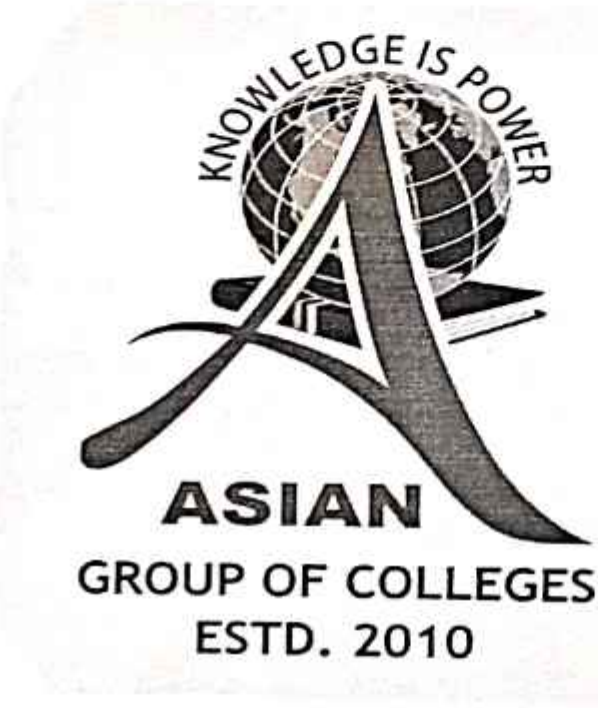
Asian Educational Institute, Patiala

(An Autonomous College)

School of Science and Mathematics



SYLLABUS

B.Sc.

MAJOR- PHYSICS

(Semester-I, II)

Batch: 2024-25

Semester-I

Type of Course	Course code	Course title	Teaching hrs	Credits
Major-Physics	BPHY101T	Mechanics	4 hrs per week	04
Major- Physics Laboratory	BPHY101L	Physics Laboratory-I	2 hr per week	01

Semester-II

Type of Course	Course code	Course title	Teaching hrs	Credits
Major-Physics	BPHY102T	Electricity and Magnetism	4 hrs per week	04
Major- Physics Laboratory	BPHY102L	Physics Laboratory-II	2 hr per week	01

Semester-I

MECHANICS

Subject Code: BPHY101T

(Major Theory)

Max.Marks: 100 **Credits:** 04

End-Semester Exam: 70 **Total load:** 50 Hours (04 hours per week)

Internal Evaluation: 30 marks **Pass Marks:** 40%

Course Outcomes: At the end of the course students will be able to:	
CO1	Understand the various co-ordinate systems and Student will able to know the fundamental forces of nature, concept of center of mass, central forces and motion under central force,
CO2	Know the conservation laws and the symmetries of space and time. They will be able to know the origin of coriolis forces and their consequences on acceleration due to gravity and Foucault's Pendulum.
CO3	They will learn the rotational motion of a body in general by studying the Euler's Equation.
CO4	Know the frame of references and explain the concept of Lorentz, Galilean transformations, Michelson-Morley experiment, length contraction, time dilation, relativistic transformation of velocity and relativistic variation of mass.

Instructions for Paper Setter:

The end-semester examination will be of 70 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 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 marks 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

Co-ordinate systems and Inverse square law force: Cartesian and spherical polar co-ordinates, area, volume, velocity and acceleration in these systems, various forces in nature (brief

Anup Singh

introduction), Center of mass, Equivalent one body problem, central forces, equation of motion under central force, equation of orbit in Inverse Square.

Conservation laws and symmetries of space and time: Dynamics of a system of particles, centrifugal force and its effect on acceleration due to gravity, Conservation of momentum and energy, symmetries of space and time, coriolis force and its applications, variation of acceleration due to gravity with latitude, Foucault's pendulum (qualitative), Particle collision (Elastic and inelastic collisions), CM system velocities, angles, and energies, cross section of elastic scattering.

SECTION B

Oscillatory motion and rigid body: Angular momentum, torque, conservation of angular momentum, Moment of inertia, Rotational motion, principle moments and axes, Euler's equations, Kepler laws and their derivations, Michelson Morley experiment and its result.

Special theory of relativity: Inertial frame of reference, Galilean transformation and invariance, Non-inertial frame of reference,, Postulates of special theory of relativity, Lorentz transformation, observer and viewer in relativity, relativity simultaneity, length, time, relativistic addition theorem of velocities, Relativistic Doppler effect, variation of mass with velocity, mass energy equivalence, rest mass in an elastic collision, relativistic momentum and energy, their transformation.

Reference Books

1. Mechanics: Berkeley Physics Course, Volume I by C.Kittel, W D Knight, M Alvin and ARuderman, 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 McGrow Hill 2000.
4. Kittel . C. et. al. Mechanics Berkeley Physics Course, Volume 1, Tata McGraw Hill 2007.
5. Halliday, D. Resnickel, R. & Walker, J. Fundamentals of Physics 9th edition., John Willey & Sons (2010)
6. Bhattacharya B. Engineering Mechanics, 2nd edition, Oxford University press 2015.

Semester-I

Physics Laboratory-1

Subject Code: BPHY101L

(Major Practical)

Max. Marks: 25 **Credit: 01**

End Semester Practical Exam: 15 marks **Total load:** 28 hours (02 hours per week)

Internal Evaluation: 10 marks **Pass Marks:** 40%

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 (08 marks)**
(ii) **Brief theory (02 marks)**
(iii) **Viva-voice (03 marks)**
(iv) **Record (practical file) (02 marks)**

S.No	Practical Description
1.	To measure the thickness of wire using vernier calipers and screw gauge.
2.	Determination of Modulus of rigidity of material of wire using Maxwell's needle.
3.	Determination of moment of inertia of a flywheel.
4.	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.
5.	Determination of Poisson's ratio for rubber.
6.	To determine the Young's Modulus By bending of beam.
7.	To measure time period of oscillation of a Maxwell needle and determine modulus of rigidity of the material of a given wire.
8.	Determination of g by Kater's pendulum.
9.	To calculate spring constant and acceleration due to gravity by studying the motion of a spring.
10.	Determination of value of acceleration due to gravity by simple pendulum.
11.	To study one dimensional collision using two hanging sphere.
12.	Determination of height of a building using sextant.

S. No	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-I

Evolving Universe

Subject Code: BEUNI101

(IDC/MDC)

Max. Marks: 50

Credits: 02

End-Semester Exam: 35 marks

Total load: 25 Hours (02 hours per week)

Internal Evaluation: 15 marks

Pass Marks: 40%

Course Outcomes: At the end of the course students will be able to:	
CO1	Understand the concept of solar systems: theories of sun, stars, galaxies and planets.
CO2	Understand the general description of solar system.
CO3	They will be able to learn the structure and components of astronomy.
CO4	They will be able to understand the concept of universe.

Instructions for Paper Setter:

The end-semester examination will be of 35 marks and of 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 syllabus. Each question will carry 06 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

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, upper clusters), Evolution of universe (steady state theory, Big bang Theory, Oscillating theory), Dark Matter and Dark Energy.

Reference Books:

1. Astronomy: Dinah L Moche, John Wiley &ons, INc.Eigth Edition, 2014.
2. The cosmos-Astronomy in the new Millenium: Jam M. Pasachoff& Alex Filipenko, Cambridge University Press, Fourth edition, 2013.
3. The life and death of stars: Kennith R. Lang, Canbridge University Press, First edition, 2013.
4. The Cambridge guide to the solar system: Kennith R. Lang, Cambridge University Press Second edition, 2011.

Electronics Workshop-1

Paper code: BEWS 101

(Skill Enhancement Course)

Max. Marks: 50

Credits: 02

End-Semester Exam: 35

Total Load: 36 Hour

Internal Evaluation: 15

Pass Marks: 40%

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. Examination Time duration will be of 1.5 Hours.

2. The distribution of marks is as a follows:

(i) One full activity requiring the student to take some data, analyse it and draw conclusions. (17)

(ii) Brief theory (06)

(iii) Viva-Voce (06)

(iv) Record (Activity File) (06)

List of The Activities:

1. Draw Symbols of various electronic components on drawing sheets.Draw the circuit diagrams of various(Simple to Complex)electronics circuits on drawing sheets.
2. Familiarization of Electronics Measuring Instruments and Components.
3. Testing of electronics 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. Practice to Solder different components such as resistor, capacitor,diodes and transistors
7. 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

Semester-II

ELECTRICITY AND MAGNETISM

Subject Code: BPHY102T

(Major Theory)

Max.Marks: 100 **Credits:** 04

End-Semester Exam: 70 **Total load:** 50 Hours (04 hours per week)

Internal Evaluation: 30 marks **Pass Marks:** 40%

Course Outcomes: At the end of the course students will be able to:	
CO1	Understand the vector calculus and vector algebra and its applications in electricity and magnetism. The students will be able to solve the electrostatic problems with the help of Gauss law and Coulomb's law.
CO2	Understand the applications of scalar potential for the calculation of electric field and electric potential due to an arbitrary charge distribution.
CO3	They will be able to find the electric potential and electric field of various charge distributions with the help of method of images. Students will understand the conduction of electric current in conductors by studying Ohm's law and equation of continuity.
CO4	They will be able to Lorentz's force, Ampere's Circuital law, Faraday's Law and Maxwell's equations. They will be learning the origin of magnetism and properties of various kinds of magnetic materials.

Instructions for Paper Setter:

The end-semester examination will be of 70 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 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 marks 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

Introduction to vector calculus: Basic ideas of Vector Calculus Gradient, Divergence, curl and their physical significance. Laplacian in rectangular, cylindrical and spherical coordinates. Coulomb's Law for point charges

Electric field and Electric Potential: Work and potential difference, Potential difference as line integral of field. Electric potential due to a point charge a group of point charges, dipole and quadruple moments, long uniformly charged wire, charged disc. Stoke'stheorem and its applications in Electrostatic field, curl E=0, Electric fields 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

Magnetic field and Magnetic properties of Matter: 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 point charge moving with constant velocity, Interaction between moving charges and force between parallel currents,behavior 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.

Electromagnetism: 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.

Reference Books:

1. Fundamentals of Electricity and Magnetism by Author F.Kipp.
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.

Semester-II

Physics Laboratory-II

Subject Code: BPHY102L

(Major Practical)

Max. Marks: 25 **Credit:** 01

End Semester Practical Exam: 15 marks **Total load:** 28 hours (02 hours per week)

Internal Evaluation: 10 marks **Pass Marks:** 40%

General Guidelines for End-Semester Practical Examination:

1. **The student will be alloted 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 (08 marks)
(ii) Brief theory (02 marks)
(iii) Viva-voice (03 marks)
(iv) Record (practical file) (02 marks)

S. No.	Practical Description
1.	To study the dependence of solenoidal field on number of turns and current.
2.	To study the magnetic field produced by current carrying solenoid using a search coil and to find the value of permeability of air.
3.	To determine the Hall coefficient of the given sample and hence find the carrier concentration and mobility.
4.	To determine the unknown capacitance using flashing and quenching of a neon lamp.
5.	To study the induced emf as a function of velocity of magnet.
6.	To study the charging and discharging capacitance of a capacitor.
7.	To calculate the angle of prism using spectrometer.
8.	To study the refractive index of doubly reflecting prism.
9.	To study the resonance in series LCR Circuits for different resistances and calculate Value.
10.	To study the resonance in parallel LCR Circuits for different resistances and calculate Value.
11.	To study the phase relationship between voltage and current using impedance triangle.
12.	To determine the flashing and quenching of a neon lamp.

S. No	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.

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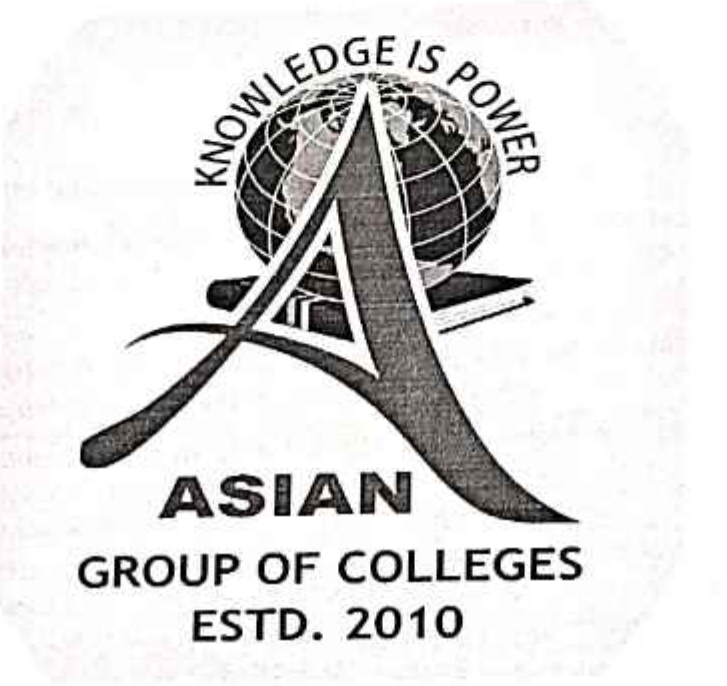

SYLLABUS

B.Sc.

MINOR- PHYSICS

(Semester-I, II)

Batch: 2024-25

Semester-I

MECHANICS

Subject Code: BPHY101T

(Minor Theory)

Credits: 03

Max. Marks: 75

Total load: 40 Hours (03 hours per week)

End-Semester Exam: 50

Pass Marks: 40%

Internal Evaluation: 25 marks

Course Outcomes: At the end of the course students will be able to:	
CO1	Understand the various and its applications. Student will able to know the fundamental forces of nature, concept of center of mass, central forces and motion under central force,
CO2	Know the frame of references and explain the concept of Galilean transformations, and their consequences on acceleration due to gravity.
CO3	Know the frame of references and explain the concept of Lorentz, transformations, Michelson-Morley experiment, length contraction, time dilation, relativistic transformation of velocity and relativistic variation of mass.
CO4	Know the frame of references and explain the concept of Lorentz, Galilean transformations, Michelson-Morley experiment, length contraction, time dilation, relativistic transformation of velocity and relativistic variation of mass.

Instructions for Paper Setter:

The end-semester examination will be of 50 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 syllabus. Each question will carry 10 marks and may be segregated into sub-parts. Section C will be compulsory with 10 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

Co-ordinate system and spherical polar co-ordinates, area, volume, displacement, velocity and acceleration in these systems, solid angle, various forces in nature (brief introduction), Center 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.

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

SECTION B

Michelson Morley experiment and its result, Postulates of special theory of relativity, Lorentz transformation, observer and viewer in relativity, relativity simultaneity, length, time, relativistic addition theorem of velocities, Relativistic Doppler effect, variation of mass with velocity, mass energy equivalence, rest mass in an elastic collision, relativistic momentum and energy, their transformation, concept of Minkowski space, four vector formulation.

Reference Books

1. Mechanics: Berkeley Physics Course, Volume I by C.Kittel, W D Knight, M Alvin and ARuderman, 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 McGrow Hill 2000.
4. Kittel . C. et. al. Mechanics Berkeley Physics Course, Volume 1, Tata McGraw Hill 2007.
5. Halliday, D. Resnickel, R. & Walker, J. Fundamentals of Physics 9th edition., John Willey & Sons (2010)
6. Bhattacharya B. Engineering Mechanics, 2nd edition, Oxford University press 2015.

Semester-I

Physics Laboratory-I

Subject Code: BPHY101L

(Minor Practical)

Credit: 01

Max. Marks: 25

End Semester Practical Exam: 15 marks

Total load: 28 hours (02 hours per week)

Internal Evaluation: 10 marks

Pass Marks: 40%

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 (08 marks)
   (ii) Brief theory (02 marks)
   (iii) Viva-voice (03 marks)
   (iv) Record (practical file) (02 marks)

S. No	Practical Description
1.	To measure the thickness of wire using vernier calipers and screw gauge.
2.	Determination of Modulus of rigidity of material of wire using Maxwell's needle.
3.	To establish relationship between torque and angular acceleration using fly wheel and hence to find inertia of flywheel.
4.	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.
5.	Determination of Poisson's ratio for rubber.
6.	To determine the Young's Modulus By bending of beam.
7.	To measure time period of oscillation of a Maxwell needle and determine modulus of rigidity of the material of a given wire.
8.	Determination of g by Kater's pendulum.
9.	To calculate spring constant and acceleration due to gravity by studying the motion of a spring.
10.	Determination of value of acceleration due to gravity by simple pendulum.
11.	To study one dimensional collision using two hanging sphere.

12.	Determination of height of a building using sextant.

S. No	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

ELECTRICITY AND MAGNETISM

Subject Code: BPHY102T

(Minor Theory)

Max. Marks: 75 **Credits:** 03

End-Semester Exam: 50 **Total load:** 40 Hours (03 hours per week)

Internal Evaluation: 25 marks **Pass Marks:** 40%

Course Outcomes: At the end of the course students will be able to:	
CO1	Understand the vector calculus and vector algebra and its applications in electricity and magnetism. The students will be able to solve the electrostatic problems with the help of Gauss law and Coulomb's law.
CO2	Understand the applications of scalar potential for the calculation of electric field and electric potential due to an arbitrary charge distribution.
CO3	They will be able to find the electric potential and electric field of various charge distributions with the help of method of images. Students will understand the conduction of electric current in conductors by studying Ohm's law and equation of continuity.
CO4	They will be able to Lorentz's force, Ampere's Circuital law, Faraday's Law and Maxwell's equations. They will be learning the origin of magnetism and properties of various kinds of magnetic materials.

Instructions for Paper Setter:

The end-semester examination will be of 50 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 syllabus. Each question will carry 10 marks and may be segregated into sub-parts. Section C will be compulsory with 10 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

Introduction to 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, differential form of Gauss's law, Green's Theorem, Gauss's divergence theorem.

Electric field and Electric Potential: 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, charged disc, Stoke's theorem and its application in Electrostatics field, curl E=0, Electric field as gradient of scalar potential.

SECTION-B

Magnetic field and Magnetic properties of Matter: 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 point charge moving with constant velocity, Interaction between moving charges and force between parallel currents, behavior 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.

Electromagnetism: 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.

Reference Books:

1. Fundamentals of Electricity and Magnetism by Author F.Kipp.
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.

Semester-II

Physics Laboratory -II

Subject Code: BPHY102L

(Minor Practical)

Max. Marks: 25 **Credit:** 01

End Semester Practical Exam: 15 marks **Total load:** 28 hours (02 hours per week)

Internal Evaluation: 10 marks **Pass Marks:** 40%

General Guidelines for End-Semester Practical Examination:

(i) The student will be alloted one experiment out of the experiments mentioned in syllabus and asked to perform.
(ii) (The distribution of marks is as follows:
(iii) One full experiment requiring the student to take some data, analyse it and draw conclusions (08 marks)
(iv) Brief theory (02 marks)
(v) Viva-voice (03 marks)
(vi) Record (practical file) (02 marks)

S. No.	Practical Description
1.	To study the dependence of solenoidal field on number of turns and current.
2.	To study the magnetic field produced by current carrying solenoid using a search coil and to find the value of permeability of air.
3.	To determine the Hall coefficient of the given sample and hence find the carrier concentration and mobility.
4.	To determine the unknown capacitance using flashing and quenching of a neon lamp.
5.	To study the induced emf as a function of velocity of magnet.
6.	To study the charging and discharging capacitance of a capacitor.
7.	To calculate the angle of prism using spectrometer.
8.	To study the refractive index of doubly reflecting prism.
9.	To study the resonance in series LCR Circuits for different resistances and calculate Value.
10.	To study the resonance in parallel LCR Circuits for different resistances and calculate Value.
11.	To study the phase relationship between voltage and current using impedance triangle.

S. No	Reference Books
1.	B.Sc. Practical Physics, By C.L.Arora, S.Chand& Co.
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