SYLLABUS OF PHYSICS FOR

MULTIDISCIPLANARY UG PROGRAMME B.Sc. (Honours)

(Semester - I and II)

Session: 2025-26, 2026-27

GURU NANAK COLLEGE BUDHLADA

(An Autonomous College)

Under Punjabi University Patiala

Head
Department of Physics
Guru Nanak College Budhlada

Guru Nanak College, Budhlada

(Autonomous College, Punjabi University Patiala)

MULTIDISCIPLANARY UG PROGRAMME B.Sc. (Honours)

(I and II Semesters)

SESSION 2025-26 & 2026-27

Study Scheme for Physics

Semester I	Title of Paper	Credits	Max Marks	External Marks	Internal Marks	Examination Time (Hours)
BPHY1101T	**MAJ:** Mechanics	3	100	70	30	03 hrs.
BPHY1101P	**MAJ:** Physics Laboratory-I	1	50	35	15	03 hrs.
BPHY1101T	**MIN:** Mechanics	3	100	70	30	03 hrs.
BPHY1101P	**MIN:** Physics Laboratory-I	1	50	35	15	03 hrs.
BPHY1103T	**IDC:** Evolving Universe	3	100	70	30	03 hrs.
BPHY1104T	**SEC:** Electronic Workshop-I	2	50	35	15	1.5hrs
BPHY1104P	**SEC:** Electronic Workshop-I	1	50	35	15	03 hrs.
Semester II	**Title of Paper**	**Credits**	**Max Marks**	**External Marks**	**Internal Marks**	**Examination Time (Hours)**
BPHY1201T	**MAJ:** Electricity and Magnetism	3	100	70	30	03 hrs.
BPHY1201P	**MAJ:** Physics Laboratory-II	1	50	35	15	03 hrs.
BPHY1201T	**MIN:** Electricity and Magnetism	3	100	70	30	03 hrs.
BPHY1201P	**MIN:** Physics Laboratory-II	1	50	35	15	03 hrs.
BPHY1203T	**IDC:** Applied Physics-I	3	100	70	30	03 hrs.
BPHY1204T	**SEC:** Electronic Workshop-II	2	50	35	15	1.5hrs
BPHY1204P	**SEC:** Electronic Workshop-II	1	50	35	15	03 hrs.

MAJ: Discipline Specific Core Course; **MIN:** Minor Core Course; **IDC/MDC**: Inter Disciplinary Course/ Multi-Disciplinary Course; **SEC:** Skill Enhancement Course.

Note: 1. Weightage of different components in internal assessment of theory paper is as: Attendance - **20%**, Assignment/Project/Seminar - **40%** and Performance in two Mid Semester Tests - **40%** and weightage for practical and workshop paper is as: Attendance - **20%,** Viva Voce/Project/Seminar - **40%** and Lab/Workshop performance - **40%**.

2. Students will be allowed to opt courses pertaining to SEC/VAC/AEC/IDC/MDC from a pool of papers under each category.

Head
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Semester -I
MECHANICS
Paper Code: BPHY1101T
(Major)

Max. Marks: 100
External Marks: 70
Internal Marks: 30

Credit: 03
Total Lectures: 45 Hours
Pass Marks: 35%

Instructions for Paper Setter

The end-semester examination will be of 70 marks and 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 12 marks and may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of 2 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.

Course Outcomes: *On completion of this course, student will be able to: –*

1. ***CO1:*** *Apply coordinate transformation techniques in Cartesian and spherical polar systems to derive expressions for area, volume, velocity, acceleration, and understand solid angles.*
2. ***CO2:*** *Analyze physical systems under central forces using the concept of center of mass, derive the equation of motion and orbital equation under inverse square law, and explain Kepler's laws with mathematical derivation.*
3. ***CO3:*** *Interpret the conservation laws of linear momentum, angular momentum, and energy in relation to space-time symmetries, and examine the non-inertial reference frames with applications of Coriolis force and variation of gravity with latitude.*
4. ***CO4:*** *Understand the postulates of special relativity, derive and apply Lorentz transformations, and analyze the relativity of simultaneity, length contraction, time dilation, and relativistic velocity addition.*
5. ***CO5:*** *Apply the concepts of relativistic mechanics to derive relations for mass-energy equivalence, relativistic momentum, and analyze inelastic collisions in terms of rest mass and energy conservation.*
6. ***CO6:*** *Understand the kinematics and dynamics of collisions, distinguish between elastic collisions in laboratory and C.M. frames, calculate scattering angles, cross-sections, and qualitatively explain Rutherford scattering.*

SECTION A

Co-ordinate systems: Cartesian and spherical polar co-ordinate systems, area, volume, displacement, velocity and acceleration in these systems, Solid angle.
Central Forces: 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, Kepler laws and their derivations.
Conservation laws and symmetries: Relationship of conservation laws and symmetries of space and time. Inertial frame of reference. Coriolis force and its applications.

SECTION B

Special theory of relativity: Postulates of special theory of relativity. Galilean Transformation and its invariance, Lorentz transformations, Observer and viewer in relativity. Relativity of simultaneity. Length, Time, Velocities, Relativistic Doppler effect. Variation of mass with velocity, mass-energy equivalence, rest mass in an inelatic collision, Relativistic momentum and energy,

Collision: Elastic collision in Laboratory and C.M.system, velocities, angels and energies, Cross section of elastic scattering . Rutherford scattering (qualitative).

Text Books:

1. Mechanics : Berkeley Physics Course, vol. I by C.Kittel, W.D.Knight and M.A.Ruderman, Mc Graw-Hill Publication

2. Mechanics : H.S.Hans and S.P.Puri, Tata McGraw Hill, New Delhi

Guru Nanak College, Budhlada

(Autonomous College, Punjabi University Patiala)

Physics Laboratory-1
Paper Code: BPHY1101P
(Major Practical)

Max. Marks: 50 | Credits: 01
End-Semester exam: 35 marks | Total Load: 30 hours
Internal Evaluation: 15 marks | Pass Marks: 35 %

General Guidelines for End-Semester Practical Examination:

1. The student will be allotted one experiment out of the experiments mentioned in syllabus and asked to perform.
2. The distribution of marks is as follows:
   (i) One full experiment requiring the student to take some data, analyse it and draw conclusions (17)
   (ii) Brief theory (06)
   (iii) Viva-Voce (06)
   (iv) Record (Practical File) (06)

Course Outcomes: *On completion of this course, student will be able to: –*

CO1:
Apply fundamental principles of mechanics and electromagnetism through hands-on experiments involving torque, collisions, oscillations, and field measurements.

CO2:
Analyze experimental data using statistical tools such as linear fitting and probable error to interpret results with accuracy and reliability.

CO3:
Determine mechanical and elastic properties of materials, including Young's modulus and Poisson's ratio, through experimental setups like beam bending and deformation tests.

CO4:
Operate and interpret signals using a Cathode Ray Oscilloscope (CRO), and understand waveform characteristics such as amplitude and frequency.

CO5:
Investigate electrical and magnetic properties through experiments on solenoids, search coils, capacitance measurement, and energy efficiency of heating devices.

List of Experiments

List of Experiments

1. Analysis of experimental data by :
   i) Fitting of given data to a straight line. ii) Calculation of probable error.

2. To establish relationship between torque and angular acceleration using fly wheel and hence to find inertia of flywheel.

3. To determine the Young's Modulus by bending of beam.

4. To study one-dimensional collision using two hanging spheres of different materials.

5. Determination of Poisson's ratio for rubber.

6. Study the dependance of moment of inertia on distribution of mass (by noting time periods of oscillations) using objects of various geometrical shapes but of same mass.

7. To set up CRO for Sine and Square wave and to find their frequency and amplitude.
8. Study the dependence of solenoidal field on number of turns and current.
9. To study the magnetic field produced by a current carrying solenoid using a search coil and to find the value of permeability of air.
10. To determine the value of air capacitance by de-Sauty method and to find the permittivity of air and to determine the dielectric constant of medium.
11. To study the efficiency of an electric kettle/heater element with varying input voltages.
12. To study the working of energy meter.

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

MECHANICS
Paper Code: BPHY1101T
(Minor Theory)

Max. Marks: 100
External Marks: 70
Internal Marks: 30

Credit: 03
Total Lectures: 45 Hours
Pass Marks: 35%

Instructions for Paper Setter

The end-semester examination will be of 70 marks and 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 12 marks and may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of 2 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.

Course Outcomes: *On completion of this course, student will be able to: –*

1. *Apply coordinate transformation techniques in Cartesian and spherical polar systems to derive expressions for area, volume, velocity, acceleration, and understand solid angles.*
2. *Analyze physical systems under central forces using the concept of center of mass, derive the equation of motion and orbital equation under inverse square law, and explain Kepler's laws with mathematical derivation.*
3. *Interpret the conservation laws of linear momentum, angular momentum, and energy in relation to space-time symmetries, and examine the non-inertial reference frames with applications of Coriolis force and variation of gravity with latitude.*
4. *Understand the postulates of special relativity, derive and apply Lorentz transformations, and analyze the relativity of simultaneity, length contraction, time dilation, and relativistic velocity addition.*

5. *Apply the concepts of relativistic mechanics to derive relations for mass-energy equivalence, relativistic momentum, and analyze inelastic collisions in terms of rest mass and energy conservation.*
6. *Understand the kinematics and dynamics of collisions, distinguish between elastic collisions in laboratory and C.M. frames, calculate scattering angles, cross-sections, and qualitatively explain Rutherford scattering.*

SECTION A

Co-ordinate systems: Cartesian and spherical polar co-ordinate systems, area, volume, displacement, velocity and acceleration in these systems, Solid angle.
Central Forces: 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, Kepler laws and their derivations.

SECTION B

Collision: Elastic collision in Laboratory and C.M.system, velocities, angels and energies, Cross section of elastic scattering . Rutherford scattering (qualitative).

Special theory of relativity: Postulates of special theory of relativity. Galilean Transformation and its invariance, Lorentz transformations, Observer and viewer in relativity. Relativity of simultaneity. Length, Time, Velocities, Relativistic Doppler effect. Variation of mass with velocity, mass-energy equivalence, rest mass in an inelatic collision, Relativistic momentum and energy,

Text Books:

1. Mechanics : Berkeley Physics Course, vol. I by C.Kittel, W.D.Knight and M.A.Ruderman, Mc Graw-Hill Publication

2. Mechanics : H.S.Hans and S.P.Puri, Tata McGraw Hill, New Delhi

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Physics Laboratory-1
Paper Code: BPHY1101P
(Minor Practical)

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

Credits: 01
Total Load: 30 hours (02 hours per week)
Pass Marks: 35 %

General Guidelines for End-Semester Practical Examination:

1. The student will be allotted one experiment out of the experiments mentioned in syllabus and asked to perform.
2. The distribution of marks is as follows:
   (i) One full experiment requiring the student to take some data, analyse it and draw conclusions (17)
   (ii) Brief theory (06)
   (iii) Viva-Voce (06)
   (iv) Record (Practical File) (06)

Instructions for Students

Students have to perform at least nine experiments.

Course Outcomes: *On completion of this course, student will be able to: –*

CO1:

Apply fundamental principles of mechanics and electromagnetism through hands-on experiments involving torque, collisions, oscillations, and field measurements.

CO2:

Analyze experimental data using statistical tools such as linear fitting and probable error to interpret results with accuracy and reliability.

CO3:

Determine mechanical and elastic properties of materials, including Young's modulus and Poisson's ratio, through experimental setups like beam bending and deformation tests.

CO4:

Operate and interpret signals using a Cathode Ray Oscilloscope (CRO), and understand waveform characteristics such as amplitude and frequency.

CO5:

Investigate electrical and magnetic properties through experiments on solenoids, search coils, capacitance measurement, and energy efficiency of heating devices.

List of the Experiments:

1. Analysis of experimental data by:
   iii) Fitting of given data to a straight line.
   iv) Calculation of probable error.
2. To establish relationship between torque and angular acceleration using flywheel and hence find moment of inertia of flywheel.
3. To find the Young's modulus of material of a rectangular bar by bending.
4. To determine modulus of rigidity of material of wire using Maxwell's needle.
5. To study the dependence of moment of inertia on distribution of mass (by recording time periods of oscillations) using objects of various geometrical shapes but of same mass.
6. To study one-dimensional collision using two hanging spheres.

7. To find relationship between longitudinal strain and lateral strain in case of rubber tube and hence find Poisson's ratio for rubber.
8. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and hence determine:
   (i) Radius of gyration of bar pendulum about an axis through its centre of gravity and perpendicular to its length.
   (ii) Value of acceleration due to gravity, g.
9. To find the value of acceleration due to gravity using Kater's pendulum.
10. To measure the logarithmic decrement, co-efficient of damping, relaxation time and quality factor of a damped simple pendulum.

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

Evolving Universe
Paper Code: BPHY1103T
(IDC/MDC)

Max. Marks: 100
End-Semester exam: 70 marks
Internal Evaluation: 30 marks

Credits: 03
Total Load: 45 hours
Pass Marks: 35 %

Instructions for Paper Setter

The end-semester examination will be of 35 marks and 1.5 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 06 marks and may be segregated into sub-parts. Section C will be compulsory with 11 objective/short-answer type questions of 01 mark each which will cover the entire syllabus.*

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.

Course Outcomes: *On completion of this course, student will be able to: –*

CO1:
Describe the structure and components of the solar system including planets, satellites, asteroids, comets, and other minor bodies.

CO2:
Explain theories of the origin of the solar system and analyze the physical structure and properties of the Sun and other stars.

CO3:
Interpret stellar properties such as distance, mass, and luminosity, and discuss the life cycle of stars including white dwarfs, neutron stars, and black holes.

CO4:
Classify galaxies and describe the structural features of the Milky Way, quasars, and interstellar medium.

CO5:
Evaluate the large-scale structure and evolution of the universe, and explain key cosmological theories including the Big Bang and the role of dark matter and dark energy.

SECTION-A

Solar System: Terrestrial Planets, Jovian Planets, Natural Satellites, Minor Bodies of the Solar System (Asteroids, Comets, Dwarf Planets, Trans-Neptunian Objects)

Origin of Solar System: Basic theories, Sun: Structure and General Properties

Stars: Stellar Properties (Distances, Sizes, Masses), Interstellar Medium (General Description), Formation of Stars, End Stages of Stars (White Dwarfs, Neutron Stars, Supernova, Black Holes)

SECTION-B

Galactic Astronomy: Galaxies, Classification of Galaxies, Galactic Properties, Milky Way Galaxy (Structure and Components), Quasars (Brief Description)

Universe: Introductory Concept, Large Scale Structure of the Universe (Group of Galaxies, Clusters, Super clusters), Evolution of Universe (Steady State Theory, Big Bang Theory, Oscillating Theory), Dark Matter and Dark Energy

Text Books:

1. Astronomy: Dinah L Moche, John Wiley & Sons, Inc. Eight Edition, 2014.
2. The Cosmos-Astronomy in the New Millennium: Jam M. Pasachoff & Alex Filippenko, Cambridge University Press, Fourth Edition, 2013.
3. The Life and Death of Stars: Kenneth R. Lang, Cambridge University Press, 1st edition, 2013.
4. The Cambridge Guide to the Solar System: Kenneth R. Lang, Cambridge University Press,2nd edition 2011.

Electronics Workshop-I

Paper Code: BPHY1104T
(Skill Enhancement Course)

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

Credits: 02
Total Load: 30 hours
Pass Marks: 35%

Instructions for Paper Setter

The end-semester examination will be of 35 marks and 1.5 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 06 marks and may be segregated into sub-parts. Section C will be compulsory with 11 objective/short-answer type questions of 01 mark each which will cover the entire syllabus.

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.

Objective of the course

The emphasis of course is to enhance a particular skill among the students.

SECTION-A

Introduction to electronic components: Resistors, Capacitors, Diodes, Switches, Inductors, Transistors, Transformers and ICs.

Electrical Measurement Instruments: their types - Analog & Digital Instruments; DC and AC Voltmeter, Ammeters, Construction and working of an Analog Multimeter and Digital Multimeter, CRO.

SECTION-B

Soldering: Basics of soldering process, soldering tools and materials (solder, flux), Types of soldering irons including Wattage, Temperature, Tips, Soldering and Disordering station.

Basic electronic Circuits and power sources: Resistor & capacitor circuit, PN junction, Zener diode, LED, Solar Cells, AC to DC convertor, Low & high pass RC filter circuit, DC & AC voltage and Current sources their symbols including Batteries, Function generator.

Recommended Books:

1. Electronic Instrumentation and Measurements, 4th Edition, by H.S. Kalsi, Tata McGraw-Hill Publishing Company Limited, New Delhi (2019).
2. Electronic Principles: Devices and Circuits by M.L. Anand, A H Wheeler Publishing Co Ltd (31 May 2001).
3. Soldering in Electronics Assembly by Mike Judd & Keith Brindley, Newnes; 2nd edition (26 March 1999).
4. The Basics of Soldering by A Rahn, John Wiley & Sons Inc; 1st edition (17 May 1993).
5. Electronic Principles by Albert Paul Malvino & David J. Bates, McGraw Hill; 8th edition (16 February 2015).
6. Electronics Workshop Companion by Stan Gibilisco, McGraw Hill TAB; Illustrated edition (16 June 2015).

Electronics Workshop I
Paper Code: BPHY1104P
(SEC)

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

Credits: 01
Total Load: 30 hours
Pass Marks: 35 %

General Guidelines for End-Semester Examination:

1. The student will be allotted one activity out of the activities mentioned in syllabus and asked to perform.
2. The distribution of marks is as follows:
   (i) One full activity requires the student to take some data, analyze it and draw conclusions. (17)
   (ii) Brief theory (06)
   (iii) Viva-Voce (06)

(iv) Record (Activity File) (06)

Course Outcomes: *On completion of this course, student will be able to: –*

CO1:
Identify and draw symbols of basic electronic components and circuit diagrams from simple to moderately complex electronic circuits.

CO2:
Demonstrate the use of electronic measuring instruments like multimeters for testing and troubleshooting components.

CO3:
Test and analyze basic electronic components such as resistors, capacitors, diodes, and transistors using standard tools.

CO4:
Construct and verify series and parallel combinations of resistors and capacitors, and measure related quantities like voltage, current, and resistance.

CO5:
Assemble, solder, and test basic electronic circuits (e.g., LED light circuit, transistor timer, fire alarm) on a breadboard with proper safety and functionality.

List of the Activities:

1. Draw symbols of various electronic components on drawing sheets. Draw the circuit diagrams of various (Simple to Complex) electronic circuits on drawing sheets.
2. Familiarization of Electronic Measuring Instruments and Components.
3. Testing of electronic components like Resistor, Capacitor, Diode, Transistor using Multimeter.
4. Measurement of resistance, voltage and current using Digital Multimeter.
5. To study the series and parallel combination of a resistor.
6. To study the series and parallel combination of a capacitor.
7. Practice to Solder different components such as resistor, capacitor, diodes and transistors.
8. Sketch, mount, solder and test at least one from following electronic circuit on bread board (Circuits given as a guideline only)
   (i) How to build a very simple circuit which lights up a single Light Emitting Diode (LED)?
   (ii) To build the transistor timer circuit.
   (iii) Fire alarm
   (iv) Electronic Eye Controlled Security System Applications

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Semester-II
ELECTRICITY AND MAGNETISM
Paper Code: BPHY1201T
(Major)

Max. Marks: 100
External Marks: 70
Internal Marks: 30

Credit: 03
Total Lectures: 45 Hours
Pass Marks: 35%

Instructions for Paper Setter

The end-semester examination will be of 70 marks and 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 12 marks and may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of 2 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.

Course Outcomes: *On completion of this course, student will be able to: –*
CO1:*Apply vector calculus concepts (gradient, divergence, and curl) to analyze electrostatic fields and understand the physical significance of vector operations.*
CO2:*Evaluate electric fields and electric potential due to various charge distributions using Coulomb's law, Gauss's law, and the principles of electrostatics.*
CO3:*Derive and interpret Poisson's and Laplace's equations and solve problems involving electric potentials of dipoles, line charges, and charged discs.*
CO4:*Apply Biot-Savart's law and Ampere's circuital law to calculate magnetic fields in symmetric configurations and understand the physical concepts like the Hall effect.*
CO5:*Analyze time-varying electromagnetic fields using Faraday's and Maxwell's equations, and examine the behavior of AC circuits with LCR components, resonance, and power factor.*

SECTION A

Vector Calculus: Basic ideas of vector calculus, Gradient, Divergence, curl and their physical significance, Coulomb's law in vector form, Coloumb law for point charges, Conservation and quantization of charges,

Electric Field: Electric field due to dipole line charge and sheet of charge, Solid Angle, Electric Flux, Gauss law and its applications, Gauss Divergence theorem, differential form of Gauss Law, Greens Theorem.

Electric Potential: Work and potential difference, Electric potential due to point charge, dipole and quadruple moments, , potential due to arbitrary charge distribution and multipole moment, long uniformly charged wire, charged disc, Stoke Theorem, curlE=0, Electric field as gradient of scalar potential, Derivation of Poisson and Laplace Equation in cartesian system,

SECTION B

Magnetic Field: Definition of B, Biot Savart's Law and its applications to long straight wire, circular current loop and solenoid. Ampere's Circuital law and its applications. Divergence and curl of **B**. Hall effect and derivation of Hall co-efficient.

Electromagnetic Induction: Faraday's Law and EM induction. Displacement current. Derivation and Physical Significance of Maxwell's equations. Self and mutual inductance, Coupling of Electrical circuits. Analysis of LCR series and parallel resonant circuits.Q-factor. Power consumed Power factors.

Text Books:

1. Electricity and Magnetism. Berkeley Physics Course. Vol.II by E.M.Purcell, McGraw-Hill, 1965.
2. Fundamentals of Electricity and Magnetism by Author F.Kip.Mc Graw Hill (1969)
3. Introduction to Classical Electrodynamics by David Griffith. Prentice Hall of India, New Delhi.
4. EM Waves and Radiating Systems by Edward C.Jordan and K.G.Balmain. Prentice Hall of India, New Delhi.

Physics Laboratory-2
Paper *Code: PHYB1201P*
(Major Practical)

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

Credits: 01
Total Load: 30 hours
Pass Marks: 35 %

General Guidelines for End-Semester Practical Examinaiton:

1. The student will be allotted one experiment out of the experiments mentioned in syllabus and asked to perform.
2. The distribution of marks is as follows:
   (i) One full experiment requiring the student to take some data, analyse it and draw conclusions (17)
   (ii) Brief theory (06)
   (iii) Viva-Voce (06)
   (iv) Record (Practical File) (06)
3. ***Course Outcomes:*** *On completion of this course, student will be able to: –*

CO1. Understand and determine the **Hall coefficient**, **carrier concentration**, and **mobility** in semiconductors using the Hall effect.

CO2. Analyze **resonance behavior** in **LCR circuits** and determine the **Q-factor** for different resistances in both **series and parallel configurations**.

CO3. Apply **de-Sauty's bridge** to determine the **unknown capacitance** and evaluate the **permittivity of air**, linking theory to practical measurements.

CO4. Investigate the **magnetic field of a solenoid** using a **search coil** and accurately determine the **permeability of free space** (μ_0).

CO5. Use **Carey Foster's Bridge** to measure **low resistance values** with precision, reinforcing concepts of electrical bridge circuits and potential difference.

List of the Experiments:

1. To study the dependence of solenoidal field on number of turns and current.
2. To study the magnetic field produced by a current carrying solenoid using a search coil and to find the value of permeability of air.
3. To determine the value of air capacitance and find the permitivity of air by de-Sauty's method.
4. To determine the Hall coefficient of the given sample and hence find the carrier concentration and mobility.
5. To determine the unknown capacitance using flashing and quenching of neon lamp.
6. To study the phase relationships between voltage and current using impedence triangle.
7. To study the resonance in series LCR cicuits for different resistances and calculate Q-value.
8. To study the resonance in parallel LCR cicuits for different resistances and calculate Q-value.
9. To find an unknown low Resistance using Carey Foster's Bridge.
10. To determine the value of unknown inductance with the help of Anderson's Bridge.
11. To study the induced e.m.f as a function of velocity of magnet.

Text Books:

1. B.Sc. Practical Physics, C.L. Arora, S. Chand & Company Ltd. 2020.

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ELECTRICITY AND MAGNETISM

Paper Code: BPHY1201T

(Minor)

Max. Marks: 100
External Marks: 70
Internal Marks: 30

Credit: 03
Total Lectures: 45 Hours
Pass Marks: 35%

Instructions for Paper Setter

The end-semester examination will be of 70 marks and 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 12 marks and may be segregated into sub-parts. Section C will be compulsory with 11 short-answer type questions of 2 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.

Course Outcomes: *On completion of this course, student will be able to: –*

CO1:*Apply vector calculus concepts (gradient, divergence, and curl) to analyze electrostatic fields and understand the physical significance of vector operations.*

CO2:*Evaluate electric fields and electric potential due to various charge distributions using Coulomb's law, Gauss's law, and the principles of electrostatics.*

CO3:*Derive and interpret Poisson's and Laplace's equations and solve problems involving electric potentials of dipoles, line charges, and charged discs.*

CO4:*Apply Biot-Savart's law and Ampere's circuital law to calculate magnetic fields in symmetric configurations and understand the physical concepts like the Hall effect.*

CO5:*Analyze time-varying electromagnetic fields using Faraday's and Maxwell's equations, and examine the behavior of AC circuits with LCR components, resonance, and power factor.*

SECTION A

Vector Calculus: Basic ideas of vector calculus, Gradient, Divergence, curl and their physical significance, Coulomb's law in vector form, Coloumb law for point charges, Conservation and quantization of charges,

Electric Field: Electric field due to dipole line charge and sheet of charge, Solid Angle, Electric Flux, Gauss law and its applications, Gauss Divergence theorem, differential form of Gauss Law, Greens Theorem.

Electric Potential: Work and potential difference, Electric potential due to point charge, dipole and quadruple moments, , potential due to arbitrary charge distribution and multipole moment, long uniformly charged wire, charged disc, Stoke Theorem, curlE=0, Electric field as gradient of scalar potential, Derivation of Poisson and Laplace Equation in cartesian system,

SECTION B

Magnetic Field: Definition of B, Biot Savart's Law and its applications to long straight wire, circular current loop and solenoid. Ampere's Circuital law and its applications. Divergence and curl of **B**. Hall effect and derivation of Hall co-efficient.

Electromagnetic Induction: Faraday's Law and EM induction. Displacement current. Derivation and Physical Significance of Maxwell's equations. Self and mutual inductance, Coupling of Electrical circuits. Analysis of LCR series and parallel resonant circuits.Q-factor. Power consumed Power factors.

Text Books:

1. Electricity and Magnetism. Berkeley Physics Course. Vol.II by E.M.Purcell, McGraw-Hill, 1965.
2. Fundamentals of Electricity and Magnetism by Author F.Kip.Mc Graw Hill (1969)
3. Introduction to Classical Electrodynamics by David Griffith. Prentice Hall of India, New Delhi.
4. EM Waves and Radiating Systems by Edward C.Jordan and K.G.Balmain. Prentice Hall of India, New Delhi.

Physics Laboratory-2
Paper *Code: PHYB1201P*
(Minor Practical)

Max. Marks: 50 | **Credits: 01**
End-Semester exam: **35 marks** | **Total Load: 30 hours**
Internal Evaluation: 15 marks | **Pass Marks: 35 %**

General Guidelines for End-Semester Practical Examinaiton:

1. The student will be allotted one experiment out of the experiments mentioned in syllabus and asked to perform.
2. The distribution of marks is as follows:
   (i) One full experiment requiring the student to take some data, analyse it and draw conclusions (17)
   (ii) Brief theory (06)
   (iii) Viva-Voce (06)
   (iv) Record (Practical File) (06)

Course Outcomes: *On completion of this course, student will be able to: –*

CO1. Understand and determine the **Hall coefficient**, **carrier concentration**, and **mobility** in semiconductors using the Hall effect.

CO2. Analyze **resonance behavior** in **LCR circuits** and determine the **Q-factor** for different resistances in both **series and parallel configurations**.

CO3. Apply **de-Sauty's bridge** to determine the **unknown capacitance** and evaluate the **permittivity of air**, linking theory to practical measurements.

CO4. Investigate the **magnetic field of a solenoid** using a **search coil** and accurately determine the **permeability of free space** (μ_0).

CO5. Use **Carey Foster's Bridge** to measure **low resistance values** with precision, reinforcing concepts of electrical bridge circuits and potential difference.

List of the Experiments:

1. To study the dependence of solenoidal field on number of turns and current.
2. To study the magnetic field produced by a current carrying solenoid using a search coil and to find the value of permeability of air.
3. To determine the value of air capacitance and find the permitivity of air by de-Sauty's method.
4. To determine the Hall coefficient of the given sample and hence find the carrier concentration and mobility.
5. To determine the unknown capacitance using flashing and quenching of neon lamp.
6. To study the phase relationships between voltage and current using impedence triangle.
7. To study the resonance in series LCR cicuits for different resistances and calculate Q-value.
8. To study the resonance in parallel LCR cicuits for different resistances and calculate Q-value.
9. To find an unknown low Resistance using Carey Foster's Bridge.
10. To determine the value of unknown inductance with the help of Anderson's Bridge.
11. To study the induced e.m.f as a function of velocity of magnet.

Text Books:

1. B.Sc. Practical Physics, C.L. Arora, S. Chand & Company Ltd. 2020.

Applied Physics-I
Paper Code: BPHY1203T
(IDC/MDC)

Max. Marks: 100
End-Semester exam: 70 marks
Internal Evaluation: 30 marks

Credits: 03
Total Load: 45 hours
Pass Marks: 35 %

Instructions for Paper Setter

The end-semester examination will be of 35 marks and 1.5 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 06 marks and may be segregated into sub-parts. Section C will be compulsory with 11 objective/short-answer type questions of 01 mark each which will cover the entire syllabus.*

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.

Course Outcomes: *After completing this course, the students will be able to:*

CO1. *Derive and solve the* ***differential equation of simple harmonic motion*** *and analyze physical systems such as* ***mechanical and electrical (LC) oscillators****.*
CO2. *Understand and evaluate the effect of* ***damping in oscillatory systems****, define parameters like* ***logarithmic decrement****,* ***relaxation time****, and* ***quality factor****, and relate them to* ***LCR circuits****.*
CO3. *Explain and apply the principle of* ***interference by division of amplitude****, analyze the behavior of* ***thin films****, and use* ***Michelson interferometer*** *for measurement-based applications.*
CO4. *Analyze* ***Fraunhofer diffraction patterns*** *from apertures and slits, and calculate the* ***resolving power*** *of optical instruments based on* ***Rayleigh's criterion****.*
CO5. *Describe the phenomenon of* ***polarization****, understand the use of* ***Nicol prism****, and distinguish between* ***plane, circular, and elliptical polarization*** *using mathematical formulations.*

Guru Nanak College, Budhlada

(Autonomous College, Punjabi University Patiala)

SECTION-A

Simple harmonic motion: Differential equation, Energy of simple harmonic oscillator, lissajous figures formed by superposition of two SHM, Charge oscillations in a LC circuit. Damped oscillator: Differential equation, methods of describing damping of an oscillator- logarithmic decrement, relaxation time, quality factor, Damped oscillations in a LCR circuit.

SECTION-B

Interference by division of amplitude: plane parallel thin films, colors in thin films, non-reflecting films/coatings, high reflectivity thin film coatings, Michelson interferometer.

Fraunhoffer diffraction from circular aperture, double slit and a grating (normal incidence case), Rayleigh's criteria of resolution, resolving power of telescope, microscope and grating.

Polarization by double refraction, Nicol prism, Concept of plane, circular and elliptical polarization with mathematical expression.

Text Books:

1. Physics of Vibrations and Waves by H.J. Pain, Wiley & Sons, New Delhi, 6th Edition, 2005.
2. Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill.
3. Physics for Engineering Applications by S. Puri (Narosa Publishers), 2010.

Guru Nanak College, Budhlada

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Electronics Workshop-2

Paper Code: BPHY1204T

(Skill Enhancement Course)

Max. Marks: 50 **Credits: 02**
End-Semester exam: 35 marks **Total Load: 30 hours**
Internal Evaluation: 15 marks **Pass Marks: 35%**

Instructions for Paper Setter

The end-semester examination will be of 35 marks and 1.5 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 06 marks and may be segregated into sub-parts. Section C will be compulsory with 11 objective/short-answer type questions of 01 mark each which will cover the entire syllabus.

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.

SECTION-A

Introduction to PCB: History, Types, Mounting Technologies, Plated Through Hole, Surface Mount, PCB Material, Design rules for Digital circuit PCBs, Analog circuit PCBs, high frequency and fast pulse applications, Power electronic applications, Microwave applications.

EDA (Electronic design automation) tools for PCB designing: Proprietary tools like Eagle, Ultiboard, Orcad and Opensource tools like KiCad/EasyEDA.

SECTION-B

KiCad/EasyEDA: Schematic Design: Component Libraries, Symbol Creation, Electrical Rule Check. PCB Layout Design: Netlist Generation and Import, Component Placement, Routing, Design Rules Check (DRC). **Multilayer PCBs:** Layer Management, Via and Pad Design. Power and Signal Integrity: Ground Planes and Power Planes, Signal Integrity. Design for Manufacturing: Designing for Fabrication, Panelization, Gerber Files. Simulation and Testing: Circuit Simulation, Design Iteration and Testing.

Advanced Features: Scripting and Customization, BOM (Bill of Materials) Management,Techniques for managing different versions of your PCB design. Fabrication and Assembly: Choosing a Manufacturer based on your design requirements, component assembly and soldering techniques.

CRO: Basic working, construction and Principle of CRO.

RECOMMENDED BOOKS

1. Printed circuit Board Design and technology, Walter C. Bosshart, McGraw Hill Education, 1983.
2. Printed Circuits Handbook, Sixth Edition, by Clyde F. Coombs, Jr, Happy T. Holden, Publisher: McGraw-Hill Education Year, 2016.
3. https://docs.easyeda.com/en/Introduction/Introduction-to-EasyEDA/.
4. RS Khandpur, Printed Circuit Board, McGraw Hill Education, 2017.
5. S D Mehta, Electronic Product Design Volume-I, S Chand & Company, 2011.

6. V. Shukla, Signal Integrity for PCB Designers, Reference Designer, 2009.

Electronics Workshop-II
Paper Code: BPHY1204P
(Skill Enhancement Course)

Max. Marks: 50 **Credit: 01**
End-Semester exam: 35 marks
Internal Evaluation: 15 marks

Total Load: 30 hours
Pass Marks: 35 %

General Guidelines for End-Semester Examination:

1. The student will be allotted one activity out of the activities mentioned in syllabus and asked to perform.
2. The distribution of marks is as follows:

(i) One full activity requires the student to take some data, analyze it and draw conclusions. (17)
(ii) Brief theory (06)
(iii) Viva-Voce (06)
(iv) Record (Activity File) (06)

Course Outcomes: *After completing this course, the students will be able to:*

CO1. Design the schematic and PCB layout for basic electronic circuits using standard PCB design software and apply it to real-world applications such as power supplies, sensors, and alarms.
CO2. Understand and demonstrate the use of CRO for waveform visualization, amplitude and frequency measurement, and analysis of different signal types.
CO3. Measure and interpret electrical quantities like voltage, frequency, phase difference, and pulse characteristics using an oscilloscope.
CO4. Fabricate a working PCB based on a given schematic, including component placement and soldering, and document the process in a technical report.
CO5. Develop and implement mini-projects or working models related to electrical wiring or circuit design, encouraging creativity and application-based learning.

List of the Activities:

1. To create the schematic and layout of a given electronic circuit using any PCB-design software:

(a) ± 12 V Regulated Power Supply using 7812 & 7912
(b) Light-operated Relay
(c) TV-remote checker using transistor, IR photodiode, red LED
(d) Touch switch using transistor
(e) Door safety using Reed and magnet
(f) Water-level alarm using single transistor
(g) Opaque-object sensing alarm using LDR, transistor & buzzer

2. List of Activities on CRO (any five)

(1) Study of CRO and its controls,
(2) Measurement of amplitude and frequency of a sinusoidal signal,
(3) Comparison of different waveforms such as sine, square, and triangular,
(4) Measurement of phase difference between two AC signals,
(5) Display and measurement of both DC and AC voltages.
(6) Observation of pulse and digital waveforms,
(7) Measurement of rise time and fall time of a pulse signal,
(8) Study of triggering and synchronization techniques,
(9) Measurement of RMS and average values of an AC signal using CRO, and

3.To create the schematic, layout and fabricate a PCB for an electronic circuit and prepare a brief report on it. **OR**
faculty may allot other required electrical-wiring related projects or any other working-model project.