Durgapur Govt College

Department of Physics

Programme Specific Outcome (PSO)

We are offering six semester undergraduate courses (Honours, Generic and Program) in Physics under Kazi Nazrul University, Asansol, following the Choice Based Credit System (CBCS), prescribed by UGC, India. A student may either choose a Honours/Major course in Physics or may opt for Physics as a subsidiary subject.

Physics, being a natural science, investigates on the interactions among various particles and force-fields; those govern the rhythms of the dynamics of the ever-alive universe. There are different aspects of the phenomena, like mechanical, thermal, electrical, magnetic properties etc. Mankind has learned to see the world from the macroscopic to microscopic length and time scales. We have jumped from the quantum to nano-ages in science and technology. We realized that the physics changes when the speed of a matter becomes comparable with speed of light, which makes the scientists to reconsider the absoluteness of space-time and put forward the theory of relativity. The modification may not be earnestly needed in daily-world but surely relevant in astro and terrestrial physics.

The exploration of the different corners of physics through hard-core mathematical calculations and demonstrative verification of the theories through table-top experiments, our students learn and practice under the guidance of a group of qualified and trained mentors.

On the completion of under-graduate (B.Sc.) course in Physics,

1. Students learn the basic mathematical tools, needed to understand different branches of Physics. They are trained to apply these techniques through numerical exercises.

2. They are familiarized with hands-on training in the furnished and equipped laboratory for practical verification of the physical theories that they learn during class lectures.

3. They are trained with basic computer programming with motivation of Physics-applications. In these courses, they learn the language like FORTRAN, C, C++, and apply on problems through numerical analysis.

4. The Honours course in Physics makes the students eligible for the further post-graduate studies, in physics, electronics, instrumentation, computer applications etc. They can apply for different integrated-PhD courses in IITs and NITs. They may appear for competitive examinations like JAM, JEST etc.

5. The general courses (Program and Generic) trains the students as a complementary for their major courses, and they may also apply for various trainee jobs with substantial salary packages.

6. All students may choose physics from the panel of optional subjects in WBCS, IAS, and CDS etc.

PHYSICS HONOURS

SEM	Name of the Subject	Paper Code	Course Outcome
I	Mathematical Methods of Physics-I	BSCHPHSC101	This aims for a mathematical foundation course designed to train students for analytical tools needed for further studies in physics, like basic linear algebra, vector algebra and calculus, solutions of ordinary and partial differential equations, stable probability distributions, determinant and non-singular matrices.
I	Mechanics	BSCHPHSC102	1. This course familiarizes students with classical mechanics of single as well as system of particles within the scope Newtonian formulation. 2. It discusses on the general properties of bulk matter and different types of simple harmonic linear oscillations.
II	Mathematical Methods of Physics-II	BSCHPHSC201	1. This introduces to the (i) different properties of special functions, useful in other branches of physics; (ii) Fourier expansion of analytic functions; (iii) properties of complex variables and their integrals; (iv) standard integrals. 2. It provides a scope for students to learn computer programming in C /C++, aiming for basic mathematical problems as well as on problems based on standard numerical analysis.
II	Electricity and Magnetism	BSCHPHSC202	1. This course enables students to familiarize with the properties of (i) the produced electric field due to charges at rest; (ii) the produced magnetic field due to steady, both in free-space and inside matter. 2. This indicates on the idea of electromagnetism, through Maxwell's equation. 3. This describes on the analysis of electrical networks and bridges in presence of alternating currents.
III	Classical Mechanics and Special Theory of Relativity	BSCHPHSC301	1. This course enables to learn the classical mechanics of rotating systems and particle under central force. 2. It introduces students to the Lagrangian and hamiltonian formulations of classical mechanics.

			3. This course discusses on the necessity of replacing Newtonian relativity through Einstein's special relativity, and elaborates on the classical mechanics of fast particles under the special relativity.
III	Thermal Physics- I	BSCHPHSC302	1. It informs students on the molecular motion (kinetics) inside an ideal and a real classical gas. 2. The processes of heat transfer through solid, viz., conduction and radiation, is discussed for the students.
III	Analog Systems and Applications	BSCHPHSC303	1. It informs the students on the electronic transport mechanisms through intrinsic and extrinsic semiconductors. 2. The theory of the transport through doped semiconductor junctions in diodes, transistors are included in the course. 3. The applications of diode as rectifier and junction transistors as amplifiers are discussed.
III	Electrical Circuit Network Skills	BSCHPHSSE301	1. Design and trouble shoots the electrical circuits, networks and appliances through hands-on mode. 2. The implementation of ac circuits for house-wiring is emphasised.
IV	Electromagnetic Theory	BSCHPHSC401	1. This course demonstrates the theory behind the generation of the electromagnetic (transverse) progressive wave in combination of oscillating electric and magnetic fields 2. It describes the propagation of EM wave through dielectrics and conducting medium. 3. The theories of the manifestations by EM wave (viz., dispersion, scattering, polarisation) are discussed.
IV	Waves and Optics	BSCHPHSC402	1. This theory for linear superposition of several collinear and mutually perpendicular SHMs can be learnt. 2. The understanding due to manifestations by the optical (light) waves (viz., interference, diffraction and polarisation) can be made. 3. The commertial applications based on them are also included.
IV	Digital Systems and Applications	BSCHPHSC403	1. After completing the course students develop knowledge of working of binary

			logic, and how different kinds of logic gates work. 2. Students develop a digital logic and apply it to solve real life problems. They understand the difference between combinational and sequential logic circuits. 3. They can analyze, design and implement combinational and sequential logic circuits. By this way they can get an opportunity to gain knowledge how modern day computer works.
IV	Computational Physics	BSCHPHSSE402	1. The course emphasizes on using Linux as useful operating system and uses computer programming language **FORTRAN** for solving the problems in physics through programming. 2. It introduces **LateX** software for the preparation of the manuscript for scientific publication. **GNUPLOT** is discussed as a plotting software.
V	Quantum Mechanics	BSCHPHSC501	1. The failures of classical theory in explaining different experiments of early twentieth century are discussed. The ideas of wave-particle duality, matter-wave are proposed. 2. The Schrodinger equation (time-dependent and time-independent) is introduced to students and its solutions for different proto-type potentials (1d and 3d) are demonstrated. 3. General discussions on quantum (hermitian) operators and basis vectors are included.
V	Thermal Physics-II	BSCHPHSC502	1. Thermodynamics is introduced as an emperical description for the thermal properties of a macroscopic system. 2. The formulation is developed in terms of 1st, 2nd and 3rd laws. 3. Applications of thermodynamics and the theory of the phase-transitions are discussed.
V	Nuclear and Particle Physics	BSCHPHSDSE501	1. Explain structure and properties of nuclei, the mechanism of different radioactive decays and theirapplications in peaceful use of nuclear energy. 2. Understand what are the elementary particles constitute this known universe.

			Students will gather. capability of elementary problem solving in nuclear and particle physics.
V	Atomic Physics and Spectroscopy	BSCHPHSDSE503	Understand the concepts of atomic spectra and its origin using the old quantum theory whose consistency can be later verified by the direct application of the quantum mechanics.
VI	Statistical Mechanics	BSCHPHSC601	1. This course is designed to treat a macroscopic system through its ergodic ensemble with PEAP for microstates as guiding rule. 2. The classical (MB) and quantum (BE, FD) distributions are introduced to students as a most-probable micro-canonical distribution. 3. The techniques to derive the thermodynamic quantities (viz., entropy, pressure, chemical potential etc.) from the canonical partition function can be understood. 4. Properties of bosonic systems- BE condensation, black-body radiation, superfluidity, Lattice specific heat due to phonon (Einstein's and Debye theory) will be elaborated. 5. Properties of fermionic systems- electronic specific heat, variation of the fermi-energy and Saha Ionisation formula , will be discussed.
VI	Condensed Matter Physics	BSCHPHSC602	1. This course is designed to introduce the students with the lattice structure in a crystalline solids and their different properties (viz., dielectric, magnetic, electrical transport). 2. An elementary discussion on superconductivity is included.
VI	Applied Optics	BSCHPHSDSE601	1. Students will get familiarize with the geometrical / ray optics through transfer matrix-formalism. 2. The technological applications of optical phenomena as a background of the fiber optics, holography, LASER and photo-detectors will be covered.
VI	**Classical Dynamics**	**BSCHPHSDSE603**	1. The formulation of the Lagrangian and Hamiltonian classical mechanics will be introduced through the calculus of

			variation. 2. Idea of small oscillations of isolated and coupled systems will be studied through normal modes. 3. The formulation of (special) relativistic mechanics is introduced through four-vectors and Minkowski cone.

PHYSICS GENERIC

SEM	Name of the Subject	Paper Code	Course Outcome
I	**Mechanics**	**BSCHPHSGE101**	1. This course familiarizes students with vector calculus, classical mechanics of single as well as system of particles within the scope Newtonian formulation. 2. It discusses on the general properties of bulk matter and different types of simple harmonic linear oscillations. 3. It enables to learn the classical mechanics of rotating systems and particle under central force. 3. It introduces the Einstein's special theory of relativity and the classical mechanics of fast moving particles as per the theory.
II	**Electricity and Magnetism**	**BSCHPHSGE201**	1. This course enables students to familiarize with the properties of (i) the produced electric field due to charges at rest; (ii) the produced magnetic field due to steady, both in free-space and inside matter. 2. This indicates on the idea of electromagnetism, through Maxwell's equation. Hence the generation of EM waves. 2. This describes on the electrical circuits and bridges in presence of AC current.
III	**Fundamentals of Thermal and Statistical Physics**	**BSCHPHSGE301**	1. It describes to the students on the kinetic theory of ideal classical gas. 2. The radiative process of heat transfer can be studied. 3. Different laws of thermodynamics and their applications are discussed for simple system. 4. (i)The classical (MB) and quantum (BE, FD) distributions are introduced to

			students as a most-probable micro-canonical distribution; (ii) different thermodynamic quantities (viz., entropy, pressure, chemical potential etc.) are redefined from statistical physics; (iii) a qualitative discussions on the BE condensation, black-body radiation, fermi-level are included.
IV	**Fundamentals of Waves and Optics**	**BSCHPHSGE401**	1. The resultant of two collinear and mutually perpendicular SHMs can be learnt. Progressive elastic wave is discussed. 2. The understanding due to manifestations by the optical (light) waves (viz., interference, diffraction and polarisation) can be made.

PHYSICS PROGRAM

SEM	Name of the Subject	Paper Code	Course Outcome
I	**Mechanics**	**BSCPPHSC101**	1. This course familiarizes students with vector calculus, classical mechanics of single as well as system of particles within the scope Newtonian formulation. 2. It discusses on the general properties of bulk matter and different types of simple harmonic linear oscillations. 3. It enables to learn the classical mechanics of rotating systems and particle under central force. 3. It introduces the Einstein's special theory of relativity and the classical mechanics of fast moving particles as per the theory.
II	**Electricity and Magnetism**	**BSCPPHSC201**	1. This course enables students to familiarize with the properties of (i) the produced electric field due to charges at rest; (ii) the produced magnetic field due to steady, both in free-space and inside matter. 2. This indicates on the idea of electromagnetism, through Maxwell's equation. Hence the generation of EM waves. 2. This describes on the electrical circuits and bridges in presence of AC current.
III	**Basics of Thermal and Statistical Physics**	**BSCPPHSC301**	1. It describes to the students on the kinetic theory of ideal classical gas.

			2. The radiative process of heat transfer can be studied. 3. Different laws of thermodynamics and their applications are discussed for simple system. 4. (i)The classical (MB) and quantum (BE, FD) distributions are introduced to students as a most-probable micro-canonical distribution; (ii) different thermodynamic quantities (viz., entropy, pressure, chemical potential etc.) are redefined from statistical physics; (iii) a qualitative discussions on the BE condensation, black-body radiation, fermi-level are included.
III	**Electrical Circuit Network Skills**	**BSCHPHSSE301**	1. Design and trouble shoots the electrical circuits, networks and appliances through hands-on mode
IV	**Basics of Waves and Optics**	**BSCPPHSC401**	1. The resultant of two collinear and mutually perpendicular SHMs can be learnt. Progressive elastic wave is discussed. 2. The understanding due to manifestations by the optical (light) waves (viz., interference, diffraction and polarisation) can be made.
IV	**Basic Instrumentation Skills**	**BSCHPHSSE401**	1. Get exposure with various aspects of instruments and their usage through hands-on mode. 2. Do experiments listed below in continuation of the topics.
V	**Modern Physics**	**BSCPPHSDSE501**	1. Understand the root in the development of modern physics 2. Understand the relationship between the real and reciprocal space and learn the Bragg's X-ray diffraction in crystals 3. Gain a hands-on learning experience by performing experiments on these properties of materials. 4. Describe the behaviour of matter and energy at atomic and subatomic level
V	**Technical Drawing Skills**	**BSCHPHSSE301**	Know and understand the conventions and the method of engineering drawing. Interpret engineering drawings using

			fundamental technical mathematics. Construct basic and intermediate geometry. Improve their visualization skills so that they can apply thes skill in developing new products. Improve their technical communication skill in the form of communicative drawings. Comprehend the theory of projection.
VI	**Basic Electronics**	**BSCPPHSDSE601**	1. Understand both in analog and digital electronics. 2. Design several electronic devices thorough the knowledge on electronic circuit, semiconductor and its properties
VI	**Computational Physics**	**BSCHPHSSE402**	1. The course emphasizes on using Linux as useful operating system and uses computer programming language **FORTRAN** for solving the problems in physics through programming. 2. It introduces **LateX** software for the preparation of the manuscript for scientific publication. **GNUPLOT** is discussed as a plotting software.