Kabi Jagadram Roy Government General Degree College, Mejia

Department of Physics

(Affiliated to Bankura University)

Programme Outcome, Programme Specific Outcome and Course Outcome for B.Sc. in Physics for Academic Session 2023-2024 & 2024-2025 following NEP Pattern

For UG NEP syllabus of Physics in Bankura University click link below:

https://www.bankurauniv.ac.in/uploads/tempimagepdflink/1691037675.pdf
https://www.bankurauniv.ac.in/uploads/tempimagepdflink/1724647982.pdf

Introduction:

The Undergraduate (UG) programme of Physics is composed of major, minor and interdisciplinary subjects. The syllabus is based on the National education policy which covers almost all the fields of Physics. The Physics course at Department of Physics helps to create an academic base that eventually strengthen the students to understand the basic laws of physics and its imperative applications in various physical domains. The programme is designed and implemented in such a way that helps the students acquire scientific attitude, develop critical and analytical skills and research oriented aptitude along with understanding the conventional existing knowledge base in the subject. Apart from the main subjects of the programme, the students has options to relate the knowledge gained and connect it to the society.

Programme Outcomes (PO)

1. To provide strong foundation in basic sciences
2. Acquire the knowledge related to academics with facts and figures related to various subjects in pure sciences such as Physics, Mathematics, etc. which will enhance their learning.
3. Develop skills of observations and drawing logical inferences from the scientific experiments.
4. Students will grow their ability to tackle physics related problems. They will be able to apply their acquired knowledge related to various practical issues in their day-to-day life.
5. Students will acquire personal skills such as the ability to work both independently and in a group.
6. Understand the theories which describe the nature of physical phenomena and to establish them by experiments.
7. Students will be able to prepare themselves for the job oriented competitive examination.
8. Understand ethical principles and responsibilities of a physics graduate to serve the society.
9. Use the computer to learn ICT skills for knowledge communication and knowledge dissemination.
10. Think creatively to propose novel ideas in explaining facts and figures or providing new solution to the problems.

Programme Specific Outcomes (PSO)

1. **PSO 1:** Develop deep understanding of the basics of subjects like vector, mechanics, gravitation, elasticity, special theory of relativity, sound, electrostatics, properties of matter, e-m theory, thermodynamic, statistical mechanics, environmental issues related to physics which will help them to pursue higher studies.

2. **PSO 2:** Discover of physics concepts in other disciplines such as mathematics, computer science, chemistry etc.
3. **PSO 3:** Realize and develop an understanding of the impact of physics and science on society.
4. **PSO 4:** Students should have the skill of identifying the key factors and applying appropriate principles and assumptions in the formulation of physical problems.
5. **PSO 5:** Students should learn how to design and conduct an experiment demonstrating their understanding of the scientific method and processes.
6. **PSO 6:** After the completion of program, students will be able to have in-depth knowledge of basic concepts in physics.
7. **PSO 7:** Students will be able to apply the laws of physics in real life situations to solve the problems.
8. **PSO 8:** Identify their area of interest in academic and competitive fields related to their subject.
9. **PSO 9:** Acquire analytical and logical skills for higher Education and other Entrepreneurships
10. **PSO 10:** Enhance their academic abilities, personal qualities and transferable skills which will give them an opportunity to develop as responsible citizens.

Course Outcomes (CO) for Physics

Semester I

Major (MJ): DSC

Course Title: Mechanics and General Properties of Matter [MJC-1 (Theory)]

Course Code: S/PHS/101/MJC-1

Course Outcomes:

1. Develop the concepts of classical mechanics, vector, vector differentiation and integration.
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.
4. Capable of analyzing and solving problems using oral and written reasoning skills based on the concepts of classical mechanics.

Course Title: Mechanics and General Properties of Matter [MJC-1 (Lab)]

Course Code: S/PHS/101/MJC-1

Course Outcomes:

1. Students will learn to use the screw gauge, slide callipers, microscope, telescope.

2. They will know how to experimentally measure the Young's modulus, coefficient of viscosity of liquid, acceleration due to gravity, spring constant.

Minor Stream

Course Title: Mechanics and General Properties of Matter[MN-1 (Theory)]

Course Code: S/PHS/102/MN-1

Course Outcomes:

1. Develop the concepts of classical mechanics, vector, vector differentiation and integration.
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.
4. Capable of analyzing and solving problems using oral and written reasoning skills based on the concepts of classical mechanics.

Course Title: Mechanics and General Properties of Matter[MN-1 (Lab)]

Course Code: S/PHS/102/MN-1

Course Outcomes:

1. To study the Motion of Spring and calculate, (a) Spring constant, (b) g and(c) Modulus of rigidity.
2. To determination of the Young's modulus of a material in the form of a bar by the method of flexure.
3. Determination of the coefficient of viscosity of highly viscous liquid by Stoke's method.
4. To determine the value of g by using Bar Pendulum.
5. To determine the value of g by using Kater's Pendulum

Multidisciplinary

Course Title: Fundamentals of Physics-I [MD-1]

Course Code: S/PHS/103/MD-1

Course Outcomes:

1. Students will learn and 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. Students will Learn and realize about vector theorems like Divergence and Green theorem etc.

3. Students will develop the concepts on classical mechanics and enhance the basic knowledge of the non-inertial and inertial frame of reference, variable mass, rocket motion, special theory of relativity.
4. They will acquire knowledge about the elasticity of the material and the streamline and turbulent motion.
5. Enhance the capability to prepare and organize a presentation on the application of fundamental dynamics.
6. They can understand the relation between electrical charge, electrical field, electrical potential.
7. They can understand and realize the superposition of SHM collinearly and perpendicularly and can study the Beat and Lissajous figures.

Skill Enhancement Courses ((SEC-1)

Course Title: Basics of Computer and Python Programming [SEC-1 (Theory) and SEC-1 (Lab)]

Course Code : S/PHS/104/SEC-1

Course Outcomes:

1. There is a scope to know the computer architecture.
2. There is a scope to study the Python programming language.
3. The students will be able to learn how can solve any physical problem in Python.
4. There is a scope to learn the graph plotting.

Semester II

Major (MJ): DSC

Course Title: Electricity and Magnetism [MJC-2 (Theory)]

Course Code: S/PHS/201/MJC-2

Course Outcomes:

1. The course will help the students to understand the basic concepts of electrostatics including electric field, potential, electrostatic energy, electric dipole etc.
2. They should be able to understand Laplace's equation, Poisson's equation, method of images and their application to simple electrostatic problems.
3. The students will also acquire knowledge about dielectric properties of matter and application of laws of electrostatics for dielectric materials.
4. This course will provide the students with basic knowledge of magnetostatics i.e. magnetic effect of current and related laws of physics.
5. On completion of the course students will learn about electromagnetic induction, magnetic properties of matter, operation of different ac electrical circuits, network theorem, etc.

Course Title: Electricity and Magnetism [MJC-2 (Lab)]

Course Code: S/PHS/201/MJC-2

Course Outcomes:

1. On performing the laboratory experiments students should have a rudimentary grasp on how experimental equipment related to electricity and magnetism can be used.
2. They will have a better insight by experimentally verifying some of the laws/theorems of electricity and magnetism.

Minor Stream

Course Title: Mechanics and General Properties of Matter[MN-2 (Theory)]

Course Code: S/PHS/202/MN-2

Course Outcomes:

1. The course will help the students to understand the basic concepts of electrostatics including electric field, potential, electrostatic energy, electric dipole etc.
2. They should be able to understand Laplace's equation, Poisson's equation, method of images and their application to simple electrostatic problems.
3. The students will also acquire knowledge about dielectric properties of matter and application of laws of electrostatics for dielectric materials.
4. This course will provide the students with basic knowledge of magnetostatics i.e. magnetic effect of current and related laws of physics.
5. On completion of the course students will learn about electromagnetic induction, magnetic properties of matter, operation of different ac electrical circuits, network theorem, etc.

Course Title: Mechanics and General Properties of Matter[MN-2 (Lab)]

Course Code: S/PHS/202/MN-2

Course Outcomes:

1. On performing the laboratory experiments students should have a rudimentary grasp on how experimental equipment related to electricity and magnetism can be used.
2. They will have a better insight by experimentally verifying some of the laws/theorems of electricity and magnetism.

Multidisciplinary

Course Title: Fundamentals of Physics-II [MD-2]

Course Code: S/PHS/203/MD-2

Course Outcomes:

1. After completion of the course the students should understand the basic concepts about magnetic effect of current, basic concepts about different types of magnetic materials and electromagnetic induction.
2. This course further enables the students to acquire knowledge about basic concepts of kinetic theory of gases.
3. They will also gain knowledge about laws of thermodynamics and their application to different thermodynamic processes.
4. This course will further help the students to acquire knowledge on basic modern physics such as structure of matter, atomic model, production of x-rays, theory of photo electric effect, Compton scattering, pair production and black body radiation.

Skill Enhancement Courses ((SEC-2)

Course Title: Basic Instrumentation Skills [SEC-2 (Theory) and SEC-2 (Lab)]

Course Code : S/PHS/204/SEC-2

Course Outcomes:

1. Through this course, the students will develop the ideas about the basics of measurements.
2. They learn the uses of various instruments like electronic voltmeter, cathode ray oscilloscope (CRO), Signal Generators and Analysis Instruments, Impedance Bridges & Q-Meters and some digital instruments.

Semester III

Major (MJ): DSC

Course Title: Mathematical Physics-I [MJC-3 (Theory)]

Course Code: S/PHS/301/MJC-3

Course Outcomes:

1. Students will develop the concepts of First Order and Second Order Differential equations.

2. Acquire knowledge on Particular Integral, Partial derivatives, and Integrating factor.
3. Learn about vector integration and related theorems like Divergence and Green theorem etc.
4. Acquire Knowledge about the orthogonal curvilinear coordinate systems and their transformation relation with special emphasis on spherical polar system.
5. Able to think about the mathematical formulation of Fourier series, half range series, Fourier transformation etc.
6. Get knowledge about ODE learn to solve series solution of 2nd order ODE, Bessel's differential equation, Legendre's differential equation, Partial differential equations.
7. Solution of Laplace's equation in different coordinate systems by the method of separation of variables.

Course Title: Mathematical Physics-I [MJC-3 (Lab)]

Course Code: S/PHS/301/MJC-2

Course Outcomes:

1. Understand and visualize different coordinate systems.
2. Implement basic vector operations in Python.
3. Solve first- and second-order differential equations using Python.
4. Implement numerical solutions for ordinary and partial differential equations.
5. Compute Fourier series for different functions.
6. Understand and visualize the impact of harmonics in periodic functions.
7. Explore special functions like Legendre and Bessel functions using Python.

Major (MJ): DSC

Course Title: Waves and Oscillation [MJC-4 (Theory)]

Course Code: S/PHS/302/MJC-4

Course Outcomes:

1. 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.
2. The students will acquire knowledge about wave motion, superposition of waves and formation of waves on strings and pipes.
3. Students also recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems, point out the limitations, and be able to refer to very different solutions of identical oscillator equations due to different initial and boundary conditions.

Course Title: Waves and Oscillation [MJC-4 (Lab)]

Course Code: S/PHS/302/MJC-4

Course Outcomes:

1. This course will help the students to know how to determine the acceleration due to gravity at a place using Compound pendulum and Simple pendulum.
2. Notice the difference between flat resonance and sharp resonance in case of volume resonator and sonometer experiments respectively.
3. Verify the laws of transverse vibrations in a stretched string using sonometer and comment on the relation between frequency, length and tension of a stretched string under vibration.
4. Demonstrate the formation of stationary waves on a string in Melde's string experiment.
5. Observe the motion of coupled oscillators and normal modes.
6. Examine phenomena of simple harmonic motion and the distinction between undamped, damped and forced oscillations and the concepts of resonance and quality factor with reference to damped harmonic oscillator.

Minor Stream

Course Title: Waves and Oscillation [MN-3 (Theory)]

Course Code: S/PHS/303/MN-3

Course Outcomes:

1. 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.
2. The students will acquire knowledge about wave motion, superposition of waves and formation of waves on strings and pipes.
3. Students also recognize and use a mathematical oscillator equation and wave equation, and derive these equations for certain systems, point out the limitations, and be able to refer to very different solutions of identical oscillator equations due to different initial and boundary conditions.

Course Title: Waves and Oscillation [MN-3 (Lab)]

Course Code: S/PHS/303/MN-3

Course Outcomes:

1. This course will help the students to know how to determine the acceleration due to gravity at a place using Compound pendulum and Simple pendulum.
2. Notice the difference between flat resonance and sharp resonance in case of volume resonator and sonometer experiments respectively.
3. Verify the laws of transverse vibrations in a stretched string using sonometer and comment on the relation between frequency, length and tension of a stretched string under vibration.

4. Demonstrate the formation of stationary waves on a string in Melde's string experiment.
5. Observe the motion of coupled oscillators and normal modes.
6. Examine phenomena of simple harmonic motion and the distinction between undamped, damped and forced oscillations and the concepts of resonance and quality factor with reference to damped harmonic oscillator.

Multidisciplinary

Course Title: Renewable Energy and Energy harvesting [MD-3]

Course Code: S/PHS/304/MD-3

Course Outcomes:

1. The students will have sufficient knowledge about the non-conventional and conventional energy sources.
2. They will learn about the need of renewable energy sources in modern times.
3. They should acquire the knowledge about the importance of solar energy and methods of utilization of solar energy.
4. They will develop the basic idea about tidal energy, wind energy, geothermal energy, bio- mass energy, hydropower and applications of these energy sources.
5. They will also understand how to utilize the piezoelectric effect as a source of non conventional energy.
6. The students will gain basic knowledge of electromagnetic energy harvesting.

Skill Enhancement Course (SEC-3)

Course Title: Introduction to LASER and Fibre Optics [SEC-3 (Theory) and SEC-3 (Lab)]

Course Code : S/PHS/305/SEC-3

Course Outcomes:

On completion of this course a student should be able to demonstrate understanding of and be able to solve problems on:

1. absorption and spontaneous and stimulated emission in two level, three level, four level systems, and the conditions for laser amplification.
2. the four-level laser system, the simple homogeneous laser and its output behavior and optimal operating conditions.
3. spectral properties of a single longitudinal mode, mode locked laser operation, schemes for active and passive mode locking in real laser system.
4. operations and basic properties of the most common laser types- He-Ne, ruby.

Semester IV

Major (MJ): DSC

Course Title: Mathematical Physics-II [MJC-5 (Theory)]

Course Code: S/PHS/401/MJC-5

Course Outcomes:

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. Able to solve simultaneous equations using matrix method and learn the properties of matrix.
4. Develop the idea about probability, probability distribution and central limit theorem.
5. Gain knowledge about Dirac-delta function and Kronecker delta functions.

Course Title: Waves and Oscillation [MJC-5 (Lab)]

Course Code: S/PHS/401/MJC-5

Course Outcomes:

1. Students will be familiar with Scilab language and be able to install and/or use the programming language.
2. They will be able to write the program to determine the roots of complex number and unity.
3. Students will gain sufficient knowledge to plot 2D/3D graph and able to plot data and functions.
4. Students will be able to solve differential equations and can determine the value of a definite integral.
5. They gain knowledge about least square fitting and may be apply this concepts to plot best graph in their laboratory work.

Major (MJ): DSC

Course Title: Heat and Thermodynamics [MJC-6 (Theory)]

Course Code: S/PHS/402/MJC-6

Course Outcomes:

1. Know about the kinetic of gases, the zeroth law of thermodynamics, 1st and 2nd law of thermodynamics.
2. Gather knowledge about isothermal and adiabatic processes and learn how to solve thermodynamic problems.
3. Able to understand the working principle of Heat engines – Carnot's engine and its applications.
4. Learn about entropy and how the entropy of the universe is changing.
5. Understand the interrelationship between thermodynamic functions and the ability to use such relationships to solve practical problems.
6. Understand how statistics of the microscopic world can be used to explain the thermal features of the macroscopic world.
7. Be able to use thermal and statistical principles in a wide range of applications.

Course Title: Heat and Thermodynamics [MJC-6 (Lab)]

Course Code: S/PHS/402/MJC-6

Course Outcomes:

1. Able to learn how to experimentally measure the thermal conductivity in different methods.
2. Also learn about the platinum resistance thermometer, thermocouple, etc.

Major (MJ): DSC

Course Title: Classical mechanics [MJC-7 (Theory)]

Course Code: S/PHS/403/MJC-7

Course Outcomes:

Upon successful completion of this course it is intended that a student will be able to:

1. .Know how to impose constraints on a system in order to simplify the methods in solving physics problems. They will also understand the important of concepts such as generalized coordinates and constrained motion.
2. Learn about Lagrangian and Hamiltonian formulation of classical mechanics and get familiar with their applications to solve simple physics problems.
3. Distinguish between inertial and non-inertial frames.
4. They will also get acquainted to the various aspects of Theory and application in the field of special theory of relativity.

Course Title: Classical mechanics [MJC-7 (Lab)]

Course Code: S/PHS/403/MJC-7

Course Outcomes:

Upon successful completion of this course, it is intended that a student will be able to:

1. Determine moment of inertia and elastic constants of different materials.
2. Estimate the value of acceleration due to gravity and get familiar with the digital timing technique.

Major (MJ): DSC

Course Title: Analog Electronics systems and Applications [MJC-8 (Theory)]

Course Code: S/PHS/404/MJC-8

Course Outcomes:

1. This course will help the students to get familiar with different topics of semiconductor physics.
2. Acquire knowledge about three terminal devices, voltage-controlled devices and current controlled devices.
3. They will able to know about different amplifier circuits. Gain Understand how major concepts developed and changed over time.
4. The students will come to know about the operational amplifier and its uses in different aspects
5. Overall, they will gain sufficient knowledge on the theories of electronic circuits.

Course Title: Analog Electronics systems and Applications [MJC-8 (Lab)]

Course Code: S/PHS/404/MJC-8

Course Outcomes:

1. This course will help the students to get familiar electronic circuits, uses of bread board and discreate components.
2. Students will learn experimentally the I-V characteristics of PN diode, LED and BJT.
3. They will be able to design an amplifier using transistor.
4. They will be able to investigate the uses of Op. Amp. as inverting, non-inverting, adder and subtractor.
5. The students will be able to design Wien bridge oscillator, integrator, and differentiator by employing Op. Amp.

Minor Stream

Course Title: Heat and Thermodynamics [MN-4 (Theory)]

Course Code: S/PHS/405/MN-4

Course Outcomes:

1. Know about the kinetic of gases, the zeroth law of thermodynamics, 1st and 2nd law of thermodynamics.
2. Gather knowledge about isothermal and adiabatic processes and learn how to solve thermodynamic problems.
3. Able to understand the working principle of Heat engines – Carnot's engine and its applications.
4. Learn about entropy and how the entropy of the universe is changing.
5. Understand the interrelationship between thermodynamic functions and the ability to use such relationships to solve practical problems.
6. Understand how statistics of the microscopic world can be used to explain the thermal features of the macroscopic world.
7. Be able to use thermal and statistical principles in a wide range of applications.

Course Title: Heat and Thermodynamics [MN-4 (Lab)]

Course Code: S/PHS/405/MN-4

Course Outcomes:

1. Able to learn how to experimentally measure the thermal conductivity in different methods.
2. Also learn about the platinum resistance thermometer, thermocouple, etc.