Course Code: US01CPHY01
Course Title: Properties of Matter and Sound Wave
Course Outcome

UNIT-1 : Elasticity-I

Students learn about basic concepts of elasticity in unit I and II. Hook's law is one of the oldest laws of elasticity and hence unit starts with the law and related concepts like stress and strain etc. Most important parameters bulk modulus, modulus of rigidity, Young modulus Poisson's ratio are the key concepts which will learn the students.

UNIT-2 : Elasticity-II

In this unit, students will learn theory and methods related to various parameters related to elasticity. These methods based on concepts of twisting couple on a cylinder (or wire). Students learn about torsional pendulum and its applications. Mainly students will learns Statical method (Horizontal twisting apparatus for a rod), Maxwell's vibrating needle method etc to determination of modulus of elasticity.

UNIT-3 : Sound-I

In unit 3 and 4, students will learn about Physics of Sound. Sound propagates as longitudinal waves. Students will derive various formulae to calculate velocity of longitudinal waves in gaseous medium, velocity of sound in air. Students able to understand effect of pressure, temperature, and humidity on the speed of sound,. Kundt's tube is very important devise to study sound and hence students learn about the construction, working and application of the tube.

UNIT-4 : Sound-II

Unit 4 is related to Doppler's effect and Applications of Doppler's principle. Student will be familiar with Characteristics of musical sounds, Intensity of sound etc. Second part is related with ultrasonic waves. Student will be familiar with production of ultrasonic waves, detection of ultrasonic, properties of ultrasonic and applications of ultrasonic waves.

Course Code: US01CPHY02

Course Title: Network Analysis, Optics and LASER

Course Outcome

UNIT 1: Network Analysis

Elementary Network Theory

In this unit, students will get knowledge about basic of electrical engineering. It includes variety of elementary networks like network analysis by mesh current methods (two and three mesh network),circuit analysis by Node pair voltages(one and two node pair).from these students will able to calculate current and voltage respectively. From voltage divider theorem, student can calculate unknown resistance. From superposition theorem,Thevenin's theorem, student can calculate current for complicated networks. From Norton's theorem voltage for complicated networks can be obtained.

UNIT 2: Bridges and their application

DC bridges

From students will learn basic operations, measurement of errors for Whetstones and Kelvin Bridge. Students will also learn Thevenin equivalent circuit and effects of connecting leads.

AC bridges

It includes variety of ac bridges like Maxwell, Hay, Schering, Wein bridges. Student can learn how balance AC bridges. From these bridges student can also calculate unknown inductance, capacitance and frequency.

UNIT 3: Optic

In this unit, students will get knowledge about construction, working and applications of Jamin's, Rayleigh's refractometer, from which they will able to calculate refractive index of gases, construction and working of Michelson's interferometer and its applications.

Resolving power of Optical Instruments

It includes criteria of resolving power and calculation of resolving power of telescope, grating, prism and microscope. From these students will able to calculate resolving power of optical instruments and their limitations.

UNIT 4: LASER

From these unit, students will learn about of properties of LASER like Stimulated absorption, spontaneous and stimulated emission. They will also learn about Einstein's coefficients. Students will get familiar with variety of production techniques of LASER like ND: YAG, CO_2 ,LASER. They will get knowledge about different applications like Holography, cutting, welding of materials etc.

Course Code: US02CPHY01
Course Title: CLASSICAL MECHANICS AND RELATIVITY
Course Outcome

UNIT- I Vector Algebra

Students have studied basic concepts of scalar and vectors in 11^{th} standard. So here students will learn about the applications of scalars and vectors i.e. how vector represents surface area. Students will learn how to obtain the scalar and vector triple products. Students will learn how to interpret and find gradient of a scalar function, divergence and curl of a vector point function. Further they will apply all this in the form of theorems which are named as Greens, Gauss and Stokes Theorems.

UNIT- II Mechanics of a particle

Students study Newton's laws of motion in earlier standards. So here students will study the object in motion i.e. motion of particles with and without considering forces responsible for the motion of the particle as well as their behavior. Student will learn about how to obtain general form of equation for different cases such as constant force, time – dependent force, constant electric and magnetic field. Student will learn the representation of motion of particle in crossed fields. They derive equations of cyclotron frequency and drift velocity.

UNIT – III Simple harmonic motion

In this unit students will study different types of pendulums. Students will study acceleration due to gravity. The equation for time period of simple pendulum is derived. Students will study Compound pendulum and interchangeability of centers of suspension and oscillation. Students will learn center of Percussion and other points collinear with center of gravity. Students will also study Bar pendulum and Kater's Pendulum.

UNIT- IV Special theory of relativity

The students will learn about frame of reference and its different types. Students will obtain the Galilean transformation equation and will learn how to obtain Lorentz Transformation equations. Students will study Michelson Morley experiment to prove the presence of ether. Lorentz –Fitzgerald contraction and time dilation will be discussed. Students will also derive mass energy equivalence and energy momentum relation.

Course Code: US02CPHY02
Course Title: Electronics, Nuclear Physics and Modern Physics
Course Outcome

Unit I: Electronics

This unit of electronics deals with Rectifiers and Filters. These two aspects are the most elementary topics in electronics. The unit gives the students an opportunity to understand the conversion of AC into DC through half wave and full wave rectifiers. It also covers the process of obtaining pure DC using different filters like Inductor filter, Capacitor filter L type and π type filters.

Unit II: Electronics

The second unit of electronics is meant for providing knowledge of different diodes and transistors. In this unit students can learn the difference between signal and power diodes. They can also understand the working of some special diodes like Zeener diode (Voltage regulation), Varactor diodes and LED. The second part is devoted to transistor biasing and working. The students will learn the basic theory of transistor parameters and working of transistors. Finally the students will learn the use of transistors as amplifiers.

Unit III: Nuclear Physics

This unit acts as a bridge course between 12^{th} standard simple physics and advanced level physics of third B.Sc. This unit starts with simple nuclear terminologies like nuclear spin, magnetic moment, radius of nuclei and goes through concept of stable combination of neutrons and protons. The concept of Binding energy and binding energy per nucleon slowly takes the students to partial study of Liquid drop model of the nucleus. At the end of this unit, the students are expected to be prepared to take on higher level concepts of Nuclear Physics.

Unit IV: Modern Physics

This unit is also designed as a bridge course between 12^{th} standard simple physics and advanced level physics of third B.Sc. Students can start with concept of Black body radiation and understand the process emission of EM radiation through plank's radiation law. Later part of this unit includes some of main concepts and experiments of the modern physics like Compton effect, De Broglie's hypothesis, Uncertainty principle and Devisson Germer experiment. The last part is given to the theory of model of atom, starting from Bohr model to Vector atom model. This provides a plate form to the students to take up advanced level graduation physics.

Course Code: US03CPHY01
Course Title: Optics
Course Outcome

UNIT- I Geometrical Optics

Students studied some basic concepts of Optics in standards 11^{th} and 12^{th}. Students will recall this knowledge of optics in a different way with respect to thick lenses, that means, the construction of optical system using convex and concave lenses also they will familiar to compute the various Cardinal points of lens systems.

Students will also learn the different types of aberrations occur in thick lens. Moreover, students will study different eyepieces used in the various optical instruments.

UNIT- II Interference and Diffraction

Students have studied the basic concepts of interference and diffraction in their previous standards. Students will learn through this unit is different techniques for obtaining interference, as well as the Diffraction and its analytical treatment.

UNIT – III Polarization

Through this unit student will learn about polarization and its applications. Such that types of polarization, Polarizer and analyzer, explanation of double refraction, Superposition of waves, types of polarized light and LCDs as an application.

UNIT- IV Earth Science

The fiber optics is new concept for the students of B.Sc. through this unit the students will learn about the optical fiber technology and applications, The students will also learn through this unit is the concept of total internal reflection, Propagation of light through an optical fiber, Classification of optical fibers, Materials used to prepare optical fiber, Characteristics and merits of the fibers.

Course Code: US03CPHY02
Course Title: Basic Solid State Electronics
Course Outcome

UNIT- I Transistor Biasing Circuits

Students have studied the transistor characteristics and DC loan line of a CE transistor circuit in the earlier semesters. Students will learn about why we need to bias a transistor. Students will learn about selection of operating point for a proper amplification. Students will learn about why stabilization of bias if required. Students will learn about the requirement of good biasing circuits.

Students will learn about how to determine the operating point of different biasing circuits like Fixed-bias, Collector to base bias, Emitter bias and Voltage divider biasing circuit. Students will learn to determine operating point of above biasing circuit using numerical. At the end of the unit students will gain the amplifier circuit designing skills to set a proper operating point using a good biasing circuit

UNIT- II Small Signal Amplifiers and h-parameters

Students will learn about a Single stage transistor amplifier and its performance analysis. Students will learn to determine AC and DC load lines, Calculation of gain, Input and output phase relationship for a single stage amplifier using Graphical method. Students will learn to develop AC equivalent circuit of a transistor using Equivalent circuit method for performance analysis.

Students will learn about h-parameters of a transistor and to develop a h- parameter equivalent circuit of a transistor for analysis. Students will learn amplifier analysis using the h-parameters. Students will learn about need of a multistage amplifier. Students will learn to determine gain of multistage amplifier in dB and its advantages. At the end of unit, students will develop necessary analysis skills to determine performance of a small signal amplifier circuit.

UNIT- III Feedback in Amplifiers

Students will learn the concepts of feedback in amplifiers. Students will learn different types of feedback and voltage gain of feedback amplifier. Students will know advantages-disadvantages of negative feedback in amplifier. Students will develop a skill to modify the amplifier parameters like gain, distortion, noise, input impedance, output impedance and bandwidth.

Students will developer a skill to analyze amplifier circuit with negative Feedback. Students will be able to understand the effect of emitter bypass capacitor in CE amplifier circuit and learn about Emitter follower circuit. At the end of unit, students will devop necessary application skills to use process of proper feedback in various amplifier circuits.

UNIT- III Oscillators

Students will know about why we need oscillator circuits. Students will learn the concepts and types of oscillator circuits. Students will study the circuits for generation of sine waves of certain frequency of oscillation with LC circuit. Students will learn about the effect of damping in the oscillator output and understand the concepts of sustained oscillations.

Students will understand the application of positive feedback in amplifier to use it as an oscillator. Students will learn about the designing of various types of LC oscillators like Hartley and Colpitts oscillator. Students will learn the basic principles of RC oscillators and understand the working of Phase shift and Wien bridge oscillator. Students will know about the concepts of Crystal oscillators and working of Crystal oscillator circuit. At the end of unit, students will gain skills to design a LC, RC or crystal oscillator operating at a certain frequency required for a proper application.

Course Code: US04CPHY01
Course Title: Electromagnetic Theory and Spectroscopy
Course Outcome

UNIT- I Electrostatics

Students studied some basic concepts of electrostatics in previous standards. Also they learnt about basic tools and operators of the electrostatics in standards 12^{th} and B.Sc. sem. 2. Students will revive the brief introduction about all the basic tools of electrostatics namely, Gradient, Divergence, Curl and various coordinate systems, the electric field, Coulomb's law etc.

Students will learn about how to the derive formulae for Divergence and curl of Electrostatic fields using the concept of the field lines, flux, Gauss's law and its applications. Students can also be familiar with the electric Potential, Poisson's equation and Laplace's equation, the potential of a localized charge distribution, Work and Energy in Electrostatics.

UNIT- II Magnetostatics

Students studied some basic concepts, basic tools and operators of magnetostatics in previous standards. In this unit students will learn about Magnetic fields, Magnetic forces, Currents, the Lorentz Force Law, the Biot - Savart law, the concept of steady currents, the Magnetic field of a steady current, the straight-Line currents, Various applications of Ampere's law, Comparative study of Magnetostatics and Electrostatics, Magnetic Vector Potential, The Vector potential, multi pole expansion of the vector potential.

UNIT – III Atomic Spectra

Through this unit student will learn about the basic concepts of spectroscopy, such as investigation of Spectra, Production of Spectra, types of Spectra, wave Number, the Spinning electron also students will know the fundamentals of the quantum mechanics, like space quantization, quantum numbers and their physical Interpretation, L-S Coupling, J-J Coupling. They will also be capable to understand the Zeeman Effect, their classical Interpretation of Normal and anomalous Zeeman Effect and its experimental study. The Students will also learn about Stark Effect.

UNIT- IV X-ray Spectra

The students will learn in this unit are the fundamentals of the X Rays, its production, the X –Ray and electromagnetic spectrum, explanation and characteristic Emission Spectrum and absorption Spectrum, diffraction of X-Radiations through crystals, Bragg's law, Comparison of Optical and X-ray Spectra, also study of Moseley's Law, the Fluorescence yield and Auger Effect.

Course Code: US04CPHY02
Course Title: Solid State Physics
Course Outcome

UNIT- I Basic Elements of Crystallography

Basically matter is classified in to three states viz., Solid, Liquid and Gas, to understand the properties of solid one must understand how solid is formed, how the atoms are arranged, what are different structures in which solid exist, for this we require a knowledge of Lattice, space lattice, Primitive cell, non-primitive cell, unit cell, two and three dimensional crystal, then symmetry, different type of symmetry, symmetry operation etc are require, then we need a knowledge of plane, hence we formulate Miller Indices, its construction and applications along with necessary mathematics.

UNIT- II Atomic Cohesion, Crystal Binding, Atomic Size

After realizing solid structure, question arises what are the forces that holds the atoms together? which is down as Cohesive forces, or Cohesion, we develop a method to calculate Cohesive energy, Madelung constant etc., one should also know about the electron ion interaction, popularly known as Bonding forces, generally the bonding forces are classified as Primary bonds and Secondary bonds, then we should know what is Atomic radius, nearest neighbor distance, ionic radius etc which is essential to understand the various physical properties of solids.

UNIT – III Thermal & Dielectric Properties of Solids

The behavior of solid is different in different environment to understand these we study thermal properties, what is specific heat? On what does it depends? is it changes with temperature? Why it changes with temperature? What is lattice vibration? What is the contribution of electron in specific heat of solids?

Similarly if we place insulator in electric filed, it shows dielectric properties, and then one must understand what dipole is? Dipole moment, what is quadruple? What is polarization, what is polarisability etc.,

UNIT- IV Structure of Polymer and its Applications

With advancement in science and technology we require a material which has outstanding strength, performance, low cost and high durability, the journey from metal to alloys, to polymers, to smart materials, to composite materials etc.,

To understand polymer properties one must understand what is Organic chemistry, what is hydrocarbon, its chemical formula, its structure, its manufacturing processes, its industrial requirements, how its properties are changing with ambient parameters etc.,

Course Code: US05CPHY01
Course Title: Classical Mechanics

Course Outcome

UNIT- I Inverse square law field, potential and Motion in a central force field

Students can understand the Law of gravitational and electrostatic forces, Using the forces they can find the Gravitational and electrostatic fields and potentials, Lines of force and equipotential surfaces.

Students will learn about the Fields and potentials of dipole and quadrupole and then find the Field equations of bound charges. Students can find the equivalent one body problem. The motion in a central force field and the general features of the motion can understand in this unit. They will learn the motion in an inverse square law force field, equation of orbit and Kepler's laws of planetary motion

UNIT- II Lagrangian Formulation

The concept of Constraints and Generalized co-ordinates is important to understand the new formulation of classical mechanics. The students can derive D'Alembert's principle, and Lagrange's equations of motion. Students can use Lagrangian formulations to find the equation of motion of different mechanical system.

A General expressions for kinetic energy is important. The students can prove the the laws of conservation of energy. The students will apply the Lagrangian formulation and solve various Illustrations.

UNIT- III Moving coordinate systems and motion of a rigid body

The Coordinate systems with relative translation motions and rotating coordinate systems is important to understand the motion of the earth. Students can learn the Corioli's force, motion on the earth and Effect of Corioli's force on freely falling particle.

Students can learn Euler's Theorem and find the angular momentum and kinetic energy for rotating body. The concept of inertia tensor and Euler's equations of motion are important to understand the rotating body. They will also learn about torque free motion, Euler's angles and motion of a symmetric top.

UNIT- IV Variational Principle

The students will learn about configuration space. Some techniques of calculus of variation is important to understand the motion of the system. Students will solve various applications of the variational principle.

Students can learn new formulation using Hamilton's principle. They will differentiate the Lagrange's and Newton's equations and find the advantages of the Lagrangian Formulation and Hamilton's equations of motion

Course Code: US05CPHY02
Course Title: Mathematical Physics
Course Outcome

UNIT- I Matrices & Curvilinear Co-ordinate System

In the first part of unit-I, students will learn basic concept of matrix, matrix operations, their linear and orthogonal transformations, Eigen values, Eigen vectors and diagonalization of matrices. In the second part of unit-I, they study about Curvilinear Coordinate System and derive gradient, divergence, curl & Laplacian which are the basic differential operations, in curvilinear coordinates and derive the equivalent familiar expressions in orthogonal/ rectangular coordinate system. They study cylindrical coordinate system & spherical polar coordinate system as a special cases of curvilinear coordinate system.

UNIT- II Harmonics with Special Functions

In this unit students deal with the Legendre's differential equation, Bessel's differential equation and Hermite's differential equation and by following almost same methodology they derive Legendre's polynomials, Bessel's polynomials & Hermite polynomials from them respectively. They study the recurrence relations and the orthogonal properties of all three polynomials.

UNIT – III Fourier series, Diffusion and Wave Equation

In this unit students study Fourier series, which is a linear combination of sine and cosine waves within a period. They derive Fourier series in real and complex form and use these series to study different types of periodic waves like triangular wave, square wave, saw tooth wave etc. and to solve different types of numerical with tricky methods. The main focus on the unit is application side of Fourier series such as to calculate phase angles, Effective values and the average of a product, Thermal state, transverse vibration of a string etc. They study diffusion equation and derive one dimensional and two dimensional wave equations.

UNIT- IV Numerical Techniques

In this last unit, students study the least square fitting method in curve fitting. They study how to fit a curve or given data to straight line, parabola, exponential. They study the interpolation and different types of interpolation formulas. They also study different types of differential operators used in differentiation and different types of numerical integration methods like Trapezoidal Rule, Simpson's (1/3) Rule, Eigen values and its problems and Jacobi's Method.

Course Code: US05CPHY03
Course Title: Solid State Physics
Course Outcome

UNIT- I Introduction to X-ray

After having the knowledge of Solid structure and symmetry the question arises, how do we practically determines the structure and symmetry, in condensed matter physics we have a tools like, X-ray, neutron and electron diffraction techniques by means of which we can determine, lattice parameters and symmetry, the popular experiments are, Laue Method, Rotating Crystal method, and Powder method.

moreover the mathematics which correlates the structure and symmetry is equally essential, we need structure factor for different structure viz, FCC, BCC, HCP

We need miller indices, its geometrical construction and related mathematic**s.**

UNIT- II Free electron Fermi Gas

To understand electrical properties one must know about electron and its behaviour, why there are conductors, semi-conductors and insulators? is it because of electron? or electron distribution in various orbitals? the concept of free electron Fermi gas was developed because of failure of classical theory of electrical conductivity and paramagnetic susceptibility. one has to develop one dimensional and three dimensional Fermi gas model and its density of states as well. electrical conductivity and Ohm's Law behaviour of electron in Electric and magnetic field. very important experiment which is Hall effect which explain mobility, hall coefficient, hall field, Hall angle etc.,

Superconductivity is another phenomenon of electrical conductivity at low temperature, one classify superconductors as soft superconductors and hard superconductors, effect of superconductivity on specific heat, entropy, energy band, isotopic mass etc.,

UNIT – III Semiconducting And Optical Properties of Metals

After having ample knowledge of Freelectron Fermi Gas, another exiting area of Solid State Physics is Semiconductor Physics, which deals with the intrinsic and extrinsic semiconductors, free carrier concentration in extrinsic semiconductor, mobility of charge carries, effect of temperature on mobility, junction properties of semiconductors and metal-semiconductors.

Photo conductivity, Photoelectric effete, Photovoltaic effect, Photoluminesence, colour centres, generation of colour centres.

UNIT- IV NanoScience and NanoTechnology

What is nano science? is it new science? what is importance of nano science?

what is nano technology?origin of nano science, fabrication of nano science, surface to volume ratio in nano science, cutting down and growing up technology, instruments required for nano science and technology, lithography, atomic force microscopy, scaning tunnelling microscope,

Application of nanoTechnology in Drug delivery system, sensors, smart materials, nano electronics, are important areas.

Course Code: US05CPHY04
Course Title: Thermodynamics and Statistical Physics

Course Outcome

UNIT-I Thermodynamics

Students can learn the various laws of Thermodynamics. Maxwell's Thermodynamical Relations and Helmholtz Function are important in thermodynamics. They will learn various Thermodynamical potential and Gibbs Function. Students will learn to derive the Maxwell's Equations. Students can solve the related numerical.

UNIT-II Fundamentals of Statistical Mechanics

Students can learn the macroscopic and microscopic states and phase space. They will derive the Liouville's theorem. Students can learn the Microcanonical Ensemble: Microcanonical distribution and Microcanonical average.

Students can learn about Gibbs paradox and removal of Gibbs paradox. They will derive the specific heat at constants volume, Sackur-Tetrode formula, and Nernst's heat theorem and related numerical

UNIT-III Statistical Mechanics

Students can learn Canonical distribution, Canonical average, Canonical partition function, Maxwell-Boltzmann distribution of velocities, Maxwell-Boltzmann distribution of absolute velocity, Most probable velocity, Mean kinetic energy, Thermodynamic quantities in a canonical ensemble. Students can find the equivalence of Microcanonical and canonical ensembles.

Students can learn about Grand Canonical distribution, Grand Canonical average, Grand Canonical partition function, Thermodynamic quantities in a Grand canonical ensemble and related numerical.

UNIT-IV Three Distributions

Students can learn the Maxwell-Boltzmann Distribution, Fermi-Dirac distribution, Bose-Einstein Distribution

Students will learn about the applications of Maxwell-Boltzmann distribution and energy distribution function. Students can learn the energy distribution law, partition function, and probable energy, Total number of particles, Average energy, Velocity distribution function, and average velocity and root mean square velocity and related numerical.

Course Code: US05CPHY05
Course Title: Analog Devices and Circuits
Course Outcome

UNIT- I FET and MOSFET

Students will learn about construction, characteristics, working and applications of FET and MOSFET. There are many advantages of FET over BJT. In this unit students will know about special applications of FET.

UNIT- II Frequency Response of Amplifiers and Tuned Amplifiers

Students will be familiar with low and high frequency response of the amplifiers and Tuned Amplifiers. Key concepts of the unit are parameter on frequency response of the transistor amplifier depends.

UNIT – III Power Amplifier

In this unit, students will learn about Class A power amplifier, Class A Push-Pull Amplifiers, class B Push-Pull Amplifier, Class AB Push-Pull Amplifier etc.

UNIT- IV Operational Amplifier

This unit is related to OpAmp. Key concepts are construction of an OpAmp, Ideal Operational Amplifier, Inverting and Non-inverting Amplifiers, Measurements of Op-Amp Parameters etc. In second part of the unit students will learn about various applications of OpAmp like Summing amplifier, Difference amplifier, The Integrator, Differentiator, Current to Voltage Converter, Voltage to Current Converter-Floating Load, Logarithmic Amplifier using diode(Basic only) Active filters etc.

Course Code: US05CPHY06
Course Title: Astronomy and Astrophysics
Course Outcome

Unit I: Astronomical instruments and measurements

This unit is the beginning an interesting subject of Astronomy, which deals with some fundamental properties of light and their role in astronomical observations. Here, students can appreciate the role of atmosphere in astronomical observations and ways to overcome the effects of atmosphere. The concepts of optical and radio telescopes, spectrographs and photometry together with knowledge of detectors enables the students to understand the details of observational astronomy and correlate them with ideas of different types of stellar magnitudes and measurement of stellar distances. In the final part of this unit, the students study the problem of stellar motion and relative motion of the stars with respect to the Sun.

Unit II: The Sun

This unit is designed to make the students familiar with the star closest to the Earth. The unit starts with introduction of the Sun as a typical star. Then it slowly advances through several phenomena observed on the solar surface such as limb darkening, granulation, faculae etc. This is followed by more serious discussion on solar chromospheres and corona, the theory of the sunspots and solar magnetic field. Finally the students learn the transient events like solar flares and continuous events like solar wind and radio emissions from the Sun.

Unit III Spectral classification of stars, Binary and multiple stars

This unit covers observed and theoretical aspects of the stars and their interpretation. It starts with fundamental Boltzman's theory of ionization and its modification in the form of Saha's theory of ionization. These two theories make the students able to interpret the spectroscopic observations of stars and infer the chemical and physical status of the stars. This is followed by classification of the stars based on their spectra (eg. HD classification and HR diagram). The second part of the unit is devoted to observation and classification of binary star system, inference of orbits of binary stars, masses of the binary stars and origin of the binary stars.

Unit IV: Our Galaxy

This unit is a transition to the introduction of Cosmology. The students learn the basic structure of our Galaxy, statistical parameters of the Galaxy, radio emission from the center of the Galaxy, Rotation, Density distribution, spiral structure, the mass and magnetic field of our galaxy.

Course Code: US06CPHY01
Course Title: Quantum Mechanics
Course Outcome

UNIT- I Formulation of the Schrödinger Equation

Student's studied some concepts of quantum mechanics in sem-3 and 4 of 12^{th} standard. Recall failure of classical mechanics leading towards quantum mechanics.

Students will learn about how the Schrödinger equation governing the behavior of matter waves is developed. Students will learn how to obtain the Schrödinger equation for any moving material particle. Students will learn how to interpreted mathematical findings in terms of probability/physics. Students will learn the meaning of conservation of probability.

UNIT- II Stationary States and Energy Spectra

Students will learn how to solve actual problem of a particle (Schrödinger equation) to obtain its solution and energy levels. Student will learn about how to obtain general form of Schrödinger equation for a system of N-particles. Interpretation of wave function is also explained. Student will learn the representation of state of a system of particles and the superposition principle.

UNIT – III General Formalism of Wave Mechanics

The equations relating different forms of adjoint of operator and self adjoint operators, as well as their expectation values are discussed. Students will learn the meaning of degeneracy of eigen value. Students will learn the properties of Kronecker delta function and Dirac Delta function. Students will learn to obtain eigen value of momentum operator, corresponding orthogonality and property of closure are also discussed. The general Uncertainty principle for observables is discussed, leading to Heisenberg's Uncertainty principle. Students will learn how to remove degeneracy using commuting observables.

UNIT- IV Exactly Soluble Eigenvalue Problems

The students will learn about how to solve the eigen value equation of simple harmonic oscillator to obtain energy eigen values and energy eigen functions of SHO.

The components of angular momentum operators in spherical coordinates are obtained. The eigen value equation for L^2 is solved using method of separation of variables, The eigen values and solutions (spherical harmonics) are obtained. Students will obtain the radial wave equation for a particle moving in central potential, and will learn how to obtain possible solutions in various situations. Students will learn the non-localized states and localized states. The radial wave equation for Hydrogen Atom is solved to obtain its solution and corresponding energy eigen values. The difference between anisotropic oscillator and isotropic oscillator is discussed. Corresponding eigen value equations are solved to obtain eigen values and eigen functions.

Course Code: US06CPHY02
Course Title: Atomic-Molecular Physics, Energy Science and Earth Science
Course Outcome

UNIT- I Atomic Physics

Students studied some basic concepts of atomic physics standards 12^{th} and B.Sc. sem. 4. Students will recall the brief introduction about all atomic models.

Students will also learn about Spectrum of Hydrogen atom and spectral series, Observation of Hydrogen spectrum, Failure of electromagnetic theory, Bohr's theory and spectrum of Hydrogen atom, Franck-Hertz Experiment, Stern-Gerlach Experiment, Fine structure of Hydrogen lines, Positronium, Different series in Alkali spectra, Ritz combination principle, explanation of salient features of Alkali spectra, Alkali-like spectra, atoms of Alkaline elements, spectra of Alkaline earths.

UNIT- II Molecular Physics

The molecular spectroscopy is new concept for the students of B.Sc. through this unit the students will learn about the basics of molecular spectroscopy , they will also study the Separation of Electronic and Nuclear Motion, the Born-Oppenheimer approximation, types of molecular energy states and associated spectra, types of spectra, pure rotational spectra, Salient features, the molecule as a rigid rotator and non-rigid rotator, explanation of rotational spectra, validity of the theory, determination of the inter-nuclear distance(Bond length) and moment of inertia, Isotope effect in rotational spectra, Rotational spectra of polyatomic molecules, Raman effect, its salient features, experimental method to observe the Raman spectra.

UNIT – III Energy Science

Through this unit student will learn about the basics renewable energy and its applications. Such that Solar Thermal energy Conversion Subsystems, Solar ThermalCollectors, Characteristics features of a collectors, important aspects of solar thermal Collectors, Collector Efficiency, Simple Flat plate Collectors, Installation of Flat Plate Collectors, Guidelines for Installation, Shadow Effect, Cosine loss factor and reflective Loss Factor, introduction to Photovoltaic systems, Merits and Limitations of Solar PV Systems, Principle of a Photovoltaic cell, V-I characteristics of Solar Cell, Interconnections of solar cells, Efficiency of a Solar Cell, Configuration of a Solar PV Panel. Also learn about wind Energy, wind power density, Power in a wind stream, wind turbine Efficiency, Power of a wind turbine for given incoming Wind Velocity, Types of wind turbine –Generator Units, Mono-Blade, Twin- Blade and Three-Blade Horizontal axis Wind turbine (HAWT) Students also know about the various types of fuel cells advantages of fuel cell Power Sources, Theory of Electro-Chemistry applied to fuel Cells, Principle and Operation of fuel Cells,H_2-O_2 Acidic fuel Cell, Alkaline H_2-O_2 fuel Cell, Classification and types of Fuel Cells, Fuels for Fuel Cells, performance characteristics of Fuel Cell.

UNIT- IV Earth Science

The students will learn through this unit is the internal structure and various sections of Earth. Such as the Core, the Mantle, the Crust, also their influences, chemical composition, temperature and pressure in the earth. Also study the Atmosphere, its influence, Influence of the Sun and Moon, students also learn how to evaluate the density and mass of the Earth and the Sun.

Students can be learn about the Plate Tectonics, in this section they learn the classification of plates, oceanic and continental plates, movement of plates, Plate boundaries and about the Seismology and earth quake related all the features, namely, Seismology, Seismograph, Students also learn to determine epicenter and the focus, moreover modern applications of Seismology can be understand.

COURCE US06CPHY03
COURSE TITLE: NUCLEAR PHYSICS
COURSE OUTCOME

Unit I General Properties of Nucleus

Constituents of Nuclei and their intrinsic properties, Nuclear size, Nuclear mass – Aston's mass spectrograph and Dempster's mass spectrometer, Angular momentum, Magnetic moment, Electric quadrupole moment, Wave mechanical properties – parity and statistics, Non-existence of electron in nucleus, Neutron-proton hypothesis, Binding energy
Student will learn about how to find the mass of ion.

Unit II Q Equation and Liquid Drop Model of Nucleus

Q Equation: Introduction, Types of nuclear reactions, Balance of mass and energy in nuclear reactions, The Q equation, Solution of Q equation, Centre of mass frame in nuclear physics Liquid drop model of nucleus: Weizsacher's semi empirical mass formula, mass parabola-stability against β decay for an isobaric family, stability limits against spontaneous fission, Barrier penetration – decay probability for spontaneous fission, Nucleon emission
Student know about different types of nuclear reaction, Nuclear reaction produce tremendous high energy and where it is use?

Unit III Nuclear Energy and Applications of Nuclear Physics

Nuclear Energy: Introduction, Neutron induced fission, Asymmetrical fission-mass yield, Emission of delayed neutron by fission fragments, Energy released in the fission of 235U , Fission of lighter nuclei, Fission chain reaction, Neutron cycle in a thermal nuclear reactor, Nuclear reactors Applications of Nuclear Physics: The technique of NMR, Experimental setup of NMR, Some experiments with NMR, Radio isotopes in medicine, Diagnosis, Radio isotopes for therapy, Radio isotopes in archeology
Student know about hydrogen bomb and nuclear bomb. Nuclear physics is use in research and medicine and mankind living

Unit IV Detectors and Accelerators

Detectors: Gas filled ionization detectors, Ionization chamber, Proportional counter, Geiger-Mueller Counter, Plateau of G M Counter, Photomultiplier Tube, Cerenkov detector, Photographic Emulsion, Cloud Chamber, Bubble Chamber, Spark Chamber Accelerators: Basic components of Accelerators, Cockcroft Walton Generator, Van de Graff Accelerator, Two stage Tandem Van de Graff Accelerators, Pelletron Accelerators, Folded Tandem Accelerators, Linear Accelerators, Cyclotron, Betatron, Elementary particles-an introduction
Student visit Bhabha atomic research center (BARC) Trombay, Bombay to observe Van-de-graff generator, Liniac, Cyclotron and betatron

Course Code: US06CPHY04
Course Title: Electrodynamics & Plasma Physics
Course Outcome

UNIT- I Electrodynamics - I

In the first part of unit-I, students will learn about conductors, capacitors & dielectrics. They study the electric field inside the materials along with their basic properties and their behaviour in the electric field. They also study about Laplace's equation in one, two and three dimension. They use method of separation of variables for Cartesian and Spherical polar coordinates to study type of potential on different point inside a box, on a surface etc.

UNIT- II Electrodynamics - II

In this unit students study Magnetostatics: different types of magnets: Diamagnets, Paramagnets, Ferromagnets and study effect of magnetic fields in the material. They study bound currents, auxiliary H field and observe similarity in the physical quantities like electric displacement D and auxiliary H filed, bound charge and bound currents etc. In the second part they study about Electromotive Force, Ohm's Law, Motional emf, Electromagnetic Induction, Faraday's Law, Inductance, Maxwell's Equations and how Ampere's Law fixed by Maxwell.

UNIT – III Plasma Physics - I

We know that almost 99% of our universe is filled up with plasma. In this unit students study about plasma, properties and applications like Gas discharges, controlled thermo-nuclear fusion, Space physics, Modern astrophysics, MHD energy conversion and ion propulsion, Solid state plasma, Gas laser etc. They study the effect of electric field and magnetic field on plasma by considering single particle motion. Effect of Gravitational field, curvature drift etc.

UNIT- IV Plasma Physics - II

In this last unit, students apply fluid theory on plasma and compare with ordinary hydrodynamics. They study the fluid drift perpendicular to B and fluid drift parallel to B. By using plasma approximation they study Plasma oscillations and derive plasma frequencies. They compare the plasma oscillations with Sound waves & Ion waves and study about the validity of the plasma approximation.

Course Code: US06CPHY05

Course Title: Digital Electronics, Electronic Communication and VLSI Technology

Course Outcome

UNIT: 1 Number Systems, Gates and Logic Family

From this unit, students will avail the knowledge of binary, hexadecimal number system, and their mutual conversions. They will also learn ASCII code, varieties of logic gates like AND, OR, NOT, NOR, XNOR. Students will able to calculate Boolean algebra, De Morgan's theorem. Students will get knowledge about characteristics of TTL (Transistor Transistor Logic), its overview and 7400 device.

UNIT: 2 Flip-flops, Registers and Counters

From this students will avail about RS lateches, Level clocking, Variety of flip flops like D-flip-flop, edge triggered JK flip-flop, JK Master Slave flip-flop.
Students will also get knowledge about, registers like Buffer, shift. And different types of counters like Ripple, Ring, Synchronous, Modules and others.

UNIT: 3 Introduction to Electronic Communication (EC)

Students will learn about Importance of Electronic Communications, types of communication, elements of communication. They will learn in detail about Amplitude Modulation, Frequency modulation and Phase modulation as well as difference among them. From this unit they will also get idea about Bandwidth, Sidebands and frequency domain. They will learn about modulators (with a diode) and demodulators (diode detector).They will learn Voltage variable capacitor and Varactor modulator.

UNIT: 4 Devices for VLSI Technology

In this unit student will get very fine knowledge about general classification of integrated circuit, Advantages of ICs over discrete components, and the devices for VLSI (Very Large Scale Integration) Technology like Monolithic junction FETs,: n-channel, p-channel. MOSFETs Technology: PMOS, NMOS structure, comparison, differences and application of them. They will learn about Complementary symmetry MOSFET (CMOS), CMOS process, Silicon –gate process and Monolithic capacitors and resistors.