B.Sc (Prog) PHYSICAL SCIENCES, ELECTRONICS

COURSE OUTCOMES

CORE COURSES

Physics C-I: DSC 1A: Network Analysis and Analog Electronics (Theory)

By the end of the course, the students will be able to:

CO1	This course offers the basic knowledge to students to design and analyze the network circuit analysis and analog electronics.
CO2	It gives the concept of voltage, current sources and various electrical network theorems. Physics of Semiconductor devices including Junction diode, Bipolar junction Transistors, Unipolar devices and their applications are discussed in detail.
CO3	This also develops the understanding of amplifier and its applications.

Physics C-II: DSC 2A: Mechanics (Theory)

CO1	Understand the role of vectors and coordinate systems in Physics, solve Ordinary Differential Equations, laws of motion and their application to various dynamical situations.
CO2	Learn the concept of Inertial reference frames their transformations. Also, the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
CO3	Understand the phenomena of elastic and in-elastic collisions, phenomenon of simple harmonic motion, understand angular momentum of a system of particle, understand concept of Geosynchronous orbits
CO4	Understand special theory of relativity - special relativistic effects and their effects on the mass and energy of a moving object.
CO5	In the laboratory course, after acquiring knowledge of how to handle measuring instruments (like screw gauge, Vernier calipers, travelling microscope) student shall embark on verifying various principles and associated measurable parameters.

Maths C-III: DSC 3A: Calculus and Matrices (Theory)

CO-1	Define and use fundamental concepts of calculus including limits, continuity and differentiability.
CO-2	Find eigenvalues and corresponding eigenvectors for a square matrix, and check for its diagonalizability.
CO-3	Perform operations with various forms of complex numbers to solve equations.

Physics C-IV: DSC 1B: Linear and Digital Integrated Circuits (Theory)

CO-1	To understand Op- Amp basics and its various applications.
CO-2	To become familiar with number systems and codes, Logic Gates, Boolean Algebra Theorems.
CO-3	To understand the minimization techniques for designing a simplified logic circuit.
CO-4	To design a half Adder, Full Adder, Half-Subtractor, Full-Subtractor.
CO-5	To understand the working of Data processing circuits Multiplexers, Demultiplexers, Decoders, Encoders.
CO-6	To become familiar with the working of flip-flop circuits, its working and applications.

Physics C-V: DSC 2B: Electricity, Magnetism & EMT (Theory)

CO-1	Have basic knowledge of Vector Calculus 30
CO-2	Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.
CO-3	Apply Gauss's law of electrostatics to solve a variety of problems. Articulate knowledge of electric current, resistance and capacitance in terms of electric field and electric potential.
CO-4	Calculate the magnetic forces that act on moving charges and the magnetic fields due to currents (Biot- Savart and Ampere laws)
CO-5	Have brief idea of magnetic materials, understand the concepts of induction, solve problems using Faraday's and Lenz's laws
CO-6	In the Lab course, students will be able to measure resistance (high and low), Voltage, Current, self and mutual inductance, capacitor, strength of magnetic field and its variation, study different circuits RC, LCR etc.

Maths C-VI: DSC 2B: Calculus and Geometry (Theory)

CO-1	Sketch curves in a plane using its mathematical properties in the different coordinate systems of reference.
CO-2	Compute area of surfaces of revolution and the volume of solids by integrating over crosssectional areas.
CO-3	Be well versed with conics and quadric surfaces so that they should able to relate the shape of real life objects with the curves/conics.

Physics C-VII: DSC 1C: Communication Electronics (Theory)

CO-1	the concepts of electronics in communication, introduction to the principle, performance and applications of communication systems.
CO-2	various means and modes of communication, electromagnetic communication spectrum with an idea of frequency allocation for radio communication system in India.
CO-3	an insight on the use of different modulation and demodulation techniques used in analog communication.

CO-4	analyze different parameters of analog communication techniques.
CO-5	learn the generation and detection of a signal through pulse and digital modulation techniques and multiplexing.
CO-6	In-depth understanding of different concepts used in a satellite communication system, Mobile radio propagation, cellular system design and understand mobile technologies like GSM and CDMA, mobile communication generations 2G, 3G, and 4G with their characteristics and limitations.

Physics C-VIII: DSC 2C: Thermal Physics and Statistical Mechanics (Theory)

CO-1	Learn the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations. They are also expected to learn Maxwell's thermodynamic relations.
CO-2	Know the fundamentals of the kinetic theory of gases, Maxwell-Boltzman distribution law, equipartition of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion.
CO-3	Learn about the black body radiations, Stefan- Boltzmann's law, Rayleigh-Jean's law and Planck's law and their significances. 33
CO-4	Learn the quantum statistical distributions, viz., the Bose-Einstein statistics and the Fermi-Dirac statistics.
CO-5	In the laboratory course, the students are expected to: Measure of Planck's constant using black body radiation, determine Stefan's Constant, coefficient of thermal conductivity of a bad conductor and a good conductor, determine the temperature coefficient of resistance, study variation of thermo emf across two junctions of a thermocouple with temperature etc.

Maths C-IX: DSC 3C: Algebra (Theory)

CO-1	Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups etc
CO-2	Explain the significance of the notion of cosets, normal subgroups, and of factor groups
CO-3	Understand the fundamental concepts of Rings, Fields, Subrings, Integral domains, Vector spaces over a field, and linear transformations.

Physics C-X: DSC 1D: Microprocessor and Microcontroller (Theory)

CO-1	designing and developing embedded systems.
CO-2	major components that constitute an embedded system.
CO-3	the architecture of a 8085 Microprocessor
CO-4	assembly language programming essentials
CO-5	a microcontroller, microcomputer embedded system

CO-6	the architecture of a 8051 microcontroller and its concepts like I/O operations, interrupts, programming of timers and counters.
CO-7	Interfacing of 8051 microcontroller with peripherals
CO-8	Implementing small programs to solve well-defined problems on an embedded platform.

Physics C-XI: DSC 2D: Waves and Optics (Theory)

CO-1	Understand Simple harmonic oscillation and superposition principle.
CO-2	Understand the importance of classical wave equation in transverse and longitudinal waves and solving a range of physical systems on its basis.
CO-3	Understand Concept of normal modes in transverse and longitudinal waves: their frequencies and configurations.
CO-4	Understand Interference as superposition of waves from coherent sources derived from same parent source. Demonstrate understanding of Interference experiments: Young's Double Slit, Fresnel's biprism, Llyod's Mirror, Newton's Rings.
CO-5	Demonstrate basic concepts of Diffraction: Superposition of wavelets diffracted from apertures. Understand Fraunhoffer Diffraction from a slit. 36
CO-6	Concept of Polarization
CO-7	In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. Resolving power of optical equipment can be learnt first hand.
CO-7	The motion of coupled oscillators, study of Lissajous figures and behaviour of transverse, longitudinal waves can be learnt in this laboratory courseUnderstand the chemistry and applications of s- and p-block elements.

Maths C-XII: DSC 3D: Real Analysis (Theory)

CO-1	Familiar with the concept of sequences, series and recognize convergent, divergent, bounded, Cauchy and monotone sequences.
CO-2	Test the convergence and divergence of series using the ratio test, Leibnitz test.
CO-3	Understand and apply the basics of Riemann integration.

DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE)

Physics DSE-1A: Elements of Modern Physics (Theory)

CO-1	The different toxic gases and their toxicity hazards
CO-2	Safe design systems for large scale production of industrial gases
CO-3	Manufacturing processes, handling and storage of inorganic chemicals
CO-4	Hazardous effects of the inorganic chemicals on human beings and vegetation
CO-5	The requirement of ultra-pure metals for the semiconducting technologies
CO-6	Composition of air, various air pollutants, effects and control measures of air pollutants
CO-7	Different sources of water, water quality parameters, impacts of water pollution, water treatment
CO-8	Different industrial effluents and their treatment methods
CO-9	Different sources of energy
CO-10	Generation of nuclear waste and its disposal
CO-11	Use of biocatalyst in chemical industries

Physics DSE-2A: Electronics Instrumentations

CO-1	Basic principles of the measurement and errors in measurement, specifications of basic Measurement instruments and their significance with hands on mode.
CO-2	Principles of voltage measurement, advantages of electronic voltmeter over conventional multimeter in terms of sensitivity etc.
CO-3	measurement of impedance using bridges, Power supply, Filters, IC regulators and Load and line regulation.
CO-4	Specifications of CRO and their significance, the use of CRO and DSO for the measurement of voltage (dc and ac), frequency and time period.
CO-5	Multivibrators, working circuits of Astable and monostable multivibrators.
CO-6	Phase Locked Loop (PLL), Voltage controlled oscillators and lock-In amplifier.
CO-7	Explanation and specifications of Signal and pulse Generators
CO-8	The Interfacing techniques, Audrino microcontroller & interfacing software, Understanding and usage of Transducers

Maths DSE-3A: Differential Equations

CO-1	Solve the exact, linear and Bernoulli equations and find orthogonal trajectories.
CO-2	Apply the method of variation of parameters to solve linear differential equations.
CO-3	Formulate and solve various types of first and second order partial differential equations

Physics DSE-1B: Nuclear and Particle Physics

CO-1	Understand the chemistry and applications of 3d elements including their oxidation states and important properties of the familiar compounds potassium dichromate, potassium permanganate and potassium ferrocyanide
CO-2	Use IR data to explain the extent of back bonding in carbonyl complexes
CO-3	Get a general idea of toxicity of metal ions through the study of Hg2+ and Cd2+ in the physiological system
CO-4	Understand the fundamentals of functional group chemistry, polynuclear hydrocarbons and heterocyclic compounds through the study of methods of preparation, properties and chemical reactions with underlying mechanism.
CO-5	Gain insight into the basic fundamental principles of IR and UV-Vis spectroscopic techniques.
CO-6	Use basic theoretical principles underlying UV-visible and IR spectroscopy as a tool for functional group identification in organic molecules.

Physics DSE-2B: Photonics Devices & Power Electronics

CO-1	Develop understanding of application of fundamental laws of physics in such optoelectronics areas as telecommunications and power electronics for automation in industries.
CO-2	Acquire essential laboratory skills in designing experiments, assembling standard optical tools for optical experimentation and power electronics and analyzing acquired data.
CO-3	Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus.
CO-4	Develop understanding to compare performance and basic operation of various power semiconductor devices, passive components and various switching circuits.
CO-5	Develop understanding of Basic circuit of power rectifiers and inverters.

Maths DSE-2B: Numerical Methods

CO-1	Find the consequences of finite precision and the inherent limits of numerical methods.
CO-2	Appropriate numerical methods to solve algebraic and transcendental equations.
CO-3	Solve first order initial value problems of ODE's numerically using Euler methods

SKILL ENHANCEMENT ELECTIVE COURSES (SEC)

SEC-1: Electrical Circuits and Network Skills

CO-1	Demonstrate good comprehension of basic principles of electricity including ideas about voltage, current and resistance.
CO-2	Develop the capacity to analyze and evaluate schematics of power efficient electrical circuits while demonstrating insight into tracking of interconnections within elements while identifying current flow and voltage drop.
CO-3	Gain knowledge about generators, transformers and electric motors. The knowledge would include to interfacing aspects and consumer defined control of speed and power.
CO-4	Acquire capacity to work theoretically and practically with solid-state devices.
CO-5	Delve into practical aspects related to electrical wiring like various types of conductors and cables, wiring-Star and delta connections, voltage drop and losses.
CO-6	Measure current, voltage, power in DC and AC circuits acquire proficiency in fabrication of regulated power supply.
CO-7	Develop capacity to identify and suggest types and sizes of solid and stranded cables, conduit lengths, cable trays, splices, crimps, terminal blocks and solder.

SEC-2: Renewable Energy and Energy Harvesting

CO-1	Knowledge of various sources of energy for harvesting
CO-2	Understand the need of energy conversion and the various methods of energy storage
CO-3	A good understanding of various renewable energy systems, and its components.
CO-4	Knowledge about renewable energy technologies, different storage technologies, distribution grid, smart grid including sensors, regulation and their control.
CO-5	Design the model for sending the wind energy or solar energy plant.
CO-6	The students will gain hand on experience of: (i) different kinds of alternative energy sources, (ii) conversion of vibration into voltage using piezoelectric materials, (iii) conversion of thermal energy into voltage using thermoelectric modules.

SEC-3: Applied Optics

CO-1	Understand basic lasing mechanism qualitatively, types of lasers, characteristics of laser light and its application in developing LED, Holography.
CO-2	Gain concepts of Fourier optics and Fourier transform spectroscopy.
CO-3	Understand basic principle and theory of Holography.
CO-4	Grasp the idea of total internal reflection and learn the characteristics of optical fibres

SEC-4: Weather Forecasting

CO-1	Acquire basic knowledge of the elements of the atmosphere, its composition at various heights, variation of pressure and temperature with height.
CO-2	To learn basic techniques to measure temperature and its relation with cyclones and anti-cyclones.
CO-3	Knowledge of simple techniques to measure wind speed and its directions, humidity and rainfall.
CO-4	Understanding of absorption, emission and scattering of radiations in atmosphere; Radiation laws.
CO-5	Knowledge of global wind systems, jet streams, local thunderstorms, tropical cyclones, tornadoes and hurricanes.
CO-6	Knowledge of climate and its classification. Understanding various causes of climate change like global warming, air pollution, aerosols, ozone depletion, acid rain.
CO-7	Develop skills needed for weather forecasting, mathematical simulations, weather forecasting methods, types of weather forecasting, role of satellite observations in weather forecasting, weather maps etc. Uncertainties in predicting weather based on statistical analysis.
CO-8	Develop ability to do weather forecasts using input data.
CO-9	In the laboratory course, students should be able to learn: Principle of the working of a weather Station, Study of Synoptic charts and weather reports, Processing and analysis of weather data, Reading of Pressure charts, Surface charts, Wind charts and their analysis.