

Department of Physics
Government Girls' General Degree College, Kolkata
PROGRAMME OUTCOME AND COURSE OUTCOME
CHOICE BASED CREDIT SYSTEM (CBCS)

➤ **PROGRAMME SPECIFIC OUTCOMES(PSO)**

1.	Pursuance of this programme helps the students to understand our living world with their scientific reasoning.
2.	Students learn how to solve problems and prove various theorems. And solving problems based on realistic situation make them understand how various physical systems in everyday life works.
3.	Spreading awareness regarding the energy harvesting and other Environmental issues. Several sources of renewable energy are discussed in the program to anchor the students towards the understanding of Green energy uses.
4.	This degree opens a wide vista in the direction of science and technology.
5.	Student can pursue Masters degree in Physics, applied physics, biotechnology and other various disciplines.
6.	Study of Nano material application relates the students with industrial, medicinal, and other uses of Nanoparticles in modern days.
7.	Students can appear in different competitive examinations.
8.	Knowledge of different electrical circuit, motors provide higher study and/or job opportunities in the field of technology.

➤ **COURSE OUTCOME**

Core Courses	Course Outcomes
PHS-A-CC-1-1-TH: Mathematical Physics	<ol style="list-style-type: none"> 1. Student must know the properties of partial differentiation. 2. How to apply vector analysis in the field of different areas of physics. 3. Students must learn how to interpret mathematics physically. 4. Student should know on matrix theory. 5. Through the course of practical student should know the elementary programming with python and numerical analysis. 6. Student should know the elementary error analysis 7. Student should know the graph drawing with python and gnuplot 8. Through the course of practical student should know the elementary programming with python and data and series handling.
Paper: PHS-A-CC-1-2 Mechanics and Fluid dynamics	<ol style="list-style-type: none"> 1. Acquire an idea of Inertia, kinetics of physical objects, motion of any objects Inertial and non-inertial frame. 2. Understand how to describe motion of objects in terms of its mass and force 3. Reveal the mystery of planetary motions, gravitation, projectile motion, Rocket, escape velocity, become easier. 4) Learn the application of the conservation principle in lift and other cases. 5) Understand laws of motion, reference frames, and its applications i.e. projectile motion, simple harmonic oscillator, Rocket motion, elastic and inelastic collisions. 6) Understand the idea of conservation of angular momentum, central forces effective potential. 7) Gain an idea on the application of central force to the stability of circular orbits, Kepler's laws of planetary motion. 8) Understand the cause of deflection of wind due to Coriolis force, movement of a system having interconnected bodies. 9) Connect with the learning the important properties like

	<p>pressure, surface tension for a fluid.</p> <p>10) Understand the basics of material properties like, elasticity, elastic constants and their relation, torsion of a cylinder, bending of a beam, cantilever, beam supported at its ends and loaded in the middle.</p> <p>11) Know streamline and turbulent motion of fluid, flow of fluid through a capillary tube, equation of continuity, concept of critical velocity.</p>
<p>Paper: PHS-A-CC-2-3-TH Electricity and Magnetism</p>	<ol style="list-style-type: none"> 1) Concept of Delta Function and its importance. 2) Basic concepts of electrical charges, different concepts of charge density, relation between charges and corresponding currents. 3) Significance of different Laws and the applications. 4) Understand Divergence and Curls of fields. 5) Comparative study of conductors, dielectrics, inductance and capacitance. 6) Understand the electrical and magnetic materials. 7) Understand the concept of static and time varying fields. 8) Understand the process of generation of electrical and magnetic field by induction. 9) Learn about Electromagnetic Theory in every aspect and also in Universe. 10) Basic concepts of distribution of charge in circuit in terms of voltage and current by Kirchhoff's law. 11) Gain knowledge about reactance and impedance, Band width of series and parallel LCR AC circuit.
<p>Paper: PHS-A-CC-2-4-TH Waves and Optics</p>	<ol style="list-style-type: none"> 1. Student should learn the physics of vibration, oscillation and resonance 2. Student should learn the physics of vibration, oscillation and resonance 3. In this course student should learn the physics of vibration, oscillation and resonance 4. Student should learn the physics of vibration, oscillation and resonance 5. They should learn the physics of vibration, oscillation and resonance

	<p>6. Learn physics of light and able to understand underlying magnificent phenomena of light.</p> <p>7. Learn the mechanism of optical instruments.</p> <p>8. Student should learn Modern optical instruments and their basic principles</p> <p>8. Student should learn Modern optical instruments and their basic principles</p> <p>Practical:</p> <p>From the experimental course student must learn to calibrate an optical instrument and measure refractive index of the Material of a prism</p> <p>From the experimental course student must learn to calibrate an optical instrument and measure dispersive power and Cauchy constants of the material</p> <p>Student must learn to calibrate an optical instrument and measure wavelength of sodium light</p> <p>Student must learn to calibrate an optical instrument and measure wavelength of sodium light</p> <p>Student must learn to calibrate an optical instrument and measure the thickness of a thin paper</p> <p>Student must learn to calibrate an optical instrument and measure the spacing between the adjacent slits</p>
<p>Paper: PHS-A-CC-3-5-TH Mathematical Physics -II</p>	<p>1. Student must know the method of expansion in eigenfunction.</p> <p>2. Student must know the properties of special function.</p> <p>3. Student must know the properties of special function and their properties must be clear to them.</p> <p>4. Student must know the advanced techniques like variational principles should be familiar to them.</p> <p>5. Student must know how to solve the partial differential equation and common application and the behaviour of daily life phenomena of hearing and sound production must be clear to them.</p>

	<p>Practical: Student must learn how to represent data and experimental results are also be the outcome of the course.</p> <p>Student must learn how to represent data and analyze with Gauss elimination method and Gauss Seidel method</p> <p>Student must learn how to represent data and analyze with matrices.</p> <p>Student must learn how to represent data and analyze with Special functions</p> <p>Student must learn how to represent data and analyze with Bisection and Newton-Raphson method</p> <p>Student must learn how to represent data and analyze with Lagranges method</p> <p>Student must learn how to represent data and analyze with Numerical differentiation</p> <p>Student must learn how to represent data and analyze with Numerical integration</p> <p>Student must learn how to represent data and analyze with Solution of ODE</p> <p>Student must learn how to represent data and analyze with Basic 3D graph plotting</p>
<p>Paper: PHS-A-CC-3-6 Thermal Physics</p>	<ol style="list-style-type: none"> 1) Basic concept of equilibrium of system and surroundings, boundary of system, properties of system. 2) Gain knowledge on path dependent function of a system. 3) Understand the basic relation between work and heat, principle and laws of Thermodynamics. 4) Idea of absolute scale of Temperature. <p>Understand the concepts of Entropy, various thermodynamic potentials and their applications in various systems</p>

	<p>5) Understand the view of free or available energy of a system.</p> <p>6) Gain a sense of distribution of velocity and corresponding energy of gas molecules resulting calculation of different types of velocities.</p> <p>7) Gain knowledge about microscopic behavior of systems in explaining pressure, transport properties, viscosity, diffusion etc.</p> <p>8) Conception of ideal gas and real gas and the deviations.</p> <p>9) Calculation of one-dimensional heat flow.</p>
<p>Paper: PHS-A-CC-3-7</p> <p>Modern Physics</p>	<p>1. Fundamentals of quantum physics is introduced here.</p> <p>2. Heisenberg uncertainty principle is introduced and its applications are discussed.</p> <p>3. Schrodinger equation for non-relativistic particles is introduced here. Momentum and Energy operators and stationary states are discussed. Physical interpretation of a wave functions, probabilities and normalization and Probability and probability current densities in one dimension are also introduced.</p> <p>4. Energy eigenvalues and normalized eigenfunctions are evaluated for one dimensional infinitely rigid box.</p> <p>5. Fundamentals of atomic nucleus and nuclear models are discussed.</p> <p>6. Fundamentals of Radioactivity is introduced here.</p> <p>7. Nuclear Fission and fusion are discussed here.</p> <p>8. Fundamentals of Laser physics is introduced here.</p> <p>Practical: This practical to determine the Planck's constant using LEDs of to be performed for at least 4 different colours.</p> <p>Student should perform the experiment to determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.</p> <p>Photo-electric effect is studied here. This practical is performed to determine work function of material of filament of directly heated vacuum diode.</p>

	<p>Student should perform the tunnelling effect in tunnel diode using I-V characteristics.</p>
<p>Paper: PHS-A SEC-A-2-TH Renewable energy and Energy Harvesting</p>	<ol style="list-style-type: none"> 1. In this unit the study of Fossil fuels and Alternate Sources of energy is introduced 2. Solar energy is introduced in this unit. 3. This unit discusses the Wind Energy harvesting. 4. This unit studies the Ocean Energy. 5. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass are studied in this unit. 6. Geothermal Energy is discussed here. 7. Student should learn hydro-energy and know about the environmental impact of hydro power sources. 7. Piezoelectric Energy harvesting is introduced in this unit. 8. This unit discusses Electromagnetic Energy Harvesting. 9. Student will learn about the design principle of operation of fuel cell/
<p>Paper: PHS-A-CC-4-8 Mathematical Physics-III</p>	<ol style="list-style-type: none"> 1. Students are able to learn the underlying principles and applications of Complex Analysis 2. Students are able to learn the underlying principles and applications of . Variational calculus in Physics 3. Students are able to learn the underlying principles and applications of Special theory of Relativity
<p>Paper: PHS-A-CC-4-9 Analog Electronics</p>	<ol style="list-style-type: none"> 1. Basic idea of different component of circuits and development of network using circuits. 2. Learn the types of Semiconductor and related viewpoints. 3. Acquire a knowledge of different components of transistors in different mode, field effect transistor, Transistor in various amplification mode. 4. Learn the regulation of Power supply and Zener diode. 5. Learn and acquire a skill on feedback amplifier, OPAMP, multivibrators, oscillators.

<p>Paper: PHS-A-CC-4-10 Quantum Mechanics</p>	<ol style="list-style-type: none"> 1. The student will be able to: i) Know type of potential energy including creating a double potential, ii) Height and width of the potential energy; iii) Energy of the Gaussian wave packet 2. The student will be able to: i) Know Continuity of wave function ii) Application to one dimensional square well 3. The student will be able to: i) Describe the model of the quantum harmonic oscillator ii) Identify differences between the classical and quantum models of the harmonic oscillator iii) Explain physical situations where the classical and the quantum models coincide 4. The student will be able to identify the unique features of the hydrogen atom that make it important for calculations in quantum mechanics. 5. The student will be able to i) Define quantum number. ii) Calculate angle of angular momentum vector with an axis. iii) Define spin quantum number. 6. The student will be able to know the relationship between atomic spectra and the electronic structure of atoms 7. The student will be able to carry out experimental and theoretical studies on atomic and molecular physics with focus on structure & dynamics of atoms and molecules. 8. The student will be able to write the electron configuration of any element and relate its electron configuration to its position in the periodic table
<p>PHS-A SEC-B -TH: Electrical Circuits and Network skills</p>	<ol style="list-style-type: none"> 1. Learn the generation of emf in motors, armature, windings and their characteristics. 2. Concept of different parts of transformer and their connections. 3. Gain knowledge on AC motor, induction motor with diagram. 4. Learn wattmeter method and how to measure power by it, circuit breaker. 5. Learn utilization of sub-station with block diagram.
<p>Paper: PHS-A-CC-5-11 Electromagnetic Theory</p>	<ol style="list-style-type: none"> 1. Learn basic idea of scalar and vector potential, electromagnetic wave equation, Maxwell's equations, gauge transformations, Poynting vector, Electromagnetic field

	<p>energy density, momentum density etc.</p> <ol style="list-style-type: none"> Gain a knowledge of bounded and unbounded medium and derivation of formula for Propagation of electromagnetic wave through those medium, skin depth, reflection and refraction at interface. Derivation the theory of different types of Polarization Get a view on uniaxial and biaxial crystals, quarter and half wave plate, how to produce polarized light. Learn rotatory polarization and the working principle of polarimeter.
<p>Paper: PHS-A-CC-5-12 Statistical Physics</p>	<ol style="list-style-type: none"> It gives an account of the theory of statistical mechanics and the approximations making a statistical description possible. It applies the theory to understand gases and crystals and in addition be able to construct microscopic models and from these derive thermodynamic observables. Students will be able to understand how Bose-Einstein Statistics can be applied to particles having integral spin number and do not obey Pauli's principle. Blackbody radiation is a cornerstone in the study of quantum mechanics. Student will get complete understanding of Fermi energy, the Fermi-Dirac distribution and total electronic energy of a free electron gas Fermi-Dirac statistics has many applications in studying electrical and thermal conductivities, thermoelectricity, thermionic and photoelectric effects, specific heat of metals <p>Practical: Student will able to perform analysis of probabilistic events with random numbers and histograms.</p> <p>Student will able to perform analysis of probabilistic events with random numbers and simulate some simple experiments with Monte-Carlo.</p> <p>Student will able to perform analysis and represent various statistical laws.</p>
<p>Paper: PHS-A-DSE-A1-TH: Laser & Fiber Optics</p>	<ol style="list-style-type: none"> Students acquire knowledge about the theoretical and historical knowledge of Laser. Students know about the basic properties of Laser. Students get knowledge about essential properties of resonators and their modes. Student can analyse transient behaviour of Laser. Students gather knowledge about gas Laser, solid state Laser and semiconductor Laser.

	<ol style="list-style-type: none"> 6. Students learn how to use Laser in practical purpose. 7. Recognise and classify the structure of optical fiber analyse various coupling losses and the application of optical fiber in communication and sensing. 8. Acquire knowledge about Holography which involves transmission and reception of the wave patterns using an optical fiber. 9. Students get an idea about nonlinear effects occur in optical fiber.
PHS-A-DSE-B1-TH (a) Astronomy and Astrophysics	<ol style="list-style-type: none"> 1. Students are introduced with the basic contents of the universe. Students also get knowledge about the measurement scale of the universe. Students acquire knowledge about the radiative transfer processes. 2. Different types of telescopes are introduced here. Observational techniques in different wavebands are also discussed. 3. Students get knowledge about the stars and stellar evolution is discussed in detail. 4. The theory of the galaxy is introduced along with detailed discussion of our galaxy Milky Way. 5. Basic theory of cosmology is introduced to the students. Students also acquire knowledge about the dark matter dark energy and big bang cosmology.
PHS-A-DSE-B1-TH (b) Nuclear and Particle Physics	<ol style="list-style-type: none"> 1. Acquire basic knowledge of properties of nuclei, nuclear models and radioactivity. 2. Students get knowledge about different types of reactions. Hence find Q value and reaction cross section. 3. Students get idea about the interaction of gamma ray with matter eg photoelectric effect, Compton scattering and pair production. 4. Students gather knowledge about the principle of nuclear detectors. 5. Students acquire knowledge about Particle accelerator, their limitations and use. 6. Students can recognize fundamental particles and their antiparticles. Study their basic characters.
Paper: PHS-A-CC-6-13 Digital Electronics	<ol style="list-style-type: none"> 1. Enable students to understand how to work with IC 2. To understand and examine the structure of various number systems and its application in digital design. 3. Have a thorough understanding of the fundamental concepts and techniques used in digital electronics. 4. Educating the students about the circuit configuration of binary addition and subtraction 5. To impart clear idea of Arithmetic logic unit of Computer to the students. 6. To build up clear concepts of memory circuit configurations of Computer.

	<ol style="list-style-type: none"> 7. To develop the idea of design of registers and counters, which are essential part of learning computer hardware. 8. To develop concept of data storage in the students. 9. Enable the students to know the circuit diagram and proper operation of data conversion. <p>Practical:</p> <p>Hands on experience on computer hardware Hands on experience on circuitry performing addition etc. Learning design concepts of memory circuit To gain experience on hardware of ALU</p>
<p>Paper: PHS-A-CC-6-14 Solid State Physics</p>	<ol style="list-style-type: none"> 1. Gain an conception of crystal structure, miller indices, diffraction of x-rays, crystal indexing. 2. Learn lattice dynamics, phonon, specific heat of solid. 3. Understand different types of ferromagnetic materials, quantum mechanical characteristics of para and ferromagnetic domains, hysteresis. 4. Gain an idea of polarization in dielectric materials. 5. Acquirement a detail concept of free electron gas. 6. Understand the basic of band theory and its effect on solid. 7. Learn the phenomena of Superconductivity – one of major break-through in modern science
<p>Paper: PHS-A-DSE-A2 Nano Materials and Applications</p>	<ol style="list-style-type: none"> 1. Gain the basic concept of nanoscale in different dimension, quantum confinement, application of Schrödinger equation in different cases. 2. Learn the various types of synthesis and the process of characterization of nano structures 3. Learn optical and electrical properties of nano-materials, defects and impurities. 4. Acquire a knowledge on the different applications of nano-materials, quantum dots.
<p>Paper: PHS-A-DSE-B2 Communication Electronics</p>	<ol style="list-style-type: none"> 1. Students will learn about the flow chart of communication system 2. Students will have a brief idea about TRAI 3. Students will learn about the working principles of analog modulations like, AM, FM, PM etc 4. Students will learn about the advanced analog pulsed modulation techniques and their applications 5. Students will learn about the modern day digital pulsed modulation techniques and their applications 6. Students will learn about the GPS, navigation systems, mobile and internet technologies and their applications

➤ PROGRAMME OUTCOMES(PO)

	Program Outcome	Description
PO1	Subject Knowledge	Knowing the fundamentals of the different areas of discussion within the subject which will enable the students to consider applying the theoretical principles.
	Method of Measurement:	Assessment (Internal & university exam)
PO2	Communication Skills	Encouraging the students to apply the principles of physics in their own lives, both professional and personal, thus, they can communicate with society and nation with scientific view.
	Method of Measurement:	Regular Internal Assessment
PO3	Technical Skill Development	Knowing and developing the technical skills expected from the students professional area.
	Method of Measurement:	Assessment (Internal & Final)
PO4	Personality Development	Personality development skills to the students that are likely to be developed and enlighten their professional and personal lives, thus making them responsible and sincere citizens.
	Method of Measurement:	Regular Mentoring
PO5	Higher Study Foundation	Encouraging the students to pursue higher studies and research in the subject and enhance their knowledge on the same.
	Method of Measurement:	Regular Teacher-Student Interactive Sessions
PO6	Research Orientation and Aptitude	Encouraging the students to pursue research related to the subject either in the academic or in the professional sphere that may lead to a vibrant knowledge economy.
	Method of Measurement:	Regular Teacher-Student Interactive Sessions
PO7	Spirit of Team Work	Encouraging the students to coordinate with one another in a team environment and perform well as a team rather than trying to excel individually at the cost of group performance efficiency.
	Method of Measurement:	Group Activity Assignments Assessment
PO8	Socio-Cultural and Environmental Responsibility	Encouraging the students to be socio-culturally and environmentally responsible citizens and work accordingly towards the betterment of the society and the nation.
	Method of Measurement:	Regular Teacher-Student Interactive Sessions