



Department of Physics

B.Sc. Physics

S.No.	Course Code	Course Name	Course Outcomes
SEMESTER- I			
1.	23UPHC11	Core Course -I : Properties of Matter and Acoustics	CO1[K1]: define elastic constants, surface tension, co-efficient of viscosity, simple harmonic oscillations and, state laws CO2[K2]: derive the expressions relating elastic constants, time period of oscillations, Poiseuille's formula, Stoke's formula and Sabine's Reverberation formula CO3[K3]: apply the concepts of properties of matter and acoustics to solve problems CO4[K4]: analyze the variation of surface tension and viscosity with temperature, Lissajou's Figures, production and applications of ultrasonic waves CO5[K5]: examine the experimental methods to determine the elastic parameters of matter



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2.	23UPHC1P	Core Course -II : Practical: Properties of Matter	CO1[K1]: identify the basic concepts of properties of matter underlying in the experiments CO2[K2]: setup the experiment and collect data to determine the physical parameters involved in the experiments CO3[K3]: calculate the basic parameters involved in the experiments from the experimental data CO4[K4]: analyze / interpret / plot graph / verify the theorem from the experimental data CO5[K5]: evaluate the physical parameters using appropriate formula/make conclusions from the experimental data
3.	23UPHA11	Elective Course Generic/ Discipline Specific - I: Mathematics - I	CO1[K1]: state the elementary concepts of calculus, numerical methods solving equations, eigen values and eigen vectors of matrices CO2[K2]: explain the application of differentiation, integration and the method of solving polynomial equations numerically CO3[K3]: find the numerical solution of polynomial equations, eigen values and eigen vectors of matrices, curvature and radius of curvature of curves, area, volume and centroid of surfaces CO4[K4]: interpret Cayley-Hamilton theorem, Leibnitz theorem, Jacobian determinant, iterative methods of solving polynomial equations CO5[K5]: determine the approximate solution of polynomial equations numerically, inverse, eigen values and eigen vectors of a matrix, n^{th} derivative of a function, curvature and radius of curvature of a curve, double and triple integration of integrands



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4.	23UPHS11	Skill Enhancement Course - I: Foundation Course - Introductory Physics	CO1[K1]: list out different types of forces, forms of energies and types of motion CO2[K2]: explain Laws of vector addition and subtraction, hydrostatics, flow of liquid, diffusion and osmosis CO3[K3]: find unit and dimensions of physical quantity CO4[K4]: summarize the basic concepts of physics pertaining to the course CO5[K5]: examine the basic concepts of physics involved in real life examples
5.	23UPHN11	Skill Enhancement Course - II: Non Major Elective Course : Physics for Everyday Life	CO1[K1]: list out the mechanical objects, optical instruments, home appliances used in everyday life CO2[K2]: explain the basic principles behind working of optical instruments, home appliances, solar water heaters and solar cells CO3[K3]: present the contributions of Indian physicist to the society CO4[K4]: summarize the concepts and applications of physics in everyday life CO5[K5]: examine the functions of instruments/devices/systems used in everyday life
SEMESTER- II			



S.No.	Course Code	Course Name	Course Outcomes
6.	23UPHC21	Core Course - III : Heat, Thermodynamics and Statistical Physics	CO1[K1]: define the basic physical terms involved in heat, thermodynamics and statistical physics CO2[K2]: explain the basic concepts of heat engines, modes of heat transfer, thermodynamics, and ensembles CO3[K3]: apply the concepts of thermal physics and statistical mechanics to derive the relations and solve problems CO4[K4]: distinguish different types of specific heat capacity of gases, modes of heat transfer, engines and statistical distribution functions CO5[K5]: examine the experimental methods to determine the physical parameters related to heat, thermodynamics and statistical physics
7.	23UPHC2P	Core Course - IV : Practical: Heat, Oscillations, Waves and Sound	CO1[K1]: identify the basic concepts of heat, oscillations, waves and sound underlying in the experiments CO2[K2]: setup the experiment and collect data to determine the physical parameters involved in the experiments CO3[K3]: calculate the basic parameters involved in the experiments from the experimental data CO4[K4]: analyze / interpret / plot graph / verify the theorem from the experimental data CO5[K5]: evaluate the physical parameters using appropriate formula/make conclusions from the experimental data



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8.	23UPHA21	Elective Course Generic/ Discipline Specific - II: Mathematics - II	CO1[K1]: describe the terminologies in trigonometric functions, hyperbolic functions, partial differentiation, vector calculus and interpolation CO2[K2]: explain the elementary concepts of trigonometric functions, hyperbolic functions, partial differentiation, vector calculus and interpolation CO3[K3]: find out the expansions of trigonometric functions, the missing values of given data, divergence and curl of the vector field, partial differentiation of functions CO4[K4]: characterize the properties of divergence and curl, hyperbolic functions and partial derivatives of functions CO5[K5]: determine the missing values of given data, partial differentiation of functions, expansion of trigonometric functions, derivatives of vector functions
9.	23UPHS21	Skill Enhancement Course- III: Energy Physics	CO1[K1]: list out the various non-conventional energy resources available in our earth CO2[K2]: explain the physics concepts behind solar, wind and biomass energy conversion technologies CO3[K3]: present the applications of non-conventional energy resources CO4[K4]: summarize the importance of the solar energy, wind energy, biomass energy and energy storage systems CO5[K5]: justify the merits and demerits of non-conventional energy resources



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10.	23UPHN21	Skill Enhancement Course - IV: Non Major Elective Course : Astrophysics	CO1[K1]: recall the fundamentals of astrophysics CO2[K2]: explain the physics of telescopes and eclipses CO3[K3]: present the fundamentals of solar systems, sun, stellar evolution and galaxies CO4[K4]: distinguish different types of telescopes, stellar objects, eclipse, stars and galaxies CO5[K5]: construct simple telescopes, develop models and do case study
SEMESTER- III			
11.	23UPHC31	Core Course - V : Electricity, Magnetism and Electromagnetism	CO1[K1]: state the basic concepts of capacitors, thermoelectricity, magnetic effects of currents, electromagnetic induction, AC current, Maxwell's equation and electromagnetic waves CO2[K2]: explain the concepts of capacitors, thermoelectricity, magnetic effects of currents, electromagnetic induction, AC current, Maxwell's equation and electromagnetic waves CO3[K3]: apply the concepts of electricity, magnetism and electromagnetism to solve problems CO4[K4]: analyze the applications of concepts of electricity, magnetism and electromagnetism CO5[K5]: examine the parameters related to electricity, magnetism and electromagnetism



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12.	23UPHC3P	Core Course - VI : Practical: Electricity	CO1[K1]: identify the basic concepts of electricity underlying in the experiments CO2[K2]: setup the experiment and collect data to determine the electrical and magnetic parameters involved in the experiments CO3[K3]: calculate the basic parameters involved in the experiments from the experimental data CO4[K4]: analyze/interpret/plot graph/verify the theorem from the experimental data CO5[K5]: evaluate the electrical and magnetic parameters using appropriate formula/make conclusions from the experimental data
13.	23UPHA31	Elective Course Generic/ Discipline Specific - III: Chemistry For Physical Sciences - I	CO1[K1]: describe the principles chemical bonding, nuclear chemistry, thermodynamics and hybridization of organic compounds CO2[K2]: explain the concepts involved in Fuels, analytical chemistry, thermodynamics and phase equilibria CO3[K3]: find out the use of isotopes, fertilizers and reaction mechanism CO4[K4]: analyze the MO theory, silicones, heterocycles and thermodynamics CO5[K5]: evaluate the application of chromatography, radioisotopes and phase rule



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14.	23UPHA3P	Elective Course Generic/ Discipline Specific - III: Practical: Chemistry Practical For Physical Sciences - I	CO1[K1]: estimate oxalic acid by acidimetric and permanganometric method CO2[K2]: choose suitable indicator for carrying out volumetric estimation CO3[K3]: apply acidimetric and alkalimetric method for the quantitative volumetric estimation of acids and bases CO4[K4]: measure quantitatively the amount of inorganic compound accurately with the help of color change of the indicator CO5[K6]: plan various volumetric procedures for the estimation of any inorganic compounds
15.	23UPHS3P	Skill Enhancement Course- V: (Entrepreneurial Skill)- Practical : Electrical Wiring	CO1[K1]: identify different electrical tools/wires/devices/accessories used in electrical wiring CO2[K2]: demonstrate simple home electrical wiring circuits CO3[K3]: use electrical measuring devices for measurements CO4[K4]: verify properties of series and parallel electrical circuits CO5[K5]: construct simple home electrical switch board wiring circuits with energy meter and fuse



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16.	23UPHS31	Skill Enhancement Course – VI: Electrical Wiring and Appliances	CO1[K1]: identify the basic concepts of electricity, electrical wiring and home appliances CO2[K2]: explain the usage of AC and DC currents, motors, lighting accessories, earthing, fuses and electric devices CO3[K3]: apply concepts of electricity, electrical wiring and home appliances to solve problems CO4[K4]: analyze the functions of AC and DC currents, AC machines, switches, types of wires, fuses and home appliances CO5[K5]: justify the simple house wiring circuits
SEMESTER- IV			
17.	23UPHC41	Core Course – VII : Optics	CO1[K1]: list out aberration in lenses, different optical elements and its applications CO2[K2]: explain the construction and working of eyepieces, interferometers, zone plates, quarter and half wave plates. CO3[K3]: apply the concepts of geometrical optics and physical optics to derive expressions and solve problems CO4[K4]: distinguish optical phenomena due to refraction, interference, diffraction and polarization CO5[K5]: examine the experimental methods to evaluate the physical/optical parameters



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18.	23UPHC4P	Core Course – VIII : Practical: Light	CO1[K1]: identify the basic concepts of optics underlying in the experiments CO2[K2]: setup the experiment and collect data to determine the optical/physical parameters involved in the experiments CO3[K3]: calculate the basic parameters involved in the experiments from the experimental data CO4[K4]: analyze / interpret / plot graph / verify the theorem from the experimental data CO5[K5]: evaluate the optical/physical parameters using appropriate formula/make conclusions from the experimental data
19.	23UPHA41	Elective Course Generic/ Discipline Specific - IV: Chemistry For Physical Sciences - II	CO1[K1]: describe the principles coordination chemistry, carbohydrates, catalysis, photochemistry and electrochemistry CO2[K2]: explain the concepts in water technology, amino acids and kinetics CO3[K3]: apply the Werner's theory, energy of activation and photochemical laws CO4[K4]: analyze structure of carbohydrate, biomolecules, water components and quantum yield CO5[K5]: discuss the various cells, order of reactions and amino acids



S.No.	Course Code	Course Name	Course Outcomes
20.	23UPHA4P	Elective Course Generic/ Discipline Specific - IV: Practical: Chemistry Practical For Physical Sciences - II	CO1[K1]: recognize the analytical procedure to identify the given organic compounds CO2[K2]: determine the saturation/unsaturation nature of given organic compounds CO3[K3]: inspect the aliphatic/aromatic and nature of given organic compounds CO4[K4]: predict elements (other than C, H and O) present in the given compound CO5[K6]: perform systematic analysis and report the functional groups present in the given organic compound.
21.	23UPHS41	Skill Enhancement Course - VII: Physics of Medical Instruments	CO1[K1]: list out bio-medical instruments and its components, and medical imaging methods CO2[K2]: explain the concepts of physics applied in bio medical instruments, x-ray diagnostics and laser surgery CO3[K3]: present the basics of operation theatre, radiation safety measures, applications of X-rays and Laser in medicine CO4[K4]: compare the different types of bio potential electrodes and biomedical recording setup CO5[K5]: examine the functioning of bio-medical instruments, medical imaging systems, x-ray radiography and Laser endoscopes



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22.	23UPHS4P	Skill Enhancement Course – VIII: Practical : Basics of Optical and Electronic Devices	CO1[K1]: list the various optical and electronic devices, and instruments CO2[K2]: classify the various optical and electronic devices, and instruments CO3[K3]: operate the various optical and electronic devices, and instruments CO4[K4]: measure various basic physical parameters of optical and electronic devices CO5[K5]: analyze the various physical parameters of optical and electronic devices
SEMESTER- V			
23.	23UPHC51	Core Course – IX : Mechanics	CO1[K1]: state laws of motion, gravitation, conservation of linear momentum, angular momentum and energy CO2[K2]: explain the conservation laws, classical and Einstein's theory of gravitation, concepts of translational motion, rotational motion and Lagrangian mechanics CO3[K3]: apply concepts of mechanics to simple problems and derive equations/find solution CO4[K4]: distinguish conservative and non-conservative forces CO5[K5]: examine the satellite kinetic energy, body rolling down an inclined plane, gyroscopic precision, simple pendulum, atwood's machine on the basis of concepts of mechanics



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24.	23UPHC52	Core Course – X : Atomic and Nuclear Physics	CO1[K1]: reproduce the concepts of various atom models, atomic spectra, radioactivity, nuclear reactions, nuclear structure models and elementary particles CO2[K2]: describe the important phenomena in atomic and nuclear physics CO3[K3]: apply the concepts of atomic and nuclear physics to solve problems and to derive expressions CO4[K4]: analyze the various atom models, atomic of spectral lines, radioactive decays and nuclear structure models CO5[K5]: examine the experimental methods to understand the concepts of atomic and nuclear physics
25.	23UPHC53	Core Course – XI : Analog and Communication Electronics	CO1[K1]: identify the basic principles behind electronic devices and circuits CO2[K2]: describe the functioning of diode rectifiers, transistor amplifiers and oscillators, electronic circuits based on op-amplifiers CO3[K3]: apply basic principles to solve numerical problems pertaining to electronics circuits CO4[K4]: analyze the theory of different types of modulation, electronic circuits of demodulation and its applications CO5[K5]: evaluate the output of the electronic circuits



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26.	23UPHC5P	Core Course – XII: Practical: General Physics	CO1[K1]: identify the basic concepts of optics, electricity and electromagnetism and modern physics underlying in the experiments CO2[K2]: setup the experiment and collect data to determine the physical parameters involved in the experiments CO3[K3]: calculate the basic parameters involved in the experiments from the experimental data CO4[K4]: analyze / interpret / plot graph / verify the theorem from the experimental data CO5[K5]: evaluate the physical parameters using appropriate formula/make conclusions from the experimental data
27.	23UPHO51	Elective Course Generic/ Discipline Specific - V: Lasers and Fiber Optics	CO1[K1]: list the types, characteristics and applications of Laser and optical fibers CO2[K2]: explain principle and mechanism of working of Lasers and optical fibers and its fabrication techniques CO3[K3]: present the fundamentals of Lasers and fiber optics for different applications CO4[K4]: summarize the characteristics and applications of different types of Laser and optical fibers CO5[K5]: inspect the characteristics, construction, fabrication and applications of Lasers and optical fibers



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28.	23UPH052	Elective Course Generic/ Discipline Specific - V: Digital Photography	CO1[K1]: list out the types of camera and its components CO2[K2]: explain the basic principles of formation and controlling of images in film and digital camera CO3[K3]: present the concepts of photography CO4[K4]: summarize the image formation, components and post production process in cameras CO5[K5]: discuss the image formation, controlling of images, post production process in cameras
29.	23UPH053	Elective Course Generic/ Discipline Specific - VI: Mathematical Physics	CO1[K1]: state the fundamental theorems in matrix, vector calculus, orthogonal curvilinear coordinates, Fourier series and Fourier transform CO2[K2]: explain the fundamental theorems in pertaining to the course CO3[K3]: apply the formulae and theorems to solve the problems CO4[K4]: classify the types of matrices, operators, Fourier series and Fourier transform CO5[K5]: evaluate a physical system problem by using partial differential equations



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30.	23UPH054	Elective Course Generic/ Discipline Specific - VI: Numerical Methods and C Programming	CO1[K1]: recall the different numerical methods and fundamental terms in C programming CO2[K2]: explain numerical differentiation, integration and curve fitting and different control statements used in C programming CO3[K3]: find out the solutions by using different numerical methods CO4[K4]: analyze the applications of numerical methods and programming in C. CO5[K5]: write algorithm, flow chart and programs for simple problems using numerical methods and C programmes
31.	23UPHJ51	Internship/Industrial Training	CO1[K1]: identify different career paths within the industry and gain insights into potential future roles. CO2[K3]: apply theoretical concepts and academic knowledge to real-world situations and challenges encountered during the internship CO3[K4]: analyse problems, generate innovative solutions, and make informed decisions CO4[K5]: evaluate how to manage time effectively and prioritize tasks to meet deadlines and deliver quality work CO5[K6]: create a portfolio of the work, projects, and achievements during the internship
SEMESTER- VI			



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32.	23UPHC61	Core Course – XIII : Quantum Mechanics and Relativity	CO1[K1]: state basic terms in relativity and quantum mechanics CO2[K2]: explain about relativity, transformation relations, wave mechanical concepts, general formalism and applications of Schrödinger equations CO3[K3]: apply the concepts of relativity and quantum mechanics to solve problems CO4[K4]: analyze the validity conditions of relativity, transformation relations and quantum mechanical concepts CO5[K5]: deduce the solutions of simple problems by solving Schrödinger equation
33.	23UPHC62	Core Course – XIV : Solid State Physics	CO1[K1]: reproduce the basic principles behind the solid state materials CO2[K2]: explain the basic concepts of bonding in solids, crystal structures and lattice dynamics CO3[K3]: apply the concepts of solid state physics to solve numerical problems CO4[K4]: examine the properties of magnetic, dielectric, ferroelectric and superconducting materials CO5[K5]: evaluate the different physical parameters of solid materials



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34.	23UPHC63	Core Course – XV: Digital Electronics and Microprocessor 8085	CO1[K1]: recall the fundamentals of number systems, Boolean algebra, flip flop, registers, counters, logic families and 8085 microprocessor CO2[K2]: explain the functioning of logic gates, digital circuits, memory operations and 8085 microprocessor. CO3[K3]: apply concepts of digital electronics to simplify the Boolean equations and one number system to another number system. CO4[K4]: analyze the functioning of digital circuits, programs and I/O interfaces of the 8085 microprocessor. CO5[K5]: construct simple digital circuits and write simple programs to perform mathematical operations using 8085 microprocessor
35.	23UPHC6P	Core Course – XVI: Practical: Electronics	CO1[K1]: identify the basic concepts of analog and digital electronics, and microprocessor 8085 underlying in the experiments CO2[K2]: setup the experiment and collect data to determine the physical parameters involved in the experiments CO3[K3]: calculate the basic parameters involved in the experiments from the experimental data CO4[K4]: analyze / interpret / plot graph / verify the theorem from the experimental data CO5[K5]: evaluate the physical parameters using appropriate formula / make conclusions from the experimental data



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36.	23UPHJ61	Core Course – XVII: Project with Viva Voce	CO1[K2]: demonstrate the physical, chemical and mathematical concepts of their project work CO2[K3]: present the physical, chemical and mathematical concepts of their project work CO3[K4]: analyze the their project work qualitatively and quantitatively CO4[K5]: justify the benefits of their project work to the society CO5[K6]: develop new plans for further improvement of their project work
37.	23UPHO61	Elective Course Generic/ Discipline Specific - VIII: Materials Science	CO1[K1]: list out the different types of crystal imperfections, material strengthening methods, optical materials and mechanical testing methods CO2[K2]: explain the crystal imperfections, material strengthening methods, elastic behavior of materials and non-destructive testing methods CO3[K3]: present the applications of point defects and NLO Materials CO4[K4]: analyze the effect of imperfections, viscoelastic behaviour of materials and materials testing methods CO5[K5]: inspect the working of display devices, radiographic, ultrasonic and thermal method of NDT, and metallurgical microscope



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38.	23UPHO62	Elective Course Generic/ Discipline Specific - VIII: Nanoscience and Nano Technology	CO1[K1]: list out different types of nanostructures, properties of nanomaterials, fabrication methods and characterization techniques CO2[K2]: explain physics behind quantum confinement, electrical, mechanical, dielectric and magnetic properties of nanomaterials CO3[K3]: present different fabrication methods and analysis of nanomaterials by different characterization techniques CO4[K4]: analyze the size effect on the properties of nanomaterials CO5[K5]: examine the applications of nanomaterials in medicine, sensors, energy storage systems and nanoelectronics
39.	23UPHS61	Skill Enhancement Course – IX: Solar Photovoltaics	CO1[K1]: state the fundamentals of solar radiation, solar cells and design of PV systems CO2[K2]: explain the spectral energy distribution of solar radiation, IV characteristics of solar cell, maximizing the PV output and design of PV systems CO3[K3]: present the characteristics, classification and design of solar cells and solar PV systems CO4[K4]: classify the solar cells on the basis of thickness and types of active material, and solar PV systems. CO5[K5]: examine the different applications of solar PV systems