B.Sc. (Physics) Part-I (I and II Semester)
PROGRAMME CODE: PHYB3PUP
SESSION 2023-24, 2024-25 and 2025-26

Code	Title of Paper	Hours (Per Week)	Max Marks			Credits	Examination Time (Hours)
SEMESTER-I			**Total**	**Ext.**	**Int.**		
PHYB1101T	Mechanics	03	50	35	15	02	03
PHYB1102T	Electricity and Magnetism	03	50	35	15	02	03
PHYB1103L	Practicals	04	50	35	15	02	03
SEMESTER-II							
PHYB1201T	Waves and Vibrations	03	50	35	15	02	03
PHYB1202T	Optics	03	50	35	15	02	03
PHYB1203L	Practicals	04	50	35	15	02	03

B.Sc. (Physics) Part-II (III and IV Semester)
PROGRAMME CODE: PHYB3PUP
SESSION 2024-25, 2025-26 and 2026-27

Code	Title of Paper	Hours (Per Week)	Max Marks			Credits	Examination Time (Hours)
SEMESTER-III			**Total**	**Ext.**	**Int.**		
PHYB2301T	Thermodynamics	03	50	35	15	02	03
PHYB2302T	Modern Physics	03	50	35	15	02	03
PHYB2303L	Practicals	04	50	35	15	02	03
SEMESTER-IV							
PHYB2401T	Quantum Mechanics	03	50	35	15	02	03
PHYB2402T	Statistical Physics	03	50	35	15	02	03
PHYB2403L	Practicals	04	50	35	15	02	03

B.Sc. (Physics) Part-III (V and VI Semester)
PROGRAMME CODE: PHYB3PUP
SESSION 2025-26, 2026-27 and 2027-28

Code	Title of Paper	Hours (Per Week)	Max Marks			Credits	Examination Time (Hours)
SEMESTER-V			**Total**	**Ext.**	**Int.**		
PHYB3501T	Solid State Physics	03	50	35	15	02	03
PHYB3502T	Electronics	03	50	35	15	02	03
PHYB3503L	Practicals	04	50	35	15	02	03
SEMESTER-VI							
PHYB3601T	Laser	03	50	35	15	02	03
PHYB3602T	Nuclear and Particle Physics	03	50	35	15	02	03
PHYB3603L	Practicals	04	50	35	15	02	03

General Instructions

1. There will be two papers of theory and one laboratory (practical) course in each semester.

2. The theory paper load per week will be three hours. The practical load will be of four hours per week.

3. Use of scientific non programmable caculator is allowed in the examination centre.

4. Instructions for Paper Setter: The end-semester examination will be of 35 marks and of 3 hours duration. The question paper will consist of three sections, namely, Section A, B and C. Section A and B will have four questions each from the respective sections of the syllabus. Each question will carry 6 marks and may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of one mark each covering the whole syllabus.

5. Instructions for Students: Students have to attempt four questions in all from Section A and B by selecting two questions from each Section. Section C will be compulsory. Use of scientific calculator is allowed.

6. Weigtage of different components in internal assessment is as; Attendance- 20%, Assignment- 40% and Internal Examination-40% (So for each paper it is 15 marks i.e. attendance: 3 + Assignment: 6 + Internal Examination: 6).

Semester-I

PHYB1101T: MECHANICS

Max. Marks: 50
End-Semester exam: 35 marks
Internal Evaluation: 15 marks

Credits: 02
Total Teaching hours: 40
Pass Marks: 35 %

Instructions for Paper Setter

The end-semester examination will be of 35 marks and of 3 hours duration. The question paper will consist of three sections, namely, Section A, B and C. Section A and B will have four questions each from the respective sections of the syllabus. Each question will carry 6 marks and may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of 1 mark each covering the entire syllabus.

Instructions for Students

Students have to attempt four questions in all from Section A and B by selecting 2 questions from each Section. Section C will be compulsory. Use of scientific calculator is allowed.

SECTION A

Cartesian and spherical polar co-ordinate systems, area, volume, displacement, velocity and acceleration in these systems, Solid angle, Centre of mass, Equivalent one body problem, Central forces, Equation of motion under central force, Equation of orbit in inverse square, Force field and turning points, Energy equation and Energy diagram, Kepler laws and their derivations.

Inertial frame of reference, Galilean transformation and invariance, Non-inertial frames of reference, Centrifugal force and its effect on acceleration due to gravity, Coriolis force and its applications, Variation of acceleration due to gravity with latitude.

SECTION B

Rigid body motion: Rotational motion, principal moments and axes, Euler's equations, precession and elementary gyroscope.

Concept of stationary universal frame of reference and ether, Michelson-Morley experiment and its result, Postulates of special theory of relativity, Lorentz transformations, Observer and viewer in relativity, Relativity of simultaneity, Length, Time, Relativistic addition theorem of velocities, Relativistic Doppler effect, Variation of mass with velocity, mass-energy equivalence, Relativistic momentum and energy, their transformation, concepts of Minkowski space, four vector formulation

Text Books:

1. Mechanics: Berkeley Physics Course, vol. I by C. Kittel, W.D. Knight, M. Alvin and A. Ruderman, Tata McGraw Hill Publication, 1981.
2. Mechanics: H.S. Hans and S.P. Puri, Tata McGraw Hill, 2003, New Delhi.
3. Introduction to Classical Mechanics by R.G. Takwale and P.S. Puranik, Tata McGraw Hill, 2000.

PHYB1102T: ELECTRICITY AND MAGNETISM

Max. Marks: 50
End-Semester exam: 35 marks
Internal Evaluation: 15 marks

Credits: 02
Total Teaching hours: 40
Pass Marks: 35 %

Instructions for Paper Setter

The end-semester examination will be of 35 marks and of 3 hours duration. The question paper will consist of three sections, namely, Section A, B and C. Section A and B will have four questions each from the respective sections of the syllabus. Each question will carry 6 marks and may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of 1 mark each covering the entire syllabus.

Instructions for Students

Students have to attempt four questions in all from Section A and B by selecting 2 questions from each Section. Section C will be compulsory. Use of scientific calculator is allowed.

SECTION A

Basic ideas of Vector Calculus, Gradient, Divergence, curl and their physical significance, Electric field due to dipole line charge and sheet of charge. Electric flux. Gauss s Law and its applications. Gauss's divergence theorem and differential form of Gauss's Law. Green's theorem.

Work and potential difference. Potential difference as line integral of electric field. Electric potential due to a point charge, a group or point charges, dipole and quadruple moments, long uniformly charged wire, charged disc. Stoke's theorem and its application in Electrostatic field, curl E=O. Electric field as gradient of scalar potential. Calculation of E due to a point charge and dipole from potential. Potential due to arbitrary charge distribution and multipole moments.

SECTION B

Current and current density, equation of continuity. Microscopic form of Ohm's Law ($J= \sigma E$) and conductivity. Failure of Ohm's Law. Invariance of charge. E in different frames of reference. Field of a point charge moving with constant velocity. Interaction between moving charges and force between parallel currents. Behaviour of various substances in magnetic field. Definition of M and H and their relation to free and bound currents. Permeability and susceptibilities and their inter-relationship.

Lorentz's force. Ampere's Circuital law and its application. Divergence and curl of B. Faraday's Law of EM induction. Displacement current. Maxwell's equations. Mutual inductance and reciprocity theorem. Self inductance L for solenoid. Coupling of Electrical circuits. Analysis of LCR series and parallel resonant circuits. Q—factor. Power consumed power factor.

Text Books:

1. Fundamentals of Electricity and Magnetism by Author F. Kipp, McGraw-Hill, 1969.
2. Electricity and Magnetism, Berkeley Physics Course, Vol. II by E.M Purcell, McGraw-Hill, 1965.
3. Introduction to classical Electodynamics by David Griffith.
4. EM waves and Radiating systems by Edward C. Jordan and K.G Balmain.

PHYB1103L: General Guidelines for Physics Practical Examinaiton

Maximum Marks: External: 35
Internal: 15
Total: 50

1. The student will be asked to perform one experiment out of the experiments mentioned in syllabus.

2. The distribution of marks is as follows:
   (i) One full experiment requiring the student to take some data, analyse it and draw conclusions (candidates are expected to state their results with limits of error. (17)
   (ii) Brief theory (06)
   (iii) Viva-Voce (06)
   (iv) Record (Practical File) (06)

3 There will be one session of 03 hours duration. The paper will consist of 06 experiments out of which an examinee will mark 04 experiments and one of these is to be alloted by the external examiner.

4 Number of candidates in a group for practical examination should not exceed 12.

5. In a single group no experiment be allotted to more than three students in any group.

6. The student should determine Standard Deviations and probable error in the calculations whereas needed.

Semester- I
(Total Teaching hours: 56)

1. Analysis of experimental data by:
   i) Fitting of given data to a straight line. ii) Calculation of probable error.
2. To determine the Young's Modulus by bending of beam.
3. Determination of modulus of rigidity of material of a wire using Maxwell's needle.
4. To establish relationship between torque and angular acceleration using fly wheel and hence to find inertia of flywheel.
5. Study the dependence of moment of inertia on distribution of mass (by noting time periods of oscillations) using objects of various geometrical shapes but of same mass.
6. Determination of Poisson's ratio for rubber.
7. Study the dependence of solenoidal field on number of turns and current.
8. To study the magnetic field produced by a current carrying solenoid using a search coil and to find the value of permeability of air.
9. To determine the value of air capacitance by de-sauty method and to find the permittivity of air and also to determine the dielectric constant of medium.
10. To study the working of an Energy Meter.
11. Determination of unknown capacitance by flashing and quenching of neon lamp.
12. Study the phase relationships between voltage and current using impedance triangle.
13. To study the resonance in series and parallel LCR circuits for different resistances and calculate Q-value.
14. Verify laws of electromagnetic induction and hence study the induced e.m.f. as function of velocity.

Text and Reference Books:

1. B.Sc. Practical Physics, By C.L. Arora, S. Chand & Co.
2. A Laboratory Manual of Physics for undergraduate classes by D.P. Khandelwal

Semester –II

PHYB1201T: WAVES AND VIBRATIONS

Max. Marks: 50
End-Semester exam: 35 marks
Internal Evaluation: 15 marks

Credits: 02
Total Teaching hours: 40
Pass Marks: 35 %

Instructions for Paper Setter

The end-semester examination will be of 35 marks and of 3 hours duration. The question paper will consist of three sections, namely, Section A, B and C. Section A and B will have four questions each from the respective sections of the syllabus. Each question will carry 6 marks and may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of 1 mark each covering the entire syllabus.

Instructions for Students

Students have to attempt four questions in all from Section A and B by selecting 2 questions from each Section. Section C will be compulsory. Use of scientific calculator is allowed.

SECTION A

Simple harmonic motion. Differential equation of SHM. Energy of a Simple Harmonic Oscillations (SHO). Electrical oscillations. Superposition of two perpendicular SHM of same period and of period ratio 1: 2. Anharmonic oscillations. Damping. Differential equation of motion. Types of damping. Determination of damping Coefficient-Logarithmic decrement. Relaxation time and Quality-Factor. Electromagnetic damping (Electrical oscillator).

Forced Oscillators. Differential equation for forced mechanical and electrical oscillators. Transient and steady state oscillation. Q value of a forced oscillator and band width. Q-value as an amplication factor of low frequency response.

SECTION B

Stiffness coupled oscillators. Normal co-ordinates and normal modes of vibration. Inductance coupling of electrical oscillators. Types of waves. Wave equation (transverse) and its solution. The string as a forced oscillator. Characteristic impedance of a string. Impedance matching. Energy transport in transverse waves. Reflection and transmission of waves on the string. Reflection and transmission of energy. Reflection and Transmission of Energy coefficients. Standing waves on a string of fixed length. Energy of vibrating string. Wave and group velocity.

Text Books:

1. Physics of Vibrations and Waves by H.J. Pain, Wiley & Sons, New Delhi
2. Fundamentals of Vibrations and Waves by S.P. Puri, Tata McGraw Hill, New Delhi.
3. Waves and Oscillations, by E. Crawford, Berkeley Physics Course, McGraw-Hill Publications.

PHYB1202T: OPTICS

Max. Marks: 50
End-Semester exam: 35 marks
Internal Evaluation: 15 marks

Credits: 02
Total Teaching hours: 40
Pass Marks: 35 %

Instructions for Paper Setter

The end-semester examination will be of 35 marks and of 3 hours duration. The question paper will consist of three sections, namely, Section A, B and C. Section A and B will have four questions each from the respective sections of the syllabus. Each question will carry 6 marks and may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of 1 mark each covering the entire syllabus.

Instructions for Students

Students have to attempt four questions in all from Section A and B by selecting 2 questions from each Section. Section C will be compulsory. Use of scientific calculator is allowed.

SECTION - A

Interference: Concept of coherence. Spatial and temporal coherence. Coherence time, Coherence length, Area of coherence. Conditions for observing interference fringes. Interference by wave front division and amplitude division. Michelson's interferometer—working, Principle and nature of fringes, Interference in thin films, Role of interference in anti-reflection and high reflection dielectric coatings. Multiple beam interference, Fabry-Perot interferometer, Nature of fringes, Newton Rings.

SECTION - B

Diffraction: Huygens-Fresnel theory, half-period zones. Zone plates. Distinction between Fresnel and Fraunhofer diffraction. Fraunhofer diffraction at rectangular and circular apertures. Effects of diffraction in optical imaging, resolving power of telescope. The diffraction grating, its use as a spectroscopic element and its resolving power.

Polarization: Concept and analytical treatment of un-polarized, plane polarized and elliptically polarized light. Double refraction. Nicol prism. Sheet polarizer. Retardation plates. Production and analysis of polarized light (quarter and half wave plates).

Text Books:

1. Fundamentals of Optics, F.A. Jenkins and Harvery E. White (McGraw Hill) 4th edition, 2001.
2. Optics, Ajoy Ghatak (McMillan India) 2nd edition, 7th reprint 1997.
3. Introduction to Atomic Spectra, H.E. White (McGraw Hill Book Co.)

Reference Book:

1. Optics, Born and Wolf (Pergamom Press), 3rd edition, 1965.

PHYB1203L: General Guidelines for Physics Practical Examinaiton

Maximum Marks: External: 35
Internal: 15
Total: 50

1. The student will be asked to perform one experiment out of the experiments mentioned in syllabus.

2. The distribution of marks is as follows:
   (i) One full experiment requiring the student to take some data, analyse it and draw conclusions (candidates are expected to state their results with limits of error. (17)
   (ii) Brief theory (06)
   (iii) Viva-Voce (06)
   (iv) Record (Practical File) (06)

3 There will be one session of 03 hours duration. The paper will consist of 06 experiments out of which an examinee will mark 04 experiments and one of these is to be alloted by the external examiner.

4 Number of candidates in a group for practical examination should not exceed 12.

5. In a single group no experiment be allotted to more than three students in any group.

6. The student should determine Standard Deviations and probable error in the calculations whereas needed.

Semester- II
(Total Teaching hours: 56)

1. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine
   i) Radius of gyration of bar pendulum about an axis through its Centre of Gravity and perpendicular to its length.
   ii) Value of Centre of Gravity, g.
2. Determination of g by Kater's pendulum.
3. Measurement for logarithmic decrement, co-efficient of damping, relaxation time and quality factor of a damped simple pendulum.
4. To determine the frequency of AC mains using a sonometer and an electro magnet.
5. To set up CRO for Sine and Square wave and to find their frequency and amplitude.
6. To determine the refractive index of liquid using spectrometer
7. To determine the Cauchy's constants
8. To study the refractive index of doubly refracting prism
9. Set up Newton's Rings to find wavelength of sodium light.
10. To determine the resolving power of a telescope.
11. To determine the angle of wedge using interference method.
12. To determine the relationship between the intensity of the transmitted light through analyzer and 'θ', the angle between the axes of polarizer and analyzer and to verify Malus Law.
13. To measure an inaccessible height using Sextant.
14. To determine the dispersive and resolving power of a plane diffraction grating using Hg source.

Text and Reference Books:

1. B.Sc. Practical Physics, By C.L. Arora, S. Chand & Co.
2. A Laboratory Manual of Physics for undergraduate classes by D.P. Khandelwal