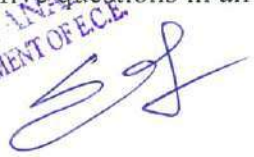
### Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL
3. Use sections of transmission line sections for realizing circuit elements
4. Characterize uniform plane wave
5. Calculate reflection and transmission of waves at media interface
6. Analyze wave propagation on metallic waveguides in modal form
7. Understand principle of radiation and radiation characteristics of an antenna

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## LINEAR INTEGRATED CIRCUITS

ECL-352

L T P

3 0 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course Objectives:

To enable the students to understand the fundamentals of integrated circuits and designing of electronic circuits .

1. To develop the skill of analysis and design of various circuits using operational amplifiers.
2. To develop design skills to design various circuits using different data conversion systems.
3. To design simple circuits like amplifiers using op-amps, waveform generating circuits, filter circuits for particular application.
4. To gain knowledge in designing a stable voltage regulators

### UNIT I

**Basics of operational amplifier:** ICs-Analog, Digital, Hybrid; Amplifier fundamentals, Block schematic of OP amp, Differential amplifier-dual input balanced output and unbalanced output, Analysis, Constant current bias, Current mirror circuits, Active Load, Level Shifters, Power amplifier stages, differential amplifier with swamping resistor, power supply requirements, Ideal & practical Op-amp, symbol and terminals, Op-amp parameters, AC and DC performance parameters of op-amp, ideal op amp, Equivalent circuit of op amp. Circuit simulation and problem solving using PSPICE.

### UNIT II

Bias current and offset-drift-compensation, Use of offset minimizing resistor and its design, Frequency response of Op amp, stability of op amp, frequency compensation, Slew rate and its effect; Open loop and closed loop configuration: Different feedback configurations- Voltage series feedback and voltage shunt feedback, concept of virtual ground. Differential amplifiers with one op amp and 3 op amps, typical data sheet 741, Circuit simulation and problem solving using PSPICE.

### UNIT III

**OP amp applications:** Sign changer, Scale changer, phase shift circuit, voltage follower, Summing amplifier, Subtractor, Integrator, differentiator, V/I converters, I/V converters, Log amplifier, Antilog amplifier, Instrumentation amplifier.

**Non linear circuits:** Comparators, Schmitt trigger, precision rectifier, window detector, clipper, clampers, zero crossing detectors.

**Waveform Generators:** Astable, Monostable, biastable, Triangular and saw tooth, RC phase shift, Wien bridge oscillators, Sample and hold circuit.

**Filters:** Transfer functions-LPF, HPF, BPF, BRFF; Butter worth-Chebyshev; Active Filters, I and II order, All Pass filters, Switched Capacitive Filters, Circuit simulation and problem solving using PSPICE and MATLAB.

### UNIT IV

**Specialized ICs and applications:** 555 timers-Functional block diagram-Astable multivibrator, monostable multivibrator.

**Phase Lock Loop:** 566 VCO chip-Mathematical block diagram, derivation of capture range, lock range and pull in time capture and lock range; applications: Frequency multiplication and division-AM demodulation-FM detection-FSK demodulation, Analog multiplier circuits and applications.

### TEXT BOOK:

1. R F Coughlin, Op amps and Linear Integrated circuits, Pearson Education/PHI.
2. Ramakant A. Gayakwad, OP-AMP and Linear IC's, Prentice Hall, 1994.
3. Gray, Analog Integrated Circuits, John Wiely 2<sup>nd</sup> Edition.
4. Sedra and Smith, Microelectronic Circuit, Oxford 3<sup>rd</sup> Edition.

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5. D A Bell, Opamps and Linear integrated Circuits, PHI Part A, second Edition.

**Course Outcomes:**

1. Understand the fundamentals of integrated circuits and designing electronic circuits using it.
2. Develop the skill of analysis and design of various circuits using operational amplifiers.
3. Develop design skills to design various circuits using different data conversion systems.
4. Able to design simple circuits like amplifiers using op-amps, waveform generating circuits, filter circuits for particular application.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## MICROWAVE ENGINEERING

ECL-353

L T P

3 0 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course Objectives

1. To enable the students to understand the fundamentals of microwave engineering.
2. To understand the passive and active devices commonly utilized in microwave subsystems are analyzed and studied.
3. To evaluate device performance using Design procedures.
4. To determine the link carrier-to-noise ratio performance factor of free space communication link.

### Unit I

**Introduction:** Microwave frequencies, Standard frequency bands, Behaviour of circuits at conventional and microwave frequencies.

**Microwave Tubes:** Limitation of conventional tubes, Construction, operation and characteristic of Klystron amplifier, reflex klystron, magnetron, TWT, BWO, CF amplifiers.

### Unit II

**Microwave Components:** Introduction, comparison with transmission lines, propagation in TE & TM mode, rectangular wave guide, TEM mode in rectangular wave guide, characteristic impedance, circular waveguides, Wave-guide tees, corners, bends, twists, circulars and isolators, directional couplers, hybrid ring, S-parameters, attenuators, cavity resonators, mixers & detectors, matched load, phase shifter, wave meter.

### Unit III

**Semiconductor Microwave Devices and Circuits:** Strip lines and micro strip circuits, microwave transistors and integrated circuits, varactor diodes, step-recovery diodes, tunnel diode, Gunn diode, IMPATT diode, TRAPATT diode, PIN diode, schottky barrier diodes, MASER, parametric amplifiers.

### Unit IV

**Microwave Measurements:** Description of Microwave bench—Different blocks and their features, power measurement; calorimeter method, bolometer bridge method, Impedance measurement, Measurement of frequency and wavelength, Measurement of unknown loads, Measurement of reflection coefficient, VSWR.

### Text Books:

1. Samuel Y Liao, Microwave Devices and Circuits, Prentice Hall India.
2. F.E. Terman, Electronic and Radio Engineering, McGraw-Hill, 4<sup>th</sup> Edition. 1955.
3. M .Kulkarni, Microwave devices and Radar Engineering, Umesh Publication.
4. Sanjeev Gupta, Microwave Engineering, Khanna Publication.
5. Dennis Roddy, Microwave Technology, PHI.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit

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## DIGITAL SIGNAL PROCESSING

ECL-354

L T P

3 0 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course objectives:

1. To compute DFT, FFT and using these in various applications.
2. To utilize the design techniques for digital IIR and FIR filters.
3. To analyze signals mathematically in time and frequency domain and obtain the response of an LTI system to different signals.
4. To design of different types of digital filters for various applications

### UNIT I

Limitations of analog signal processing, advantages of digital signal processing.

**Sampling Of Continuous Time Signals:** Sampling theorem, frequency domain representation, reconstruction of band limited signal from its samples, discrete time processing of continuous time signals, changing the sampling rate using discrete time processing, Applications of DSP.

**Discrete Fourier Transform:** Discrete-Time Fourier Transform, DFT as a linear transformation—relationship to other transforms—properties of DFT—Linear filtering methods based on DFT—frequency analysis of signals using DFT— Efficient computations of the DFT-FFT algorithms—direct computation, divide-and-conquer approach, radix-2, radix-4 and split radix algorithms—implementation of FFT algorithms—Applications of FFT.

### UNIT II

**Structure for Discrete Time Systems:** Solution of difference equations of digital filters, System function, stability criterion, frequency response of stable systems;

Realization—direct, canonic, cascade and parallel forms, lattice and transposed structures, signal flow graph representation

**Finite Precision Effects:** Fixed point and floating representation, errors due to rounding, truncation, quantization of filter coefficients, round off effects in digital filters, limit cycle oscillations, scaling for overflow prevention.

State space analysis of discrete filter

### UNIT III

Fundamentals, analog filter approximations—Butterworth and Chebyshev, design of IIR filters from analog filters, bilinear transformation method, step and impulse invariance techniques, spectral transformations.

**FIR Digital Filters:** Characteristics, frequency response, Design of FIR filters using window techniques, Frequency sampling technique, Comparison of IIR & FIR filters.

### UNIT IV

Decimation, interpolation, sampling rate conversion, filter design and implementation for sampling rate conversion.

**DSP Processors:** Introduction to programmable DSPs: Multiplier and multiplier accumulator (MAC), Modified bus structures and memory access schemes in DSPs multiple access memory, multiport memory, VLSI Architecture, pipelining, special addressing modes, On-chip peripherals.

### TEXT BOOKS:

1. Proakis, J.Gard and D.G.Manolakis, Digital Signal Processing: Principals, Algorithms and Applications, 3rd Edn. PHI, 1996.
2. Robert J. Schilling, L. Harris, Fundamentals of Digital Signal Processing, Thomson.
3. S. Salivahanan et al., Digital Signal Processing, TMH, 2000.
4. M.Mulkarni & Umesh Gupta, Digital Signal Processing, IK Publisher.

### REFERENCES:

1. A.V. Oppenheim and R.W. Schaffer, Discrete Time Signal Processing, PHI, 1989.
2. Thomas J. Cavicchi, Digital Signal Processing, John Wiley, 2004.
3. B. Venkata Ramani, M. Bhaskar, Digital Signal Processors, Architecture, Programming & Applications, TMH, 4<sup>th</sup> reprint, 2004.

**Course Outcomes:** At the end of this course students will demonstrate the ability to: Compute DFT, FFT and using these in various applications.

1. Utilize the design techniques for digital IIR and FIR filters.

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2. Analyze signals mathematically in time and frequency domain and obtain the response of an LTI system to different signals.
3. Design of different types of digital filters for various applications

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## CMOS DESIGN

ECL-355-A

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

Internal Marks: 80

Total Marks: 100

### Course Objectives:

1. To learn and skill about Design different CMOS circuits using various logic families along with their circuit layout.
2. To learn and skill about use tools for VLSI IC design.

### UNIT I

Review of MOS transistor models, Non-ideal behavior of the MOS Transistor.

### UNIT II

Transistor as a switch, Inverter characteristics, Integrated Circuit Layout: Design Rules, Parasitic.

### UNIT III

Delay: RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout.

### UNIT IV

Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic. Sequential Circuit Design: Static circuits. Design of latches and Flip-flops.

### Text/Reference Books:

N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011.

C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.

J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.

P. Douglas, VHDL: programming by example, McGraw Hill, 2013.

L. Glaser and D. Dobberpuhl, the Design and Analysis of VLSI Circuits, Addison Wesley, 1985.

### Course Outcomes:

At the end of the course the students will be able to

1. Design different CMOS circuits using various logic families along with their circuit layout.
2. Use tools for VLSI IC design.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit

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## POWER ELECTRONICS

ECL-355-B

L T P

3 0 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course Objectives:

1. To learn and skill about build and test circuits using power devices such as SCR
2. To understand and proficient about design controlled rectifier, DC to DC converters, DC to AC inverters,
3. To understand & learn how to analyze these inverters and some basic applications.
4. To learn and skill about Design SMPS.

### UNIT I

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT-Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based). Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

### UNIT II

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers. Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

### UNIT III

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter

### UNIT IV

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.

Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

### Text /Reference Books:

Muhammad H. Rashid, "Power electronics" Prentice Hall of India.  
Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.  
P.C. Sen., "Modern Power Electronics", edition II, Chand & Co.  
V.R. Moorthi, "Power Electronics", Oxford University Press.  
Cyril W., Lander, "Power Electronics", edition III, McGraw Hill.  
G K Dubey, S R Doradla, "Thyristorised Power Controllers", New Age International Publishers. SCR manual from GE, USA.

### Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,

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3. Learn how to analyze these inverters and some basic applications.

4. Design SMPS.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit

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## OPTICAL NETWORK

ECL-355-C

L T P

3 0 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course Objectives:

1. To learn and understand basic concepts of optical network and WDM network design.
2. To learn about to implement simple optical network and understand further technology developments for future enhanced network

### UNIT I

SONET/SDH: optical transport network, IP, routing and forwarding, multiprotocol label switching. WDM network elements: optical line terminals and amplifiers, optical add/drop Multiplexers, OADM architectures, reconfigurable OADM, optical cross connects.

### UNIT II

Control and management: network management functions, optical layer services and interfacing, performance and fault management, configuration management, optical safety. Network Survivability: protection in SONET/SDH & client layer, optical layer protection schemes

### UNIT III

WDM network design: LTD and RWA problems, dimensioning wavelength routing Networks, statistical dimensioning models.

### UNIT IV

Access networks: Optical time division multiplexing, synchronization, header processing, buffering, burst switching, test beds, Introduction to PON, GPON, AON.

### References:

1. Rajiv Ramaswami, Sivarajan, Sasaki, "Optical Networks: A Practical Perspective", MK, Elsevier, 3 rd edition, 2010.
2. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts Design, and Algorithms", PHI, EEE, 2001.

### Course Outcomes:

At the end of this course, students will be able to

1. Contribute in the areas of optical network and WDM network design. Implement simple optical network and understand further technology developments for future enhanced network.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## ICT IN AGRICULTURE DEVELOPMENT

ECL-356-A

L T P

3 0 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course Objectives:

1. To understand the initiatives of ICT in agriculture development in India.
2. To learn the role of ICT in Sustainable development.
3. To learn ICT design and implementations applications in agriculture
4. To learn ICT infrastructure requirements

### UNIT I

**Introduction:** ICT initiatives for agricultural development in India, usage of various communication technologies for agricultural development, current scenario, ICT and agricultural industry, Innovations for sustainable agriculture

### UNIT II

**Role of ICT in sustainable development:** Remote Sensing and Image Processing, GPS, GIS Data Modeling, Geographical Information Systems, Issues and Concerns in Land and Water Management, The GIS Approach, Application of GIS

### UNIT III

**Design and implementation using ICT:** Enabled rural services by integrating information collected and make services available through a single point of access.

Application of ICT in digital agriculture, agro-scientific information dissemination, expert advice dissemination system web based dissemination of Agri information, management and control of automation system, computer assisted satellite based e-learning system for agriculture extension, use of ICT for pest surveillance, agri knowledge data base, IT based agro services, whether prediction, crop health monitoring.

### UNIT IV

**ICT infrastructure requirements:** Introduction, uses, role of communication technologies in agriculture and rural development, Conventional dissemination media, electronic media: radio & television, Internet and multimedia, various communication technologies, wireless technologies, digital technology, digital radio, direct broadcast satellite, emerging technologies, fundamentals, principle etc., microwave and antenna concepts of remote sensing. Satellite and video conferencing, ICT infrastructure requirements for agricultural development, global and Indian status in usage of ICT in agriculture, relevant case studies.

### Recommended Books:

1. Information and Communication Technology in Development: Subhash C. Bhatnagar, Robert Schware, Subhash C. Bhatnagar
2. Vikram Singh, Impact of Information and Communication Technology on Public Life, University Science Press, 2009.
3. Nagy Hanna, Exploiting information technology for development: a case study of India,

**Course Outcomes:** At the end, students are learned and skilled-

1. To understand the initiatives of ICT in agriculture development in India.
2. To recognize the role of ICT in Sustainable development.
3. To know ICT design and implementations applications in agriculture.
4. To learn ICT infrastructure requirements.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## NANO ELECTRONICS

ECL-355-D

L T P

3 0 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course Objectives:

1. To be proficient up to understand various aspects of nano-technology and the processes involved in making nano components and material.
2. To be learned about leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. To understand various aspects of nano-technology and the processes involved in making nano components and material.
4. To skillful about leverage advantages of the nano-materials and appropriate use in solving practical problems.

### UNIT I

Introduction to nanotechnology, meso structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy.

### UNIT II

Band Theory of Solids. Kronig-Penny Model. Brillouin Zones.

### UNIT III

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.).

### UNIT IV

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

### Text/ Reference Books:

G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.

W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.

K.E. Drexler, Nanosystems, Wiley, 1992.

J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.

C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

### Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Dr. P. ANKA IWANE  
IN-CHARGE, DEPARTMENT OF ECE

Signature of Dr. P. Anka Iwane

## REMOTE SENSING AND GIS

ECL-356-B

L T P

3 0 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course Objectives:

1. To understand fundamental concept of remote sensing and geographic information systems.
2. To learn GIS, and map projections & co-ordinate systems.
3. To learn different data sources, data inputs, data quality, and database concepts.
4. To hands on technology and instruments using hardware and software concepts.

### UNIT I

**Introduction and Overview of Geographic Information Systems:** Definition of a GIS, features and functions; why GIS is important; how GIS is applied; GIS as an Information System; GIS and cartography; contributing and allied disciplines; GIS data feeds; historical development of GIS.

### UNIT II

#### GIS and Maps, Map Projections and Coordinate Systems:

Maps and their characteristics (selection, abstraction, scale, etc.); automated cartography versus GIS; map projections; coordinate systems; precision and error.

### UNIT III

#### Data Sources, Data Input, Data Quality and Database Concepts:

Major data feeds to GIS and their characteristics: maps, GPS, images, databases, commercial data; locating and evaluating data; data formats; data quality; metadata. Database concepts and components; flat files; relational database systems; data modeling; views of the database; normalization; databases and GIS, Questions a GIS can answer; GIS analytical functions; vector analysis including topological overlay; raster analysis; statistics; integrated spatial analysis.

### UNIT IV

#### Technology & Instruments involved in GIS & Remote Sensing:

GIS applications; GIS application areas and user segments; creating custom GIS software applications; user interfaces; case studies, Future data; future hardware; future software; Object-oriented concepts and GIS; future issues—data ownership, privacy, education; GIS career options and how to pursue them, Remote sensing of environment, E.M. Principle, Thermal infrared remote sensing, Remote sensing of Vegetation, Remote sensing of water, urban landscape.

#### Textbooks:

1. "Principles of geographical information systems", P. A. Burrough and R. A. Mcdonnell, Oxford.
2. "Remote sensing of the environment", J. R. Jensen, Pearson.

#### Course Outcomes: At end student are able to:

1. Understand fundamental concept of remote sensing and geographic information systems.
2. Learn GIS, and map projections & co-ordinate systems.
3. Learn different data sources, data inputs, data quality, and database concepts.
4. Hands on technology and instruments using hardware and software concepts.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Dr. P. S. N. S. N. S. N.  
INCHARGE, DEPARTMENT OFFICE

Dr. P. S. N. S. N. S. N.

## PC INTERFACING AND DATA ACQUISITION

ECL-356-C

L T P

3 0 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course Objectives:

1. To understand basic concept of PC interfacing and data acquisition.
2. To learn concept of memory and mass storage devices.
3. To understand concept of buses of communications.
4. To learn concept of interfacing.

### UNIT I

**PC as a platform for Data Acquisition:** Origin of PC, software-operating systems, programming languages, hardware components—mother board—microprocessors, chipsets and support circuits, functions, system control, peripheral control, memory control BIOS and its functions.

### UNIT II

**Memory and Mass Storage Devices:** Memory, logical organization, Technologies, installation, packaging, Mass storage

Devices, data organization, Magnetic storage, Optical storage, interfaces—AT attachments, SCSI parallel interface, Key board, mouse, track ball, scanners, Display systems, Display adapters, Audio Systems, Printers, Ports-USB, Firewire, IrDA, Bluetooth, RS-232C Serial Port, Parallel Ports.

### UNIT III

**Buses and Communications:** History, architecture, bus function, various buses: ISA, PCI, PCI-X, PCI-Express, PCMCIA, Infinib and, hyper transport

### UNIT IV

**Interfacing:** Local area networking—Concepts, topologies, standards, hardware, Telecommunication—analogue and digital services, Internet—addressing, Domain name systems, Routing. Design of DAS around PC, different DAQ cards and software, Interfacing of Add-on DAQ cards with PC using various buses.

Allocation and technique of data acquisition for agriculture

### Books Recommended

1. Hardware Bible – Winn. L. Rosch, Techmedia, New Delhi
2. The Complete PC maintenance and upgrade guide—Mark Minasi, BPB publications.
3. 8086/8088 Programming—John Uffenbeck, PHI.
4. Structured Computer Organisation—Tanenbaum, PHI.
5. Microprocessors—Gilmore, Mc-Graw Hill.

### Course Outcomes:

**At end the students are proficient to:**

1. To understand basic concept of PC interfacing and data acquisition.
2. To learn concept of memory and mass storage devices.
3. To understand concept of buses of communications.
4. To learn concept of interfacing.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Dr. N. K. IN-CHARGE, DEPARTMENT OF ECE.

## WIRELESS SENSOR NETWORKS

ECL-356-D

L T P

3 0 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course Objectives:

1. To understand fundamental concepts of wireless sensor networks.
2. To be skilled about MANETs. Protocols.
3. To learn concept of dissemination protocols and its applications.
4. To be skilled about single node architecture and operating systems i.e. TinyOS, nesC.

### UNIT I

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

### UNIT II

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee.

### UNIT III

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

### UNIT IV

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

### Text/Reference Books:

Waltenegus Dargie, Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications, 2011

Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009

Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications, 2004

Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science

Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press 2009

### Course Outcomes:

At the end of the course the students will be able to

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Dr. Jyoti K. INAND  
INCHARGE, DEPARTMENT OF ECE

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## LINEAR INTEGRATED CIRCUITS LAB

ECP-352

L T P

0 0 2

Total Credits: 1

External Marks: 40

Internal Marks: 10

Total Marks: 50

### Course objective:

1. To create ability among students about to design and implement the electronic circuits to gain knowledge on performance of the circuit and its application

### List of experiments:

1. Study of OP AMPs- IC741, IC555, IC565, IC566, IC1496—functioning parameters and specifications.
2. Measurement of op-amp parameters - CMRR, slew rate, open loop gain, input and output Impedances.
3. OP AMP Applications-Adder, Subtractor, Comparator Circuits.
4. Integrator and Differentiator Circuits using IC 741.
5. Instrumentation amplifier - gain, CMRR and input impedance.
6. Active Filter Applications—LPF, HPF (first order).
7. Active Filter Applications—BPF, Band Reject (Wideband) and Notch Filters.
8. IC 741 Oscillator Circuits—Phase Shift and Wien Bridge Oscillators.
9. Function Generator using OP AMPs.
10. IC 555 Timer—Monostable Operation Circuit.
11. IC 555 Timer—Astable Operation Circuit.
12. Schmitt Trigger Circuits – using IC 741 and IC 555.
13. IC 565—PLL Applications.
14. IC 566—VCO Applications.
15. Voltage Regulator using IC 723.
16. Three Terminal Voltage Regulators – 7805, 7809, 7912.
17. Four bit DAC using OP AMP.
18. Circuits using op-amps for waveform generation.
  - i) Astable multivibrators
  - ii) Monostable multivibrators.
  - iii) Wein bridge oscillator
  - iv) Triangular, square wave form generators.
19. Second order Active RC filters High pass, low pass.
20. Active notch filter realization using op-amps.
21. Wein bridge oscillator with amplitude stabilization.
22. RC phase shift oscillator.
23. Design of PLL for given lock and capture ranges & frequency multiplication
24. Precision limiters using op-amps.
25. Log and Antilog Amplifiers.
26. Single op-amp second order LPF and HPF-Sallen-Key configuration
27. Narrow band active BPF-Delyiannis configuration
28. Active notch filter realization using op-amps

**NOTE:** At least 12 experiments have to be performed in the semester; out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution.

Dr. PRIYANKA INAND  
IN-CHARGE, DEPARTMENT OF E.C.E.

h. n. jayash

## DIGITAL SIGNAL PROCESSING LAB

ECP-354

L T P

0 0 2

Total Credits: 1

External Marks: 40

Internal Marks: 10

Total Marks: 50

### COURSE OBJECTIVE:

1. To provide an introduction to DSP and DSP Devices (specifically the TMS 320C). The emphasis is on using MATLAB as a platform for understanding DSP techniques before applying these techniques on a DSP device.

### LIST OF EXPERIMENTS: Perform the experiments using MATLAB/Scilab, Simulink, Xcos and LabView:

1. To study the architecture of DSP chips– TMS 320C SX/6X instructions.
2. To represent basic signals (unit step, impulse, ramp, exponential, sine and cosine).
3. To develop program for discrete convolution & correlation.
4. To verify linear convolution & circular convolution.
5. To design FIR filter (LP/HP) using windowing technique: rectangular window, triangular window and Kaiser Window
6. Write a MATLAB program to generate sum of sinusoidal signals.
7. Write a MATLAB program to find frequency response of analog LP/HP filters.
8. To compute power density spectrum of a sequence.
9. To find the FFT of given 1-D signal and plot.
10. To understand stability test.
11. To understand sampling theorem.
12. To design analog filter (low-pass, high pass, band-pass, band-stop).
13. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
14. To Implement IIR filter (LP/HP) on DSP Processors
15. To design a program to compare direct realization values of IIR digital filter.
16. To develop a program for computing parallel realization values of IIR digital filter.
17. To develop a program for computing cascade realization values of IIR digital filter.
18. To develop a program for computing inverse Z-transform of a rational transfer function.
19. Study of pre-emphasis of speech signal.
20. Study of digital signal processing kit (TMS/ADSP).
21. Study of digital signal processing toolbox.
22. Implementation of FIR/digital filters using DSP kit.
23. Getting familiar with LabView Environment.
24. Digital FIR/IIR filter design using LabView.
25. Real time data exchange using LabView.
26. Discrete Fourier transfer/Discrete wavelet transform using LabView
27. Dual tone Multi-frequency (DTMF) system design using LabView hybrid programming
28. Getting familiar with code composer studio.
29. Generation and reconstruction of Signals using LabView.
30. Getting familiar with graphical programming environment Simulink and to study continuous and discrete block library component for discrete system realization using Simulink.
31. Realization of digital FIR/IIR filter using Simulink
32. Discrete signal and system generation and implementation using Simulink

**NOTE:** At least 12 experiments have to be performed in the semester; out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution.

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IN-CHARGE, DEPARTMENT OFFICE.



## PROFESSIONAL TRAINING-I

ECP-357

L T P

0 0 0

Total Credits: 2

External Marks:

Internal Marks: 100

Total Marks: 1000

At the end of 4<sup>th</sup> semester each student would undergo four weeks Professional Training-I (Industrial Practical Training-I) in an Industry/Institute/ Professional Organization/Research Laboratory/ In-house electronics workshop/PCB making and assembling/use of CAD software etc. during summer vacation after fourth semester with the prior approval of the Training and Placement Officer of the University. Each student in the Department submits a typed report along with a certificate from the organization. The typed report should be in a prescribed format. The report will be evaluated in the 5<sup>th</sup> Semester by a Committee consisting of three teachers from different specialization to be constituted by the Chairperson of the Department.

**The Internal assessment will be effected by the following committee of three persons:**

**Training and Placement Officer of the Department:**

**Convener**

**Two faculties from the Deptt:**

**Member**

The basis of evaluation will primarily be the knowledge and exposure of the student towards different processes and the functioning of the organization. The student will interact with the committee through presentation to demonstrate his/her learning.

Dr. PRATIK A. ANAND  
IN-CHARGE, DEPARTMENT OF ECE.



**Department of Electronics and Communication Engineering**  
**Bhagat Phool Singh Mahila Vishwavidyalaya,**  
**Khanpur Kalan (Sonapat), Haryana-131305**

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**Scheme of studies & Examinations of B. Tech (Electronics and Communication Engineering) 3<sup>rd</sup> Year (Semester 6) Choice Based Credit Scheme w.e.f (2020-21).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	ECL-361	Control Systems	3	0	0	3	20	80	100
2.	ECL-362	Computer Network	3	0	0	3	20	80	100
3.	ECL-363	VHDL Based Digital System Design	3	0	0	3	20	80	100
4.	*	Program Elective-II	3	0	0	3	20	80	100
5.	**	Open Elective-II	3	0	0	3	20	80	100
6.	HSL-366	Essence Of Indian Traditional Knowledge	3	0	0	0	20	80	100
Labs									
7.	ECP-362	Computer Networks Lab	0	0	4	2	10	40	50
8.	ECP-366	Electronic Measurement Lab	0	0	2	1	10	40	50
9.	ECP-367	Mini Project/Electronic Design Workshop	0	0	4	2	10	40	50
Total			18	0	10	20	130	520	650

**Total Contact Hours = 28**

Essence of Indian Traditional Knowledge (HSL-366) will be non credit, mandatory and qualifying course. Marks of Indian Traditional Knowledge (HSL-366) will not be counted in grand total.

Student will be opt program elective and open elective subjects as given:

<b>*Program Elective-II</b>		<b>** Open Elective-II</b>	
Subject Code	Subject	Subject Code	Subject
ECEL-365	Information Theory and Coding	ECO-363	Statistical Information Processing
ECEL-367	Introduction to MEMS	ECO-366	Telecommunication System Modeling and Simulation
ECEL-369	Bio-Medical Electronics	ECO-368	Modern Radar System
ECEL-361	Scientific computing	ECO-362	Wireless and mobile communication

**Note:** Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.

**Dr. ANKA ANAND**  
 INCHARGE, DEPARTMENT OF E.C.E.

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## CONTROL SYSTEMS

ECL-361

L T P

3 0 0

### Course Objectives:

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

1. To give an introduction to the analysis of linear control systems.
2. To exploit time domain and frequency domain tools to design and study linear control systems.

### UNIT I

Introduction to control problem- Industrial Control examples, Transfer function. System with dead-time. System response. Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, Tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems. Block diagram and signal flow graph analysis.

### UNIT II

Feedback control systems- Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness. proportional, integral and derivative systems. Feed-forward and multi-loop control configurations, stability concept, relative stability, Routh stability criterion.

Time response of second-order systems, steady-state errors and error constants. Performance specifications in time-domain. Root locus method of design. Lead and lag compensation.

### UNIT III

Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain. Nyquist plots. Nyquist stability criterion. Performance specifications in frequency-domain. Frequency-domain methods of design, Compensation & their realization in time & frequency domain. Lead and Lag compensation. Op-amp based and digital implementation of compensators. Tuning of process controllers. State variable formulation and solution.

### UNIT IV

State variable Analysis- Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability.

Introduction to Optimal control & Nonlinear control, Optimal Control problem, Regulator problem, Output regulator, tracking problem. Nonlinear system – Basic concept & analysis.

### TEXT/REFERENCE BOOKS:

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.
4. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi

**Course Outcomes:** At the end of this course students will demonstrate the ability to characterize a system and find its study state behavior Investigate stability of a system using different tests. Design various controllers Solve liner, non-liner and optimal control problems

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Dr. PRIYANKA ANAND  
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## COMPUTER NETWORK

L T P

Course

Internal Marks: 20

Total Marks: 100

**Course Objectives:**

1. Ability among students about to understand the concepts of networking thoroughly.
2. To make students proficient about design a network for a particular application.
3. To learn and understand about to analyze the performance of the network.

## UNIT I

Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts. Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical

## UNIT II

Multiplexing. Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call.

Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport - Transmission Control Protocol, Remote Procedure Call.

### UNIT III

Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

## UNIT IV

Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing

Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, and Switches.

**TEXT REFERENCE BOOKS:**

1. J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", Pearson Education, 5th Edition.
2. L. Peterson and B. Davie, "Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, 5th Edition.
3. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall
4. S. Keshav, "An Engineering Approach to Computer Networking", Pearson Education
5. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition
6. Andrew Tanenbaum, "Computer networks", Prentice Hall
7. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall
8. William Stallings, "Data and computer communications", Prentice Hall

**Course Outcomes:**

At the end of this course students will demonstrate the ability to:

1. Understand the concepts of networking thoroughly.
2. Design a network for a particular application.
3. Analyze the performance of the network.

DEEPA K. NAND  
INCHARGE, DEPARTMENT OF ECE

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Dr. P. V. ANAND  
IN CHARGE, DEPARTMENT OF E.C.E.

Dr. N. S. Jeyaraj

## VHDL BASED DIGITAL SYSTEM DESIGN

ECL-363

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

1. To make students proficient about to simulate and implement typical combinational and sequential digital systems in PLDs and express the design in VHDL.

### UNIT I

Introduction to computer-aided design tools for digital systems, Hardware description languages; introduction to VHDL, data objects, classes and data types, operators, overloading, logical operators, Types of delays entity and architecture declaration, Introduction to behavioural, dataflow and structural models.

### UNIT II

**VHDL Statements:** Assignment statements, sequential statements and process, conditional statements, case statement array and loops, resolution functions, packages and libraries, concurrent statements.

**Subprograms:** Application of functions and procedures, Structural modelling, component declaration, structural layout and generics.

### UNIT III

**Combinational Circuit Design:** VHDL Models and simulation of combinational circuits such as multiplexers, demultiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc.

**Sequential Circuits Design:** VHDL models and simulation of sequential circuits shift registers, counters etc.

### UNIT IV

**Design of Microcomputer:** Basic components of a computer, specifications, architecture of a simple microcomputer system, implementation of a simple microcomputer system using VHDL.

### REFERENCE BOOKS:

1. Bhasker, A VHDL Primer, Prentice Hall, 1995.
2. Charles. H. Roth, Digital System Design using VHDL, PWS, 1998.
3. Navabi Z, VHDL-Analysis & Modelling of Digital Systems, McGraw Hill.
4. Perry, VHDL-IV Edition, TMH, 2002.
5. Ercegovic Lang & Moreno, Introduction to Digital Systems, John Wiley, 1999.
6. Brown and Vranesic, Fundamentals of digital Logic with VHDL Design, TMH, 2000.
7. R.P Jain, Modern Digital Electronics- III Edition, TMH, 2003.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Dr. M. V. K. S. RAO  
IN-CHARGE, DEPARTMENT OF ECE

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## INFORMATION THEORY AND CODING

ECEL-365

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objectives:

1. To understand about the concept of information and entropy
2. To understand about the Shannon's theorem for coding
3. To learn about the calculation of channel capacity
4. To learn how to apply coding techniques

### UNIT I

Basics of information theory, entropy for discrete ensembles; Shannon's noiseless coding theorem; Encoding of discrete sources.

### UNIT II

Markov sources; Shannon's noisy coding theorem and converse for discrete channels; Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.

### UNIT III

Techniques of coding and decoding; Huffman codes and uniquely detectable codes; Cyclic codes, convolutional arithmetic codes.

### UNIT IV

Introduction to TCM, concept of coded modulation, TCM decoder, Performance Evaluation for AWGN Channel, TCM for Fading Channels, Introduction to BCH Codes.

### TEXT/REFERENCE BOOKS:

1. N. Abramson, Information and Coding, McGraw Hill, 1963.
2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
3. R.B. Ash, Information Theory, Prentice Hall, 1970.
4. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
5. Ranjan Bose, Information Theory, Coding and Cryptography, McGraw Hill, 2019.

### Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the concept of information and entropy
2. Understand Shannon's theorem for coding
3. Calculation of channel capacity
4. Apply coding techniques

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## INTRODUCTION TO MEMS

ECEL-367

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objectives:

1. To make proficient working principles of MEMS and NEMS devices.
2. To understand about the design and model MEM devices.

### UNIT I

Introduction and Historical Background, Scaling Effects. Micro/Nano Sensors, Actuators and Systems overview: Case studies.

### UNIT II

Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching.

### UNIT III

Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding. Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect.

### UNIT IV

Linear Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method. Modeling of Coupled Electromechanical Systems.

### TEXT/REFERENCE BOOK:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E. Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

### COURSE OUTCOMES:

At the end of the course the students will be able to

1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## BIO-MEDICAL ELECTRONICS

ECEL-369

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objectives:

1. To be aware of the application of the electronic systems in biological and medical applications.
2. Identify with the practical limitations on the electronic components while handling bio-substances.
3. Realize and analyze the biological processes like other electronic processes.

### UNIT I

Brief introduction to human physiology, Recent trends in Biomedical Electronics, Components of Medical instrumentation system, static and dynamic characteristics of Medical instruments.

### UNIT II

Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases. Bio-electrodes and bio-potential amplifiers for ECG, EMG, EEG, etc.

### UNIT III

Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrasonic, X-ray and nuclear imaging. Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects.

### UNIT IV

Neuro-Muscular instrumentation, specification of EEG and EMG machines. Electrode placement for EEG and EMG recording. Interpretation of EEG and EMG.

### Text/Reference Books:

1. W.F. Ganong, Review of Medical Physiology, 8<sup>th</sup> Asian Ed, Medical Publishers, 1977.
2. J.G. Webster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

### Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the application of the electronic systems in biological and medical applications.
2. Understand the practical limitations on the electronic components while handling bio-substances.
3. Understand and analyze the biological processes like other electronic processes.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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IN-CHARGE, DEPARTMENT OF E.C.E.

## SCIENTIFIC COMPUTING

ECEL-361

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objectives:

1. To know the significance of computing methods, their strengths and application areas.
2. To Perform the computations on various data using appropriate computation tools.

### UNIT I

Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation.

### UNIT II

System of linear equations: Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems

Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

Eigenvalues and singular values: Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigen-values, Singular Values Decomposition, Application of SVD.

### UNIT III

Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method

Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares

Finite Difference Methods, Finite Element Method, Eigenvalue Problems.

### UNIT IV

Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods

Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences.

### TEXT/ REFERENCE BOOKS:

1. Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, 2nd Ed., 2002
2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed., 2007
3. Xin-she Yang (Ed.), "Introduction To Computational Mathematics", World Scientific Publishing Co., 2nd Ed., 2008
4. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, 1st Ed., 2006

  
Dr. PRIYANKA INAMDAR  
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5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing With MATLAB And Octave", Springer, 3rd Ed., 2010

**Course Outcomes:**

At the end of the course, students will demonstrate the ability to:

1. Understand the significance of computing methods, their strengths and application areas.
2. Perform the computations on various data using appropriate computation tools.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## STATISTICAL INFORMATION PROCESSING

ECOE-365

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objectives:

1. To make students able to characterize and apply probabilistic techniques in modern decision systems, such as information systems, receivers, filtering and statistical operations.
2. To make students proficient about to demonstrate mathematical modeling and problem solving using such models.
3. To understand about to comparatively evolve key results developed in this course for applications to signal processing, communications systems.
4. To develop frameworks based in probabilistic and stochastic themes for modeling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.

### UNIT I

Review of random variables: Probability Concepts, distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Vector quantization, Tchebaychef inequality theorem, Central Limit theorem, Discrete & Continuous Random Variables. Random process: Expectations, Moments, Ergodicity, Discrete-Time Random Processes Stationary process, autocorrelation and auto covariance functions, Spectral representation of random signals, Properties of power spectral density, Gaussian Process and White noise process.

### UNIT II

Random signal modelling: MA(q), AR(p), ARMA(p,q) models, Hidden Markov Model & its applications, Linear System with random input, Forward and Backward Predictions, Levinson Durbin Algorithm.

### UNIT III

Statistical Decision Theory: Bayes' Criterion, Binary Hypothesis Testing, M-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing. Parameter Estimation Theory: Maximum Likelihood Estimation, Generalized Likelihood Ratio Test, Some Criteria for Good Estimators, Bayes' Estimation Minimum Mean-Square Error Estimate, Minimum, Mean Absolute Value of Error Estimate Maximum A Posteriori Estimate.

### UNIT IV

Spectral analysis: Estimated autocorrelation function, Periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic signals. Application of Information Theory.

### Text Books:

1. Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes", 4<sup>th</sup> Edition, McGraw-Hill, 2002.
2. D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.

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3. Mourad Barkat , "Signal Detection and Estimation", Artech House, 2nd Edition, 2005.
4. R G. Gallager, "Information theory and reliable communication", Wiley, 1st edition, 1968.
5. F. J. MacWilliams and N. J. A. Sloane, "The Theory of Error-Correcting Codes", New York, North-Holland, 1977.
6. Rosen K.H, "Elementary Number Theory", Addison-Wesley, 6th edition, 2010.

**Course Outcomes:**

At the end of this course, students will be able to

1. Characterize and apply probabilistic techniques in modern decision systems, such as information systems, receivers, filtering and statistical operations.
2. Demonstrate mathematical modeling and problem solving using such models.
3. Comparatively evolve key results developed in this course for applications to signal processing, communications systems.
4. Develop frameworks based in probabilistic and stochastic themes for modeling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

**Dr. Pankaj Khand**  
INCHARGE DEPARTMENT OFFICE

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## TELECOMMUNICATION SYSTEM MODELING AND SIMULATION

ECOE-366

L T P

3 0 0

Total Credits: 3

Internal Marks: 80

External Marks: 20

Total Marks: 100

### Course Objectives:

1. To understand the fundamental concept of system modelling and simulation.
2. To understand the fundamental concept of telecommunication system modelling and simulation.
3. To hands on softwares for modeling and simulation.

### UNIT I

Concept of Simulation, System, Model, Types of Model, Univariate & Multivariate Models, Deterministic & Stochastic models, Continuous & Discrete Models, Analog & Digital Simulation, Real Time Simulation, Hybrid Simulation, Advantages & Limitations of Simulation, Steps in Simulation Study.

### UNIT II

Pseudo Random Numbers, Generation of random numbers, properties & testing of random numbers, generation of random variables using common distributions, Bounds and approximations of Random processes, Simulation of random variables & random processors, Transformation functions, transformations of random processes, sampling & quantization for simulation.

### UNIT III

Information sources encoding/decoding, base band modulation and mapping, RF and optical modulation demodulation, Filtering communication channels and models, Noise interference and error, Control coding, Synchronization, Spread spectrum techniques.

### UNIT IV

Simulation environment, Modeling consideration, Performance evaluation techniques, Error sources in simulation, design of simulation experiment—length of run, replication, elimination of initial bias, variance reduction techniques.

**PSpice:** Simulation of analog systems using PSpice.

### Books Recommended:

1. Simulation of Communication Systems by M.C. Jeruchim & Others, Plenum Press.
2. Modern Digital and Communication Systems by Lathi B.P.
3. System Simulation—by DS Hira.
4. Discrete Event System Simulation—by Banks, Carsen, Nelson, Pearson Edu. Asia.

### Source Outcome:

**At the end of course student to be proficient about:**

1. To understand the fundamental concept of system modelling and simulation.
2. To understand the fundamental concept of telecommunication system modelling and simulation.
3. To hands on softwares for modeling and simulation.

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NOTE: There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## MODERN RADAR SYSTEM

ECOE-368

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objectives:

1. Understand the basic principle of radar equation.
2. Identify the elements of radar transmitter and of radar receiver.
3. Understand and model the characteristics of radar echoes from different types of targets and clutter.
4. Understand different types of radars; CW, MTI, Pulse Doppler, and Tracking Radars.
5. Understand the use of Doppler frequency shift to detect moving target in stationary clutter.
6. Calculate and simulate receiver noise and losses.
7. Understand the Matched-Filter Receiver and the ambiguity diagram.
8. Understand radar detection and parameter estimation using statistical decision theory.
9. Understand and identify theoretical accuracy of radar measurements and pulse compression techniques.
10. Design and analyze radar optimal receivers.

### UNIT I

Fundamentals of Surveillance Radar and Design: Bandwidth considerations, prf, Unambiguous range and velocity, Pulse length and Sampling, Radar Cross-section and Clutter.

### UNIT II

Tracking Radar: Tracking and Search Radars, Antenna beam shapes required, Radar guidance, Frequency agility, Importance of Monopulse Radar.

### UNIT III

Radar waveform design: Bandwidth and pulse duration requirements Range and Doppler accuracy uncertainty relation, pulse compression and phase coding.

### UNIT IV

Principles of Secondary Surveillance Radar, Radar studies of the atmosphere, OHR and Radar jamming, EC, ECC measures and stealth applications.

### Text Books:

1. "Understanding of Radar Systems", Simon Kingsley and Shaun Quegan, McGraw Hill, 1993.
2. Radar Handbook by Skolnik

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

  
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## WIRELESS AND MOBILE COMMUNICATION

ECOE-362

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objectives:

1. To make students familiar with fundamentals of wireless and mobile communication systems
2. To choose system (TDMA/FDMA/CDMA) according to the complexity, installation cost, speed of transmission, channel properties etc.
3. To identify the limitations of 2G and 2.5G wireless mobile communication and use design of 3G and beyond mobile communication systems

### UNIT I

Cellular Communication Fundamentals: Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction techniques and methods to improve cell coverage, Frequency management and channel assignment. GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM. 2.5 G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS), 2.75 G Standards: EDGE,

### UNIT II

Spectral efficiency analysis based on calculations for Multiple access technologies: TDMA, FDMA and CDMA, Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas. Wireless network planning (Link budget and power spectrum calculations)

### UNIT III

Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread: Flat, Frequency selective, Doppler Spread; Fast and Slow fading. Equalization. Diversity: Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving.

### UNIT IV

Code Division Multiple Access: Introduction to CDMA technology, IS 95 system architecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and Channels. Higher Generation Cellular Standards: 3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G

### References Books:

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1. V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5<sup>th</sup> edition, 2008.
2. V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.
3. T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd edition. PHI. 2002.
4. William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2<sup>nd</sup> edition, TMH, 1995.
5. Asha Mehrotra, "A GSM system Engineering" Artech House Publishers Boston

**Course Outcomes:**

1. To make students familiar with various generations of mobile communications
2. To understand the concept of cellular communication
3. To understand the basics of wireless communication
4. Knowledge of GSM mobile communication standard, its architecture, logical channels, advantages and limitations.
5. Knowledge of IS-95 CDMA mobile communication standard, its architecture, logical channels, advantages and limitations.
6. Knowledge of 3G mobile standards and their comparison with 2G technologies.
7. To under multicarrier communication systems.
8. To differentiate various Wireless LANs

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## COMPUTER NETWORKS LAB

ECP-362

L T P

0 0 4

Total Credits: 2

Internal Marks: 10

External Marks: 40

Total Marks: 50

### List of Experiments:

1. Write specifications of latest desktops and laptops.
2. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc.
3. Familiarization with Transmission media and Tools: Co-axial cable, UTP Cable, Crimping Tool, Connectors etc.
4. Preparing straight and cross cables.
5. Study of various LAN topologies and their creation using network devices, cables and computers.
6. Configuration of TCP/IP Protocols in Windows/Linux.
7. Implementation of file and printer sharing.
8. Designing and implementing Class A, B, C Networks
9. Subnet planning and its implementation
10. Installation of ftp server and client.

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## ELECTRONIC MEASUREMENT LAB

ECP-366

L T P

0 0 2

Total Credits: 1

Internal Marks: 10

External Marks: 40

Total Marks: 50

### List of Experiments

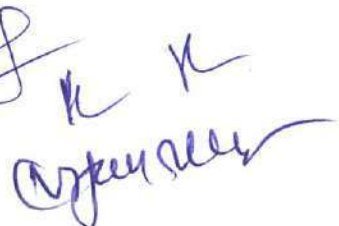
1. Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge)
2. Designing AC bridge Circuit for capacitance measurement
3. Designing signal Conditioning circuit for Pressure Measurement
4. Designing signal Conditioning circuit for Temperature Measurement
5. Designing signal Conditioning circuit for Torque Measurement
6. Designing signal Conditioning circuit for Strain Measurement
7. Experimental study for the characteristics of ADC and DAC
8. Error compensation study using Numerical analysis using MATLAB (regression)

### Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Design and validate DC and AC bridges
2. Analyze the dynamic response and the calibration of few instruments
3. Learn about various measurement devices, their characteristics, their operation and their limitations
4. understand statistical data analysis
5. Understand computerized data acquisition.

  
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IN-CHARGE, DEPARTMENT OFFICE

  
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## MINI PROJECT/ELECTRONIC DESIGN WORKSHOP

ECP-366

L T P

0 0 4

Total Credits: 2

Internal Marks: 10

External Marks: 20

Total Marks: 50

### Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

### Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Design, implement and test the prototype/algorithm in order to solve the conceived problem.
3. Write comprehensive report on mini project work.

A handwritten signature in blue ink is written over a purple rectangular stamp. The stamp contains the text "INCHARGE, DEPARTMENT OF ECE" in capital letters. To the right of the stamp, there are additional handwritten marks, including a checkmark and some illegible characters.



**Department of Electronics and Communication Engineering**  
**Bhagat Phool Singh Mahila Vishwavidyalaya,**  
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**Scheme of studies & Examinations of B. Tech (Electronics and Communication Engineering) 4<sup>th</sup> Year (Semester 7) Choice Based Credit Scheme w.e.f (2020-21).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	*	Program Elective-3	3	1	0	3	20	80	100
2.	**	Program Elective-4	3	1	0	3	20	80	100
3.	***	Program Elective-5	3	0	0	3	20	80	100
4.	****	Open Elective-3	3	0	0	3	20	80	100
Labs									
5.	ECL-407	Optical Communication System	4	0	0	4	20	80	100
6.	ECP-471	Project Stage-I	0	0	8	4	20	80	100
7.	IPT-471	Industrial Practical Training-II	0	0	0	1	100	0	0
Total			16	2	8	21	220	480	700

**Total Contact Hours = 26**

**Student will be opt program elective-3 and program elective-4 subjects as given:**

<b>*Program Elective-3</b>		<b>**Program Elective-4</b>	
Subject Code	Subject	Subject Code	Subject
ECL-471-A	Microwave Theory and Techniques	ECL-472-A	Antennas and Propagation
ECL-471-B	Fiber Optic Communications	ECL-472-B	Mobile Communication and Networks
ECL-471-C	Adaptive Signal Processing	ECL-472-C	Digital Image & Video Processing

**Student will be opt program elective-5 and open elective-4 subjects as given:**

<b>***Program Elective-5</b>		<b>****Open Elective-3</b>	
Subject Code	Subject	Subject Code	Subject
ECL-473-A	Mixed Signal Design	OEL-471-A	Optimization Techniques
ECL-473-B	Wireless Sensor Networks	OEL-471-B	Programming Using Python
ECL-473-C	Satellite Communication	OEL-471-C	Biomedical Instrumentation
ECL-473-D	Robotics and Automation	OEL-471-D	Renewable Energy Sources

**Note: Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.**

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Dr. NKA NAND  
INCHARGE, DEPARTMENT OF E.C.E.

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## OPTICAL COMMUNICATION SYSTEM

OEL-407

L T P

3 0 0

Total Credits: 4

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

To provides the basic theory of optical fibres and principle of various components in optical communication system, and to introduce the students to various optical fiber modes, optical sources and optical detectors and their use in the optical communication system.

### UNIT1

**Introduction:** Electromagnetic spectrum for optical communication, block diagram of optical communication system, basics of transmission of light rays, Advantages of fiber communication.

**Optical Fibers:** Optical laws and definitions, Optical fibers: structures, types, optical fiber modes and configurations, mode theory, single mode and graded index fibers, fiber materials, optical fibers fabrication.

### UNIT 2

**Signal Degradation in Optical Fibers:** Signal distortion in optical fibers-attenuation, absorption, scattering and bending losses, Core and cladding losses, pulse broadening in graded index fiber, mode coupling attenuation, fiber bend loss, dispersion; fiber couplers and connectors.

**Optical Sources:** LEDs-structures, materials, figure of merits, characteristics & modulation, Laser Diodes-modes & threshold conditions, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, modulation of laser diodes, temperature effects, light source linearity, Power modulation, power bandwidth product, Injection Laser Diodes- modes, threshold conditions, external quantum efficiency, reliability of LED & ILD.

### UNIT 3

**Optical Detectors:** Principles of optical detection, quantum efficiency, responsivity, general principles of PIN photodetector, intrinsic absorption, materials and designs for PIN photodiodes, impulse and frequency response of PIN photodiodes, noise in PIN Photodiodes, multiplication process, APD Design, APD bandwidth, APD noise.

**Optical System Design:** Considerations, component choice, multiplexing, point-to-point links, system considerations, link power budget with examples, overall fiber dispersion in multi mode and Single mode fibers, Rise time budget with examples.

### UNIT 4.

**WDM Concepts & Components:** Principles of WDM, Necessity, types of WDM, passive optical components, Tunable sources and filters, attenuation and dispersion.

**Advances in Optical Fiber Systems:** Telecommunications & broadband application, SONET/SDH, MUX, Analog & Digital broadband, EDFA, optical switching.

**Fiber Optical Measurements:** Test equipments, Measurement of attenuation, Dispersion, NA, EYE pattern Technique.

### TEXT BOOK:

1. John M Senior, Optical Fiber Communications, PHI.
2. John Gower, Optical Communication Systems, PHI.

### REFERENCE BOOKS:

1. Gerd Keiser, Optical Fiber Communications, TMH.
2. Selvarajan, Kar, Srinivas, Optical fiber Communication, TMH.

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**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

  
**DR. PRIYANKA ANAND**  
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## MICROWAVE THEORY AND TECHNIQUES

ECL-471-A

L T P

3 1 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course Objective:

The objective of this course is to learn:

1. Radio-frequency spectrum space, microwave communication.
2. Microwave principles, working of microwave devices.
3. RADAR and their applications.

### UNIT I

Introduction to Microwaves-History of Microwaves, Microwave Frequency bands: Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.

Mathematical Model of Microwave Transmission-Concept of Mode. Features of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission. Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Micro strip line.

### UNIT-II

Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters. Passive and Active Microwave Devices- Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers, Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

### UNIT-III

Microwave Design Principles- Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas- Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.

Microwave Measurements- Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.

UNIT-IV Microwave Systems- Radar, Terrestrial and Satellite Communication. Radio Aidsto Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

### Text/Reference Books:

1. R.E. Collins, Microwave Circuits, McGraw Hill
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

### Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand various microwave system components their properties.
2. Appreciate that during analysis/ synthesis of microwave systems, the different mathematical treatment is required compared to general circuit analysis.
3. Design microwave systems for different practical application.

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**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## FIBER OPTIC COMMUNICATION

ECL-471- B

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3 1 0

Total Credits: 3

External Marks: 80

Internal Marks: 20

Total Marks: 100

### Course Objective:

The objective of this course is to learn:

1. Optical fiber structures wave guide, fabrication and signal degradation in fiber.
2. The characteristics of optical sources and detectors.
3. Link budget and optical networks, design and management.
4. Study the multiplexing schemes

### UNIT-I

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

Different types of optical fibers, Modal analysis of a step index fiber.

Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

### UNIT-II

Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

### UNIT-III

Optical switches - coupled mode analysis of directional couplers, electro-optic switches, Optical amplifiers - EDFA, Raman amplifier.

### UNIT-IV

WDM and DWDM systems. Principles of WDM networks. Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and soliton based communication.

### Text/Reference Books

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
3. J. Gower, Optical communication systems, Prentice Hall India, 1987.
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.
5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997
7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

### Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the principles fiber-optic communication, the components and the bandwidth advantages.
2. Understand the properties of the optical fibers and optical components.
3. Understand operation of lasers, LEDs, and detectors
4. Analyze system performance of optical communication systems
5. Design optical networks and understand non-linear effects in optical fiber

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**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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Total Marks: 100

This course focuses on problems algorithms and solutions for processing signals in an manner that is responsive to a changing environment Adaptive signal processing systems are developed which take advantage of the statistical properties of the received signals The course analyzes the performance of adaptive filters and considers the application of the theory to a variety of practical problems such as interference and echo cancellation signal and system identification.

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment

**Unit-III** Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

**Text/Reference Books:**

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C. Widrow and S. D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

At the end of the course, students will demonstrate the ability to:

1. Understand the non-linear control and the need and significance of changing the control parameters w.r.t. real-time situation.
2. Mathematically represent the 'adaptability requirement'
3. Understand the mathematical treatment for the modeling and design of the signal Processing systems.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## ANTENNAS AND PROPAGATION

ECL-472-A

L T P

3 1 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

Students will be introduced to antennas, their principle of operation, Antenna analysis and their applications.

### UNIT-I

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions. Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

### UNIT-II

Aperture and Reflector Antennas- Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

### UNIT-III

Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas. Antenna Arrays- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method. Woodward-Lawson method

### UNIT-IV

Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming.

Different modes of Radio Wave propagation used in current practice.

### Text/Reference Books:

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## MOBILE COMMUNICATION AND NETWORKS

ECL-472-B

L T P

3 1 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

To study the concept of Mobile radio propagation, cellular system design. 2. To understand mobile technologies like GSM and CDMA. 3. To know the mobile communication evolution.

### UNIT-I

Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

Signal propagation-Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.

### UNIT-II

Capacity of flat and frequency selective channels. Antennas- Antennas for mobile terminal- monopole antennas, PIFA, base station antennas and arrays.

Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

### UNIT-III

Receiver structure- Diversity receivers- selection and MRC receivers. RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Alamouti scheme.

### UNIT-IV

MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

### Text/Reference Books:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill. 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall. 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York. 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley. 1995.
5. VK Garg & JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall. 1996.

### Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the working principles of the mobile communication systems.
2. Understand the relation between the user features and underlying technology.
3. Analyze mobile communication systems for improved performance

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## DIGITAL IMAGE & VIDEO PROCESSING

ECL-472-C

L T P

3 1 0

**Course Objective:**

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

1. To cover the fundamentals and mathematical models in digital image and video processing.
2. To develop time and frequency domain techniques for image enhancement.
3. To expose the students to current technologies and issues in image and video processing.
4. To develop image and video processing applications in practice.

### Unit-I

Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

Image Enhancements and Filtering-Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain

### Unit-II

Sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Color Image Processing-Color models-RGB, YUV, HSI; Color transformations- formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

### Unit-III

Image Segmentation- Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Wavelets and Multi-resolution image processing- Uncertainty principles of Fourier Transform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Subband filter banks, wavelet packets.

### Unit-IV

Image Compression-Redundancy-inter-pixel and psycho-visual: Lossless compression predictive, entropy; Lossy compression- predictive and transform coding: Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

### Text/Reference Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India, 2nd edition 2004
3. Murat Tekalp, Digital Video Processing" Prentice Hall, 2nd edition 2015

### Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Mathematically represent the various types of images and analyze them.
2. Process these images for the enhancement of certain properties or for optimized use of the resources.
3. Develop algorithms for image compression and coding

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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**Course objective:**

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform. Switched-capacitor filters- Non idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

Introduction to frequency synthesizers and synchronization: Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi, Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.
4. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
6. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
7. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

At the end of the course, students will demonstrate the ability to:

1. Understand the practical situations where mixed signal analysis is required.
2. Analyze and handle the inter-conversions between signals.
3. Design systems involving mixed signals

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## WIRELESS SENSOR NETWORKS

ECL-473-B

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course objective:

This course deals with the comprehensive knowledge about wireless sensor networks. It provides an insight into different layers and their design considerations. A thorough knowledge of infrastructure establishment and sensor network platform is provided.

### UNIT-I

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

### UNIT-II

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks. Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks. Routing protocols. MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol. IEEE 802.15.4 standard and ZigBee,

### UNIT-III

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols. Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

### UNIT-IV

Single-node architecture, Hardware components & design constraints. Operating systems and execution environments, introduction to TinyOS and nesC.

### Text/Reference Books:

1. Waltenegus Dargie, Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications.2011
2. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks". Elsevier Publications.2004
4. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science
5. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press 2009

### Course Outcomes:

At the end of the course the students will be able to

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## SATELLITE COMMUNICATION

ECL-473-C

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

1. To give the idea and basic knowledge of satellite Communication Systems, to familiarize the students with the Earth Station Technology i.e design of Earth Station, antennas, Tracking, satellite Packet Communications.
2. To give the idea about the GPS orbits and satellite position determination and to teach the students about the Very small Aperture Terminal Networks.

### Unit-I

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication. Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

### Unit-II

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc. Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

Satellite link budget

### Unit-III

Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

### Unit-IV

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

### Text /Reference Books:

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India, 2nd edition 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill, 2009.

### Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
2. State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
3. Solve numerical problems related to orbital motion and design of link budget for the given

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parameters and conditions.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## ROBOTICS AND AUTOMATION

ECL-473-D

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objectives:

This course introduces students to engineering and technology with a focus on robotics and automation through programming.

### UNIT-I

Introduction History of robots, Classification of robots, Present status and future trends, Basic components of robotic system. Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom. Mechanisms and transmission, End effectors, Grippers-different methods of gripping, Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, Cam type gripper, Magnetic grippers, Vacuum grippers, Air operated grippers; Specifications of robot.

### UNIT-II

Drive systems and Sensors Drive system- hydraulic, pneumatic and electric systems Sensors in robot – Touch sensors, Tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.

### UNIT-III

Kinematics and Dynamics of Robots 2D, 3D Transformation, Scaling, Rotation, Translation, Homogeneous coordinates, multiple transformation, Simple problems, Matrix representation, Forward and Reverse Kinematics of Three Degree of Freedom, Homogeneous Transformations, Inverse kinematics of Robot, Robot Arm dynamics,

### UNIT-IV

Introduction to Robotic Programming, On-line and off-line programming, programming examples.

### Text Books:

1. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta. "Industrial Robotics, Technology programming and Applications". McGraw Hill, 2012.
2. Craig, J. J. "Introduction to Robotics- mechanics and control", Addison- Wesley, 1999.

### Reference Books:

1. S.R. Deb, "Robotics Technology and flexible automation", Tata McGraw-Hill Education., 2009.
2. Richard D. Klafter, Thomas .A, ChriElewski, Michael Negin. "Robotics Engineering an Integrated Approach", PHI Learning., 2009.
3. Francis N. Nagy, Andras Siegler, "Engineering foundation of Robotics", Prentice Hall Inc., 1987.

### Course Outcome:

- 1 This course brings in students to engineering and technology exposes hands on on robotics and automation through programming.

**NOTE:** Nine questions will be set in all by the examiners taking two questions from each unit. Students will be required to attempt five questions in all selecting at least one question from each unit. Question No. 1 must compulsory and covers whole syllabus with

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short questions from each unit.

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## OPTIMIZATION TECHNIQUES

OEL-471-A

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

1. To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.
2. To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology.
3. To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

### UNIT – I

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

### UNIT-II

Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

### UNIT – III

Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm. Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

### UNIT – IV

Unconstrained Nonlinear Programming: One dimensional minimization methods. Classification, Fibonacci method and Quadratic interpolation method Unconstrained Optimization Techniques: Univariate method, Powell's method and steepest descent method.

### TEXT BOOKS:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons. 4th edition, 2009.
2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004
3. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.
4. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall. 2007.
5. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples". PHI Learning Pvt. Ltd, New Delhi, 2005.

### Course Objectives:

1. To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm; dynamic programming
2. Constrained and unconstrained optimization techniques for solving and optimizing an electrical and electronic engineering circuits design problems in real world situations.
3. To explain the concept of Dynamic programming and its applications to project implementation.

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**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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# PROGRAMMING USING PYTHON

L T P

**Course Objective:**

Internal Marks: 20

External Marks: 80

Total Marks: 100

1. To Learn Syntax and Semantics and create Functions in Python.
2. To Handle Strings and Files in Python.
3. To Understand Lists, Dictionaries in Python.

The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation; Strings and text files; manipulating files and directories. os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tabseparated); String manipulations: subscript operator, indexing, slicing a string.

Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries; Design with functions: hiding redundancy, complexity; arguments and return values; formal vs. actual arguments, named arguments.

Simple Graphics and Image Processing: "turtle" module; simple 2d drawing - colors, shapes; digital images, image file formats, image processing: Simple image manipulations with 'image' module (convert to bw, greyscale, blur, etc). Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects; inheritance, polymorphism, operator overloading (`_eq_`, `_str_`, etc); abstract classes; exception handling, try block

Graphical user interfaces; event-driven programming paradigm; tkinter module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames. Reference Books:

1. T.R. Padmanabhan, Programming with Python, Springer, 1st Ed., 2016.
2. Kenneth Lambert, Fundamentals of Python: First Programs, Cengage Learning., 1st Ed., 2012.

**Course outcomes:**

1. Write python programs that solve simple business problems.
2. Create python applications that are robust and multithreaded.
3. Write simple GUI interfaces for a program to interact with users, and to understand the event-based.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## BIOMEDICAL INSTRUMENTATION

OEL-471-C

L T P

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Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

The basic objective of this course is to provide the fundamental knowledge of Bio-medical Instrumentation, the science associated with the measurement of biological variables such as pressure, temperature etc related to human body, the complexities associated with the measurement of the biological parameters and the care that are to be taken for the measurement since it is concerned with human life.

### UNIT-I

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals – Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow – Biomechanics of bone – Biomechanics of soft tissues – Basic mechanics of spinal column and limbs Physiological signals and transducers – Transducers – selection criteria – Piezo electric, ultrasonic transducers – Temperature measurements – Fibre optic temperature sensors.

### UNIT II

Measurement of blood pressure – Cardiac output – Heart rate – Heart sound – Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO<sub>2</sub>, pO<sub>2</sub>, finger-tip oxymeter – ESR, GSR measurements.

### UNIT-III

Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes – Micro, needle and surface electrodes

### UNIT-IV

Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier – ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms – Electrical safety in medical environment, shock hazards – leakage current Instruments for checking safety parameters of biomedical equipments.

### TEXT BOOKS:

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
2. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th Edition, 2012.
3. Khandpur R.S, Handbook of Biomedical Instrumentation, , Tata McGraw-Hill, New Delhi, 2nd Edition, 2003.
4. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
5. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
6. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
7. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
8. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

### Course Outcomes:

Ability to understand and analyze Instrumentation systems and their applications to various industries.

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**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## RENEWABLE ENERGY SOURCES

L T P

**Course Objective:**

Total Credits: 3  
Internal Marks: 20  
External Marks: 80  
Total Marks: 100

To familiarize the students about the fundamental concepts, advantages of using renewable energy sources, various renewable energy technologies, general power scenario and some recent technological development.

## UNIT I

**Introduction:** Basics of energy, conventional energy sources, fossil fuels limitations, renewable energy sources, advantages and limitations, global energy scenario, energy scenario of India. Recent technological development.

## UNIT II

**Solar Energy:** Theory of solar cells, solar cell materials, I-V characteristics of solar cell, PV module and PV array, MPPT, PV systems, Stand alone and grid connected PV systems, applications, solar radiation, flat plate collectors and their materials, applications and performance, solar thermal power plants.

### UNIT III

**Wind Energy:** Wind power and its sources, Types of wind power plants, Types of wind turbine generator units, Site selection, Merits and demerits of wind power generation.

**Biomass Energy:** Availability of bio-mass and its conversion theory.

**Thermo-electrical and thermionic Conversions:** Working, Performance and limitations.

## UNIT-IV

**Various types of energy sources:** Overview and application of hydro, geothermal energy, Ocean Wave and Tidal Wave energy

**Energy Management system:** Energy Management system, Energy Audit, Energy crises, Energy planning, Energy exploited and energy demand, Energy demand management.

**Text/References Books:**

1. Raja et al, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. B.H Khan, "Non-Conventional Energy Resources" Tata McGraw-Hill Education.
3. H.P. Garg & Jai Prakash "Solar Energy: Fundamentals and Applications" , Tata McGraw Hill
4. D.S. Chauhan, "Non-Conventional Energy Resources", New Age International.
5. S.Hasan Saeed and D.K.Sharma, "Non- Conventional Energy Resources" S.K.Kataria & Sons.
6. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.
7. Peter Auer, "Advances in Energy System and Technology". Vol. I & II Edited by Academic Press.
8. G. D. Rai, Non Conventional Energy Resources, Dhanpat Rai, India. 2006
9. D. P. Kothari, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies. PHI. India.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## PROJECT STAGE -I

ECP-471

L T P

0 0 8

Total Credits: 4

External Marks: 80

Internal Marks: 20

Total Marks: 100

The object of Project stage- I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;

**Final Seminar, as oral Presentation before a departmental committee**

  
  
Dr. P. S. INKAVAND  
IN-CHARGE, DEPARTMENT OF ECE.


## INDUSTRIAL PRACTICAL TRAINING-II

IPT-471

L T P

0 0 2

Total Credits: 1  
External Marks: 80  
Internal Marks: 20  
Total Marks: 100

### PURPOSE

To expose the students to the industrial working environment and make them for industry ready.

### IMPLEMENTATION

At the end of 6<sup>th</sup> semester each student would undergo four weeks Professional Training-II (Industrial Practical Training-II) in an Industry/Institute/Professional Organization/Research Laboratory/In-house electronics workshop/PCB making and assembling/use of CAD software/design and simulation tool etc during summer vacation after sixth semester with the prior approval of the Training and Placement Officer of the University. Each student in the Department submits a typed report along with a certificate from the organization. The typed report should be in a prescribed format.

The report will be evaluated in the VII Semester by a Committee consisting of three teachers from different specialization to be constituted by the Chairperson of the Department. The Internal assessment will be effected by the following committee of three persons:

Training and Placement Officer of the Department: Convener

Two faculties from the deptt: Member

The basis of evaluation will primarily be the knowledge and exposure of the student towards different processes and the functioning of the organization. The student will interact with the committee through presentation to demonstrate his/her learning.

  
  
Dr. POTYANKA  
INCHARGE, DEPART



**Department of Electronics and Communication Engineering**  
**Bhagat Phool Singh Mahila Vishwavidyalaya,**  
**Khanpur Kalan (Sonepat), Haryana-131305**

Office No. 01263-283124, [www.bpswomenuniversity.ac.in](http://www.bpswomenuniversity.ac.in)

**Scheme of studies & Examinations of B. Tech (Electronics and Communication Engineering) 4<sup>th</sup> Year (Semester 8) Choice Based Credit Scheme w.e.f (2020-21).**

S. No.	Code	Course Title	Hrs/Week			Total Credits	Internal Marks	External Marks	Total Marks
			L	T	P				
Subjects									
1.	*	Program Elective-6	3	0	0	3	20	80	100
2.	**	Program Elective-7	3	0	0	3	20	80	100
3.	***	Open Elective-4	3	0	0	3	20	80	100
4.	****	Open Elective-5	3	0	0	3	20	80	100
Labs									
5.	ECP-481	Project Stage-II	0	0	16	6	20	80	100
6.	IHT-482	In House Training	0	0	2	1	100	0	0
Total			12	0	18	19	200	400	600

**Total Contact Hours = 30**

**Student will be opt Program Elective-3 and Program Elective-4 subjects as given:**

<b>*Program Elective-6</b>		<b>**Program Elective-7</b>	
Subject Code	Subject	Subject Code	Subject
ECL-481-A	High speed electronics	ECL-482-A	Embedded systems
ECL-481-B	CAD-for VLSI Circuits	ECL-482-B	Error correcting codes
ECL-481-C	Audio Video Processing	ECL-482-C	Industrial electronics
ECL-481-D	Biomedical signal processing	ECL-482-D	Operation Research

**Student will be opt Open Elective-4 and Open Elective-5 subjects as given:**

<b>***Open Elective-4</b>		<b>**** Open Elective-5</b>	
+Subject Code	Subject	Subject Code	Subject
OEL-481-A	Internet of Things	OEL-482-A	Web Designing
OEL-481-B	Soft Computing	OEL-482-B	Research Methodology and IPR
OEL-481-C	Mobile Application Development	OEL-482-C	Waste to Energy
OEL-481-D	Intelligent Instrumentation for Engineering	OEL-482-D	Solar Photovoltaic System And Technology

**Note: Minimum passing marks for any subject (paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.**

**Dr. P. K. SINGH**  
**INCHARGE, DEPARTMENT OF ECE**

## HIGH SPEED ELECTRONICS

ECL-481-A

L T P

3 0 0

**Course Objective:**

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

1. Understand significance and the areas of application of high-speed electronics circuits.
2. Understand the properties of various components used in high speed electronics
3. Design High-speed electronic system using appropriate components.

**Unit-I** Transmission line theory (basics) crosstalk and nonideal effects; signal integrity; impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency powerdelivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise; Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion, Inter modulation, Cross-modulation, Dynamic range

### Unit-II

Devices: Passive and active, Lumped passive devices (models), Active (models, low vs high frequency)

### Unit-III

RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations. Cross-over distortion Efficiency RF power output stages

Mixers –Upconversion Downconversion, Conversion gain and spurious response. Oscillators Principles.PLL Transceiver architectures

### Unit-IV

Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology. Process Control and Design challenges.

### Text/Reference Books:

1. Stephen H. Hall, Garrett W. Hall, James A. McCall “ High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices”, August 2000, Wiley-IEEE Press
2. Thomas H. Lee, “The Design of CMOS Radio-Frequency Integrated Circuits”, Cambridge University Press, 2004, ISBN 0521835399.
3. Behzad Razavi, “RF Microelectronics”, Prentice-Hall 1998, ISBN 0-13-887571-5.
4. Guillermo Gonzalez, “Microwave Transistor Amplifiers”, 2nd Edition, Prentice Hall

### Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand significance and the areas of application of high-speed electronics circuits.
2. Understand the properties of various components used in high speed electronics
3. Design High-speed electronic system using appropriate components.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

DR. P. V. ANAND  
IN-CHARGE, DEPARTMENT OF ECE.

SV K J. Jeyaraj

## CAD and VLSI Circuits

ECL-481-B

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 20

Total Marks: 100

### Course Objective:

#### UNIT I VLSI DESIGN METHODOLOGIES

Introduction to VLSI Design methodologies - Review of Data structures and algorithms - Review of VLSI Design automation tools - Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable problems - general purpose methods for combinatorial optimization.

#### UNIT II DESIGN RULES

Layout Compaction - Design rules - problem formulation - algorithms for constraint graph compaction - placement and partitioning - Circuit representation - Placement algorithms - partitioning

#### UNIT III FLOOR PLANNING

Floor planning concepts - shape functions and floorplan sizing - Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing, Simulation - Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis.

#### UNIT IV MODELING AND SYNTHESIS

High level Synthesis - Hardware models - Internal representation - Allocation - assignment and scheduling - Simple scheduling algorithm - Assignment problem - High level transformations.

#### REFERENCES BOOKS

1. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002.

#### TEXT BOOKS

1. Stephen Trimberger, "Introduction to CAD for VLSI", Kluwer Academic publisher, 2002
2. Naveed Shervani, "Algorithms for VLSI physical design Automation", Kluwer Academic Publisher, Second edition

#### Course Objectives:

- To study various physical design methods in VLSI.
- To understand the concepts behind the VLSI design rules and routing techniques.
- To use the simulation techniques at various levels in VLSI design flow
- To understand the concepts of various algorithms used for floor planning placement and routing techniques.

**NOTE:** Nine questions will be set in all by the examiners taking two questions from each unit. Students will be required to attempt five questions in all selecting at least one question from each unit. Question No. 1 must compulsory and covers whole syllabus with short questions from each unit.

See  
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IN CHARGE, DEPARTMENT OF ECE  
K. S. Jayaraman

## BIOMEDICAL SIGNAL PROCESSING

ECL-481-D

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

The objective of this course is to educate the students in the application of signal processing methods to biomedical systems. Signal processing concepts are introduced using real-life biomedical examples. Another objective is to teach the students how to use a computer workstation as part of a measurement/signal-processing system.

### UNIT-I

**Introduction:** Importance of Computer in Signal Processing, Basic Electrocardiography lead system, ECG Signal Characteristic, Single Sampling, Signal Conversion.

**Digital Filter:** Z-transform, elements of digital filters, Type of digital filters, Transfer function of a difference equation Z-plane pole-zero plots.

**IIR Filters:** Generic Equations, One pole and two pole filters integrators.

### UNIT-II:

**Integer Filters:** Basic Design Concept, Low Pass, High Pass, Band Pass, Band reject filters. Effect of cascading of filters, fast operating design techniques.

**Adaptive Filters:** Principal noise canceller model, GO Hz, Adaptive Canceling, Applications.

### UNIT-III:

**Signal Averaging:** Signal averaging as a digital filter, a typical averager, Software for single averaging, limitations, Data Reduction Techniques-Turing point Algorithm, AZTEC Algorithm, Fan Algorithm, Huffman coding, Fourier Transform, Correlation, Convolution, Power Spectrum Estimation.

### UNIT-IV

**ECG-QRS Detection:** Power Spectrum of ECG, Band Pass Filtering Techniques, Differentiation Techniques, Template Matching, QRS Detection Algorithm.

**ECG Analysis System:** ECG Interpretation, ST Segment Analyzer, Portable Arrhythmia Monitor.

### TEXT/REFERENCE BOOKS:

1. WJ.Tompkin, Biomedical Signal processing, PHI
2. JG. Prokis, Digital Signal processing, PHI
3. Salivahanan, Digital Signal Processing, Tata Mc-Graw Hill.

**Course Outcomes:** The outcome of this course at end is to educate the students in the application of signal processing methods to biomedical systems. Signal processing concepts are introduced using real-life biomedical examples.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Dr. PRANANKA ANAND  
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## AUDIO VIDEO PROCESSING

ECL-481-C

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

1. To understand about basic fundamentals of audio and video processing.
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.

### UNIT I

Basics of Television: Scanning process, Composite Video Signal, Horizontal Blank and Sync standard, Vertical Blank and Sync standard, Vestigial Sideband Transmission, TV Channels and Bands, CCIR-B standards, Negative modulation, Inter-carrier Sound System. Construction & working principle of CCD camera, software defined radio.

### UNIT II

TV Transmission and Reception: High Level modulated TV Transmitter, IF modulated TV Transmitter, Transmitting Antenna, Receiving Yagi Antenna, Block Diagram of Monochrome TV Receiver, Pattern Generator, Wobbuloscope. Basic satellite theory (Transponder). Cathode Ray Tube of CRO.

### Unit III

Color TV Systems: Color fundamentals, mixing of colors, Color perception, Color Characteristics, Chromaticity diagram, Color TV camera, Frequency Interleaving Principle, Color Bandwidth, Chroma Signal Generation, Color Burst, Simple PAL & PAL-D System

### UNIT IV

Digital Television: Merits of DTV, Digitization formats, Source Coding : Compression of Video Signal (JPEG&MPEG), Scrambling and Conditional Access, Channel Coding, Modulation by Digital Signal, Reception of Digital TV Signal, Digital TV Receiver block diagram, LCD and Plasma Displays, Types of digital TV (SDTV, EDTV, HDTV), DTH system.

### Text Books

1. R.R.Gulathi, "Monochrome & color television", New Age International.
2. Herve Benoit, "Digital Television", Focal Press.

Reference Books 1. Bernard Grobb & Charles E., "Basic TV and Video Systems". McGraw Hill.

2. Ranjan Parekh, "Principles of multimedia", Tata Mc-GrawHill
3. R.G. Gupta, "Audio Video Systems", Technical Education.

### Course Outcomes:

1. Explain the working of a TV receiver.
2. Describe transmission & reception of a TV signal.
3. Compare between analog & digital TV.
4. Interpret compression techniques used in digital TV.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

## EMBEDDED SYSTEMS

L T P

**Course Objectives:**

Internal Marks: 20

Total Marks: 100

## UNIT I

**General Purpose Processors:** Basic architecture, operation, Pipelining, Programmer's view, development environment, Application Specific Instruction-Set Processors (ASIPs)-Micro Controllers and Digital Signal Processors.

**State Machine And Concurrent Process Models:** Introduction, models Vs. languages, finite state machines with data path model (FSMD), using state machines, program state machine model (PSM), concurrent process model, concurrent processes, communication among processes, synchronization among processes, implementation, data flow model, real-time systems.

### UNIT 3

## Embedded/RTOS Concepts—II: Mailboxes, Message Queues, Event Registers, Pipes, Signals.

**Embedded/RTOS Concepts–III:** Timers, Memory Management, Priority inversion problem. Embedded operating systems Embedded Linux, Real-time operating systems. RT Linux. Handheld operating systems, Windows CE.

**TEXT BOOKS:**

- ### REFERENCES:

- NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## ERROR CORRECTING CODES

ECL-482-B

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

The Objective of this is to study various error detecting and error correction coding techniques and algorithm.

### Unit-I

Linear block codes: Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the McWilliams identities; Perfect codes.

### Unit-II

Introduction to finite fields and finite rings; factorization of  $(X^n-1)$  over a finite field; Cyclic Codes. BCH codes; Idempotents and Mattson-Solomon polynomials; Reed-Solomon codes. Justen codes, MDS codes, Alterant, Goppa and generalized BCH codes; Spectral properties of cyclic codes. ;

### Unit-III

Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp - Massey algorithm. Convolution codes; Wozencraft's sequential decoding algorithm.

### Unit-IV

Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm.

### Text/Reference Books:

1. F.J. McWilliams and N.J.A. Sloane, The theory of error correcting codes, 1977.
2. R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.
1. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
2. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw Hill, 1984.
3. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
4. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
5. R.E. Crompton, Adaptive Antennas, John Wiley

### Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the properties and various types of antennas.
2. Analyze the properties of different types of antennas and their design.
3. Operate antenna design software tools and come up with the design of the antenna of

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

  
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IN-CHARGE, DEPARTMENT OF ECE

## INDUSTRIAL ELECTRONICS

ECL-482-C

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

To understand the:

1. Construction and working of different semiconductor switches and their selection based on the application need.
2. To analyze various triggering circuits used for different semiconductor switches and their comparative study
3. Acquire knowledge of various power electronic converter for real time application like rectifier, ac voltage controller etc.

### UNIT1

**INTRODUCTION:** Role of power electronics, review of construction and characteristics of power diode, Schottky diode, power transistor, power MOSFET, SCR, DIAC, TRIAC, GTO, IGBT & SIT.

### UNIT 2.

**SCR:** Ratings and protections, series and parallel connections, R, RC and UJT firing circuit and other firing circuits based on ICs and microprocessors; pulse transformer and opto-coupler, commutation techniques.

### UNIT3.

**AC REGULATORS:** Types of regulator, equation of load current, calculation of extinction angle, output voltage equation, harmonics in load voltage and synchronous tap changer, three phase regulator.

### UNIT4.

**INVERTERS:** Basic circuit, 120 degree mode and 180 degree mode conduction schemes, modified McMurray half bridge and full bridge inverters, McMurray -Bedford half bridge and bridge inverters, brief description of parallel and series inverters, current source inverter (CSI), transistor and MOSFET based inverters.

### TEXT BOOK:

1. Power Electronics: MH Rashid; PHI

### REFERENCE BOOKS:

1. Power Electronics: PC Sen; TMH
2. Power Electronics: HC Rai; Galgotia
3. Thyristorised Power Controllers: GK Dubey, PHI
4. Power Electronics and Introduction to Drives: A.K.Gupta and L.P.Singh;Dhanpat Rai
5. Power Electronics: P.S Bhimra.

**Course Outcomes:** At the end of course students will be proficient and familiar to power electronics devices with applications.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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IN-CHARGE, DEPARTMENT OF ECE

## Operations Research

ECL-482-D

L T P

3 - -

Total Credits: 3

External Marks: 80

Total Marks: 100

Internal Marks: 20

### Unit 1:

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

### Unit 2

Formulation of a LPP - Graphical solution revised simplex method - duality theory -- dual simplex method - sensitivity analysis - parametric programming

### Unit 3:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem – max flow problem - CPM/PERT

### Unit 4

Scheduling and sequencing - single server and multiple server models – deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

### Unit 5

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

### References:

- (1) H.A. Taha, Operations Research, An Introduction, PHI, 2008
- (2) H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
- (3) J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
- (4) Hitler Libermann Operations Research: McGraw Hill Pub. 2009
- (5) Pannerselvam, Operations Research: Prentice Hall of India 2010
- (6) Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

### Course Outcomes:

At the end of the course, the student should be able to

1. Students should be able to apply the dynamic programming to solve problems of discrete  
a. and continuous variables.
2. Students should be able to apply the concept of non-linear programming

**NOTE:** Nine questions will be set in all by the examiners taking two questions from each unit. Students will be required to attempt five questions in all selecting at least one question from each unit. Question No. 1 must be compulsory and covers whole syllabus with short questions from each unit.

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*Se* *Vijay*

## INTERNET OF THINGS

OEL-481-A

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.

### UNIT I

Smart cities and IoT revolution, Fractal cities, From IT to IoT, M2M and peer networking concepts, Ipv4 and IPV6.

Software Defined Networks SDN, From Cloud to Fog and MIST networking for IoT communications, Principles of Edge/P2P networking, Protocols to support IoT communications, modular design and abstraction, security and privacy in fog.

### UNIT II

Wireless sensor networks: introduction, IOT networks (PAN, LAN and WAN), Edge resource pooling and caching, client side control and configuration.

Smart objects as building blocks for IoT, Open source hardware and Embedded systems platforms for IoT, Edge/gateway, IO drivers, C Programming, multithreading concepts.

### UNIT III

Operating systems requirement of IoT environment, study of mbed, RIOT, and Contiki operating systems, Introductory concepts of big data for IoT applications.

### UNIT IV

Applications of IoT, Connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT, Security and legal considerations, IT Act 2000 and scope for IoT legislation.

### References:

1. A Bahaga, V. Madiseti, "Internet of Things- Hands on approach", VPT publisher, 2014.
2. A. McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.
3. CunoPfister, "Getting started with Internet of Things", Maker Media, 1st edition, 2011.
4. Samuel Greenguard, "Internet of things", MIT Press, 2015.

### Web resources :

1. <http://www.datamation.com/open-source/35-open-source-tools-for-the-internet-of-things1.html>
2. <https://developer.mbed.org/handbook/AnalogIn>
3. [http://www.libelium.com/50\\_sensor\\_applications/](http://www.libelium.com/50_sensor_applications/)
4. M2MLabs Mainspring <http://www.m2mlabs.com/framework>

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Dr. ANITA K. INAND  
IN-CHARGE, DEPARTMENT OF CEE  
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## SOFT COMPUTING

OEL-481-B

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

The main objective of the Soft Computing Techniques to Improve Data Analysis Solutions is to strengthen the dialogue between the statistics and soft computing research communities in order to cross-pollinate both fields and generate mutual improvement activities. Soft Computing is a consortia of methodologies which collectively provide a body of concepts and techniques for designing intelligent systems.

### UNIT-I

Neural Networks-I (Introduction & Architecture): Neuron. Nerve structure and synapse. Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques: perception and convergence rule, Auto-associative and hetro-associative memory.

### UNIT-II

Neural Networks-II (Back propogation networks): Architecture: perception model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting back propagation training, applications.

### UNIT-III

Fuzzy Logic-I (Introduction): Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets. Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

### UNIT-IV

Fuzzy Logic -II (Fuzzy Membership, Rules) : Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications

### Text/References Books:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks.Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India.
2. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.

### Reference Books:

3. Siman Haykin,"Neural Netowrks"Prentice Hall of India
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
5. Kumar Satish, "Neural Networks" Tata Mc Graw Hill

### Course Outcomes:

1. Motivation and historical background of Soft Computing.
2. Application of Fuzzy logic.
3. Biologically inspired algorithm such as neural networks, genetic algorithms, ant colony

  
**Dr. PRIYANKA ANAND**  
INCHARGE, DEPARTMENT OF E.C.E.

4. Hybrid systems of neural network, genetic algorithms and fuzzy systems optimization, and bee colony optimization.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

  
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## MOBILE APPLICATION DEVELOPMENT

OEL-481-C

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

Course Objective is to quickly get you up to speed with writing apps for Android devices. The student will learn the basics of Android platform and get to understand the application lifecycle.

### UNIT-I

Introduction to mobile devices: Introduction to Mobile Computing, Introduction to Android Development Environment, Mobile devices vs. desktop devices, ARM and intel architectures. Application deployment, App.Store, Google Play, Windows Store, Development environments: XCode, Eclipse, VS2012, PhoneGAP, etc.; Native vs. web applications.

### UNIT-II

Factors in Developing Mobile Applications: Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User; Graphics and Multimedia: Performance and Multithreading, Graphics and UI Performance, Android Graphics, Mobile Agents and Peer-to-Peer Architecture, Android Multimedia.

### UNIT-III

Mobile OS Architectures: Comparing and contrasting architectures of all three – Android, iOS and Windows, Underlying OS, Kernel structure and native level programming. Approaches to power management, Security. Android/iOS/Win 8 Survival and basic apps: Building a simple "Hello World" App in all three applications, App-structure, built-in Controls, file access, basic graphics. Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing.

### UNIT-IV

Advanced Topics: Power Management: Wake locks and assertions, Low-level OS support. Writing power-smart applications. Augmented Reality via GPS and other sensors: GPS, Accelerometer, Camera. Mobile device security, Mobile malware, Device protections. Security and Hacking: Active Transactions. **Reference Books:**

1. Valentino Lee, Heather Schneider, and Robbie Schell, Mobile Applications: Architecture, Design and Development, Prentice Hall, 2004.
2. Tomasz Nurkiewicz and Ben Christensen, Reactive Programming with RxJava, O'Reilly Media, 2016.
3. Brian Fling, Mobile Design and Development, O'Reilly Media, Inc., 2009.

Course outcomes: 1. Understand technology and business trends impacting mobile applications  
2. Be competent with the characterization and architecture of mobile applications and design of mobile applications.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

*Dr. Priyanka Inand*  
Dr. PRIYANKA INAND  
INCHARGE, DEPARTMENT OF E.C.E.

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## INTELLIGENT INSTRUMENTATION FOR ENGINEERING

OEL-471-D

L T P

3 0 0

**Course Objective:**

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

The objective of this course is review the fundamentals and practices of to acquire the basic knowledge of Intelligent Instruments, and It covers design and analysis active filters, PLL, A/D & D/A converter and its use To prepare students to perform the analysis and design of various linear integrated circuits.

### UNIT 1

**Introduction:** Definition of an intelligent instrumentation system; feature of intelligent instrumentation; components of intelligent instrumentation: Block diagram of an intelligent instrumentation.

### UNIT 2

**Interfacing Instruments & Computers:** Basic issue of interfacing; Address decoding; Data transfer control; A/D converter; D/A converter; other interface consideration.

### UNIT 3

**Instrumentation/Computer Networks:** Serial & parallel interfaces; Serial communication lines; Parallel data bus; IEEE 488bus; Local area Networks, Star networks, Ring & Bus networks, Fiber optic distributed networks. Field bus; Communication Protocols for very large systems: communication network rationalization.

### UNIT 4

**Software Filters:** Description of Spike Filter, Low pass filter, High pass filter etc.

### TEXT BOOK:

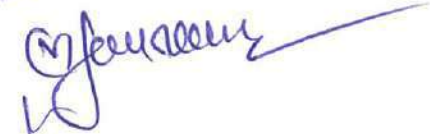
1. Principles of measurement and Instrumentation: Alan S. Morris; PHI

### Course outcome:

1. The outcome of this course is to learn the fundamentals and practices of basic knowledge of Intelligent Instruments
2. It covers design and analysis active filters, PLL, A/D & D/A converter and its use To prepare students to perform the analysis and design of various linear integrated circuits.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

Dr. PANKAJ K. NAND  
INCHARGE, DEPARTMENT OF E.C.E.



## WEB DESIGNING

OEL-482-A

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

The objective of this course to understand basic principles of web site design and design of website adhering to current web standards.

### UNIT-I

Introduction: Brief history of internet, introduction to world wide web, basic principles involved in developing a web site, rules of web designing, web standards, audience requirements, Design concept.

### UNIT-II

Web essentials and standards: Clients, servers, introduction to Markup languages, scripting languages, Introduction to elements of HTML, XHTML and CSS, Introduction to Document object model (DOM), working with text, list, tables, frames, hyperlinks, Images multimedia, forms and controls. CSS properties, Id and Class, Box Model, creating page Layout and Site Designs 3. Javascript Javascript as programming language, Data types, Values, Variables, Expressions and Operators.

### UNIT-III

JavaScript Statements, loops, arrays, strings, methods, Defining and Invoking functions and their closure, random functions and maths library, representing dates. Pattern Matching and Regular Expressions. Javascript in web browsers, difference between server side and client side javascript, embedding javascript in HTML and frameworks, Changing CSS style, hiding HTML elements, showing hidden HTML elements. DOM and event handling, error handling, mouse, text, drag, drop and keyboard events and node operations, Node operations, Cookies, Scripted HTTP, Animation and multimedia Forms of Debugging.

### UNIT-IV

Website Development Tools Google Web Designer, Macaw, Sketch, Firefox, YSlow, Wordpress, openElement etc.

Reference Books: 1. Thomas A Powell, HTML: The Complete Reference, Tata McGraw Hill Publications.

2. Scott Guelich, Shishir Gundavaram, Gunther Birzniek; CGI Programming with Perl 2/e, O'Reilly

3. Doug Tidwell, James Snell, Pavel Kulchenko; Programming Web Services with SOAP, O'Reilly

4. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.

### Course outcomes

1. Understand basic principles of web site design, considering the information architecture.
2. Incorporate best practices in navigation, usability in website design
3. Design of website adhering to current web standards (HTML, XML, CSS)

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## RESEARCH METHODOLOGY AND IPR

OEL-482-B

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

The objective of this course is to familiarize students with basic of research and the research process and to enable the students in conducting research work and formulating research synopsis and to impart knowledge for enabling students to develop data analytics skills and meaningful interpretation to the data sets so as to solve the Research problem.

### Unit-I:

Meaning of research problem, Sources of research problem, characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

### Unit-II:

Effective literature studies approaches, analysis Plagiarism , Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

**Unit-III:** Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT.

### Unit-IV:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology, Patent information and databases, Geographical Indications. Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

### References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
5. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

### Recommended Books:

1. Borg, W and Gall, M. Educational Research: An Introduction, New York, Longman.2003
2. Cohen, L. Educational Research in Classrooms and Schools A Manual of Materials and Methods NY: Harper and Row publishers.2000
3. CPSC: Developing skills in Technician Education Research Modules 1 to 11 Singapore. Colombo Plan Staff College for Technician Education
4. Garrett, HE and Woodworth, RS. Statistics in Psychology and Education, Educational Research, Bombay: Vakils Fetter and Simons Ltd. 2003
5. Gay, LR, Educational Research, Ohio: Charles E. Merrill Publishing Company2000.

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**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## WASTE TO ENERGY

OEL-482-C

L.T.P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

1. To classify solid waste sources
2. To identify methods of solid waste disposal
3. To study various energy generation methods
4. To analyse biogas production methods and recycling of e-waste

**Unit-I:** Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors. Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

**Unit-III:** Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power– Equilibrium and kinetic consideration in gasifier operation.

**Unit-IV:** Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs. Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

**Unit-V:** Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India

### References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

### Course Outcomes:

1. Apply the knowledge about the operations of Waste to Energy Plants.
2. Analyse the various aspects of Waste to Energy Management Systems.
3. Carry out Techno-economic feasibility for Waste to Energy Plants.
4. Apply the knowledge in planning and operations of Waste to Energy plants.

**Note.** There will be nine questions in total from all units. First question is compulsory having five subparts and set from all units. Students will have to attempt any five questions in all selecting at least one question from each unit. Question No.1 is compulsory which is from entire syllabus.

Dr. HETANK ANAND  
IN-CHARGE, DEPARTMENT OF E.C.E.  
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## SOLAR PHOTOVOLTAIC SYSTEM AND TECHNOLOGY

OEL-482-D

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

To learn the fundamentals, design and application of solar photovoltaic systems for power generation on small and large scale electrification.

### UNIT I - Solar Cell Fundamentals

Photovoltaic effect-Principle of direct solar energy conversion into electricity in a solar cell. Semiconductor properties, energy levels, basic equations. Solar cell, p-n junction, structure. PV Module, PV Array.

PV module performance – Equivalent Circuit model of Solar cell, Modeling and Simulation of solar cell, module and array, I-V characteristics of a PV module, maximum power point, cell efficiency, fill factor, effect of irradiation and temperature.

### UNIT II - Manufacturing of PV Cells & Design of PV Systems

Commercial solar cells - Production process of single crystalline silicon cells, multi crystalline silicon cells, amorphous silicon, cadmium telluride, copper indium gallium di selenide cells. Design of solar PV systems and cost estimation. Case study of design of solar PV lantern. stand alone PV system - Home lighting and other appliances, solar water pumping systems

### UNIT III - Classification of PV Systems And Components

Classification - Central Power Station System, Distributed PV System, Stand alone PV system, grid Interactive PV System, small system for consumer applications, hybrid solar PV system, concentrator solar photovoltaic. System components - PV arrays, inverters, batteries, charge controls, net power meters. PV array installation, operation, costs, reliability.

### UNIT IV- Pv System Applications

Building-integrated photovoltaic units, grid-interacting central power stations, stand-alone devices for distributed power supply in remote and rural areas, solar cars, aircraft, space solar power satellites. Socio-economic and environmental merits of photovoltaic systems. Technological Barriers in implementing Solar PV system. Application of Solar Photovoltaic system in digital India, Government Initiatives and policies.

### REFERENCE BOOKS

1. Chetan Singh Solanki., Solar Photovoltaic: Fundamentals, Technologies and Application. PHI Learning Pvt., Ltd., 2009.
2. Jha A.R., Solar Cell Technology and Applications, CRC Press, 2010.
3. John R. Balfour, Michael L. Shaw, Sharlave Jarosek., Introduction to Photovoltaics. Jones & Bartlett Publishers, Burlington, 2011.
4. Luque A. L. and Andreev V.M., Concentrator Photovoltaic, Springer, 2007.
5. Partain L.D., Fraas L.M., Solar Cells and Their Applications, 2<sup>nd</sup> edition. Wiley, 2010.
6. S.P. Sukhatme, J.K.Nayak., Solar Energy, Tata McGraw Hill, New Delhi, 2010.

### Course Outcome:

At the end of course students are able to understand fundamentals, design and application of solar photovoltaic systems for power generation on small and large scale electrification.

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## WEB DESIGNING

OEL-482-A

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

The objective of this course to understands basic principles of web site design and design of website adhering to current web standards.

### UNIT-I

Introduction: Brief history of internet, introduction to world wide web, basic principles involved in developing a web site, rules of web designing, web standards, audience requirements. Design concept.

### UNIT-II

Web essentials and standards: Clients, servers, introduction to Markup languages, scripting languages, Introduction to elements of HTML, XHTML and CSS. Introduction to Document object model (DOM), working with text, list, tables, frames, hyperlinks, Images multimedia, forms and controls. CSS properties, Id and Class, Box Model, creating page Layout and Site Designs 3. Javascript Javascript as programming language, Data types, Values, Variables, Expressions and Operators.

### UNIT-III

JavaScript Statements, loops, arrays, strings, methods, Defining and Invoking functions and their closure, random functions and maths library, representing dates. Pattern Matching and Regular Expressions. Javascript in web browsers, difference between server side and client side javascript, embedding javascript in HTML and frameworks, Changing CSS style, hiding HTML elements, showing hidden HTML elements. DOM and event handling, error handling, mouse, text, drag, drop and keyboard events and node operations, Node operations, Cookies, Scripted HTTP, Animation and multimedia Forms of Debugging.

### UNIT-IV

Website Development Tools Google Web Designer, Macaw, Sketch, Firefox, YSlow, Wordpress, openElement etc.

Reference Books: 1. Thomas A Powell, HTML: The Complete Reference, Tata McGraw Hill Publications.

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### Course outcomes

1. Understand basic principles of web site design, considering the information architecture.
2. Incorporate best practices in navigation, usability in website design
3. Design of website adhering to current web standards (HTML, XML, CSS)

**NOTE:** There will be nine questions in total from all four units. First question is compulsory and set from all four units. Students will have to attempt any five questions in all selecting at least one question from each unit.

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## RESEARCH METHODOLOGY AND IPR

OEL-482-B

L T P

3 0 0

Total Credits: 3

Internal Marks: 20

External Marks: 80

Total Marks: 100

### Course Objective:

The objective of this course is to familiarize students with basic of research and the research process and to enable the students in conducting research work and formulating research synopsis and to impart knowledge for enabling students to develop data analytics skills and meaningful interpretation to the data sets so as to solve the Research problem.

### Unit-I:

Meaning of research problem, Sources of research problem, characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

### Unit-II:

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

**Unit-III:** Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT.

### Unit-IV:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology, Patent information and databases, Geographical Indications. Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

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4. Garrett, HE and Woodworth, RS. Statistics in Psychology and Education, Educational Research, Bombay: Vakils Fetter and Simons Ltd. 2003
5. Gay, LR, Educational Research, Ohio: Charles E. Merrill Publishing Company 2000.

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