Program Outcome of B.Sc. Physics (Honours)

(under CBCS curriculum of the Bankura University)

PO1. The students will acquire a scientific knowledge of the fundamental principles of Physics through study of Classical Mechanics, Electromagnetic Theory, Optics, Heat and Thermodynamics, Statistical Mechanics, Solid State Physics, Nuclear Physics, Modern Physics, Quantum Mechanics and other areas of Physics.

PO2. The students will use appropriate technology for : a) experimental design and implementation, b) analysis of experimental data, and c) numerical and mathematical methods in problem solving, d) different computational techniques and apply them for experimental data analysis and solving theoretical problems.

PO3. The students will acquire a fair amount of computational skill using open source software packages such as Gnuplot, Python, Numpy, Scipy, Matplotlib, Matlab, LaTex , Arduino IDE etc. in both Linux and Windows platform. This will not only prepare them for higher studies or research in any branch of Physics but also make them ready for various kind of job in IT sector and other industries.

PO4. The students will learn to work independently as well as a group during laboratory sessions, projects and student seminars.

PO5. Students will get academic exposure through the various Internships offered by reputed National Research Institutes during their UG tenure. They will be able to utilize the small summer/ winter recesses through their involvement in small projects under careful guidance of reputed faculties and may get the flavor of the current trend of research.

PO6. The student will acquire a purposeful knowledge of scientific literature and ethical issues related to physics.

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Attainment of POs of B.Sc. Hons. in Physics:

PO No.	Attainment Status
PO 1	✓
PO 2	✓
PO 3	✓
PO 4	✓
PO 5	✓
PO 6	✓

Link for the syllabus of Physics honours course

https://www.bankurauniv.ac.in/uploads/tempimagepdflink/1663692352.pdf

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Course Outcome of B.Sc. Physics (Honours)

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Core Courses	Course Outcomes
Mathematical Physics-I (Course Code: SHPHS/ 101/C-1)	1. Students will develop the concepts of vector and basic knowledge of the vector differential operator Del and understand the operation on the scalar and vector field. 2. Learn about vector integration and related theorems like Divergence and Green theorem etc. 3. Acquire Knowledge about the orthogonal curvilinear coordinate systems and their transformation relation with special emphasis on spherical polar system. 4. Able to think about the mathematical formulation of Fourier series, half range series, Fourier transformation etc. 5. Get knowledge about ODE learn to solve series solution of 2nd order ODE, Bessel's differential equation, Legendre's differential equation, Partial differential equations, Solution of Laplace's equation in different coordinate systems by the method of separation of variables.
Mechanics (Course Code: SHPHS/102/C-2)	1. Develop the concepts of classical mechanics and basic knowledge of the non-inertial and inertial frame of reference, variable mass, rocket motion, special theory of relativity. 2. Acquire knowledge about the elasticity of the material and the streamline and turbulent motion. Understand the relationship between elastic constants. 3. Understand how major concepts developed and changed over time.

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	4. Capable of analyzing and solving problems using oral and written reasoning skills based on the concepts of classical mechanics. 5. Ability to prepare and organize a presentation on the application of fundamental dynamics.
Electricity and Magnetism (SHPHS /201/C-3)	The course will help the students to understand the basic concepts of electrostatics including electric field, potential, electrostatic energy, electric dipole etc. They should be able to understand Laplace's equation, Poisson's equation, method of images and their application to simple electrostatic problems. The students will also acquire knowledge about dielectric properties of matter and application of laws of electrostatics for dielectric materials. This course will provide the students with basic knowledge of magnetostatics i.e. magnetic effect of current and related laws of physics. On completion of the course students will learn about electromagnetic induction, magnetic properties of matter, operation of different ac electrical circuits. They should also acquire knowledge of different network theorems.
Waves and Optics (Course Code: SHPHS/ 202/C-4)	The course will provide the students with knowledge of various aspects of simple harmonic oscillation including damped and forced oscillations, resonance, superposition under different conditions, Lissajous figures etc. The students will acquire knowledge about wave motion, superposition of waves and formation of waves on strings and pipes. The waves and optics part will help the students to understand the wave nature of light and the phenomenon of interference as well as the principle of operation of different interferometers. The course further enables the students to understand the phenomena of diffraction (Fraunhofer and Fresnel type) and basic concepts of holography.

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Mathematical Physics-II (Course Code: SHPHS/ 301/C-5)	1. Students will develop the concept about Argand diagram and know the algebraic operation on complex number 2. Know about different types of singularity and able to know simplest way of integration over a closed contour. 3. Develop the idea about probability, Dirac-delta function, variational calculation, matrix algebra.
Thermal Physics (Course Code: SHPHS/ 302/ C-6)	1. Know about the kinetic of gases, zeroth low of thermodynamics, 1st and 2nd law of thermodynamics. 2. Gather knowledge about isothermal and adiabatic process and also learn how to solve the thermodynamic problems. 3. Learn about the entropy and how the entropy of the universe is changing. 4. Understand how statistics of the microscopic world can be used to explain the thermal features of the macroscopic world. 5. Be able to use thermal and statistical principles in a wide range of applications
Digital Systems and Applications (Course Code: SHPHS /303/C-7)	Develop the concept about the active and passive circuit elements and how they work in circuit. Acquire knowledge about the different types of digital circuit such as combinational and sequential and their implementation using diode and transistor. Get clear knowledge about the different types of memory elemts, 555 timer, A-stable multivibrator, bi-stable multivibrator, mono-stable multivibrator.
Mathematical Physics III (Course Code: SHPHS /401/C-8)	Mathematical Physics plays a very important role in the course of Physics. In almost all branches of Physics, Mathematics is used as a tool for analyzing various physical problems. From this course the students will able to gather knowledge regarding Linear Vector Space, Integral transformations and Eigen value problems.

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Elements of Modern Physics (Course Code: SHPHS /402/C-9)	From this course the students will learn about the black body radiation and the failure of classical theory to explain the characteristics of black body radiation. Then they will be acquainted with the basics of Quantum mechanics. They will learn how the Schrodinger equation is applied to solve physical problems with simple potentials. Students will also learn about the static properties of atomic nuclei, radioactivity, fission and fusion. Students will also learn the basic theory of LASER after completing this course.
Analog Systems and Applications (Course Code: SHPHS /403/C-10)	This course will help the students to get familiar with different topics of semiconductor physics. They will come to know about the characteristics and various applications of diodes, bipolar transistors and field effect transistors. The students will come to know about the operational amplifier and its uses in different aspects.
Quantum Mechanics and Applications (Course Code: SHPHS /501/C-11)	1) One of the most important subject in undergraduate course. Students solve various various quantum mechanical features by solving various potentials: example, Finite and infinite well, Harmonic oscillator. 2) Learn Quantum theory of Hydrogen atoms, solution of Schrodinger equation under central force, Orbital angular momentum and spin angular momentum. 3) To know generalized angular momenta, Electron's magnetic moment, Energy of a magnetic dipole, Stern-Garlach experiment. 4) To study Fine structure of hydrogen atoms, atoms in presence of electric and magnetic fields-- application of Quantum mechanics for atomic systems. 5) To learn Many electron atoms, identical particles, Pauli principle.
Solid State Physics (Course Code: SHPHS /502/C-12)	1) To learn crystal structure, lattice dynamics.

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	2) To understand quantum properties of matter like magnetic property, dielectric property. 3) To understand elementary band theory 4) Superconductivity – one of major breakthrough in modern science is to be learnt here.
Electromagnetic Theory (Course Code: SHPHS/ 601/C-13)	1) Learn Maxwell's equations, gauge transformations, Pyonting vector, Electromagnetic field energy density, momentum density etc. 2) Propagation of electromagnetic wave through medium. 3) To get a well acquaintance with the idea of polarization.
Statistical Mechanics (Course Code: SHPHS/602/C-14)	1) To understand statistical properties of matter, connections with thermodynamics. 2) To use these theory in practical systems (ideal gas, Bose and Fermi systems), Identical particles. 3) To learn Bose-Einstein statistics, and its applications, Fermi-Dirac statistics and its applications.

Departmental Specific Elective Courses (DSE)	Course Outcomes
Advanced Mathematical Physics (Course Code: SHPHS/503/DSE-1) [DSE T1]	1) To learn Linear Algebra and vector space. 2) To understand tensors and tensor algebra. 3) To know group theory and its application.
Classical Dynamics (Course Code: SHPHS/ 503/DSE-1) [DSE T2]	1) To understand calculus of variation 2) To learn about small oscillations 3) To understand about rigid body motion 4) To know about four-vector formalism of special theory of relativity.
Nuclear and Particle Physics (Course Code: SHPHS / 504/DSE-2) [DSE T3]	1) To learn general properties of nuclei, various nuclear models, radioactivity. 2) To understand nuclear reactions and interaction of nuclear radiation with matter.

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	3) To know about the detectors for nuclear radiations and particle accelerators. 4) To learn and understand fundamentals of particle physics.
Astronomy and Astrophysics (Course Code: SHPHS / 504/DSE-2) [DSE T4]	1) Gain knowledge on various tools of astronomy, basic introduction of starts, galaxies, interstellar medium, mass and length scales of astronomy. 2) To learn observational tools of astronomy. 3) To understand star and other stellar systems, formation and evolution of stars. 4) To know about the galaxies and its components. 5) To learn basics of cosmology, redshift, field equations and accelerating universe.
Physics of Earth (Course Code: SHPHS/ 603/DSE-3) [DSE T5]	Through this course, the students will know about the earth and the universe. They will know about the structure of the earth. The will get familiar with the dynamical processes and the evolution process undergone since the formation of earth. The students will also get the opportunity to study on the contemporary issues that are disturbing the earth.
Biological Physics (Course Code: SHPHS/ 603/DSE-3) [DSE T6]	While going through this course, the students will learn about the boundary, interior and exterior environment of living cells and the types of cells. They will acquire knowledge about different metabolites. Students will also come to know about the complexity of life and the evolution process.
Nano Materials and Applications (Course Code: SHPHS/ 604/DSE-4) [DSE T7]	1) To learn about nanoscale systems, their band structures, application of Schrodinger equation for such nano structures. 2) To know how to synthesis nano materials and how to characterize them. 3) To know various properties of nano materials, e.g. optical and electrical (transport) properties.
Communication Electronics (Course Code: SHPHS/	1) To introduce students to basics of electronic communication.

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604/DSE-4) [DSE T8]	2) To learn analog modulations and to modulate analog pulse. 3) To learn how to modulate digital pulse. 4) Students are introduced to communication and navigation system, which has many modern day applications.

Skill Enhancement Courses (SEC)	Course Outcomes
Computational Physics (Course Code: SHPHS/ 305/SEC-1) [SEC T1]	1. Students will design algorithms using flowcharts and FORTRAN to solve physics problems effectively, including coordinate conversions, equation solving, and simulations. 2. Students will develop proficiency in FORTRAN programming and Linux commands, applying them to solve physics problems and analyze data. 3. Students will learn to visualize and analyze computational data using Gnuplot and LaTeX, creating plots, evaluating series, and simulating physical phenomena for visualization and analysis.
Renewable Energy and Energy Harvesting (Course Code: SHPHS/305/SEC-1) [SEC T2]	1. Ability to know about the non-conventional, conventional energy source 2. to know about the need of renewable energy source. 3. To develop the idea about tidal energy, wind energy, geothermal energy, tidal energy, solar energy etc. 4. To understand how can utilize the effect of the piezoelectric effect. 5. To acquire the complete knowledge about the solar pond and its important in cold country. 6. To know the import ants of the energy harvesting.

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Radiation Safety (Course Code: SHPHS /405/SEC-2) [SEC T3]	From this course the students will learn about some basic ideas of atomic and nuclear physics. They will develop some ideas about the interaction of radiation with matter and types of radiation. They will get familiar with some radiation detection and monitoring devices and also gather knowledge regarding radiation quantities and units. Students will come to know about the biological effects of ionizing radiation. Students will be introduced to the field of radiation safety management. They will be familiar with the applications of different nuclear techniques.
Weather Forecasting (Course Code: SHPHS / 405/SEC-2) [SEC T4]	From this course the students will get acquainted with various aspects of atmosphere. They will come to know about the weather systems, climate and climate change. Students will gather knowledge about the basics of weather forecasting when going through this course.