

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,  
AURANGABAD**



## **Physics Syllabus**

**Choice Based Credit & Grading System**

**B. Sc. F. Y.  
Semester I & II**

**Effective from  
Academic Year 2022-23**

**B. Sc. I Year Physics (Semester-I)**  
**(Mechanics and Properties of Matter)**

**Course Code: PHY-111**

**Periods 45**

**Credit 02**

**Marks 50 (CA=10, ESE 40)**

**Course Outcome:** On successful completion of this course students will be able to:

- Understand Newton's laws and apply them in calculations of the motion of simple systems.
- Use the free body diagrams to analyze the forces on the object.
- Understand the concepts of friction and the concepts of elasticity, fluid mechanics and be able to perform calculations using them.
- Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process. 5. Demonstrate quantitative problem solving skills in all the topics covered

**Unit – I Mechanics**

**[13 L]**

Newton's law of Gravitation ( Statement only), Gravitational Field Gravitational Potential, Gravitational Potential of mass, Gravitational potential and field due to spherical shell and solid sphere (at a point, outside, inside and on the surface). Compound Pendulum- expression of time period, Interchangeability of centre of suspension and oscillation, Kater's Pendulum, Problems.

**Unit – II Elasticity**

**[10 L]**

Introduction, Stress and Strain, Hook's law and Coefficient of elasticity, Young's modulus, Bulk modulus, Modulus of rigidity, Twisting couple on a cylinder, Bending of Beam - Bending moment, cantilever loaded at free end- (a) When weight of beam is ineffective, (b) When weight of beam is effective, Depression of Beam supported at centre, Problems.

**Unit – III Viscosity**

**[12 L]**

Introduction, Concept of viscous force and viscosity, Coefficient of viscosity, Steady and Turbulent flow, Reynolds number, Equation of continuity, energy of liquid in motion, Bernoulli's Theorem, practical applications: (i) Law of hydrostatic pressure (ii) Filter pump, Problems.

**Unit – IV Surface Tension**

**[10 L]**

Introduction, Angle of contact, Factors affecting surface tension Difference of pressure across a curved surface, Determination of S.T. by Jaeger's method, Applications of surface tension, Problems.

**Reference Books:**

- 1) Elements of Properties of Matter - D. S. Mathur (S. Chand, 11 th edition, 1992)
- 2) Physics for Degree students-C. L. Arora and P.S.Heme (S. Chand, I st edition 2010)
- 3) Mechanics and Electrodynamics - Brijlal,N. Subrahmanyam, Jivan Seshan (S.Chand, 7 th edition)
- 4) Concepts of Physics: H. C. Verma, BharatiBhavan Publisher.
- 5) University Physics: Sears and Zeemansky, XIth/XIIth Edition, Pearson Education.

**B.Sc. First Year Physics (Semester – I)**  
**(Heat and Thermodynamics)**

**Course Code: PHY-112**

**Periods 45**

**Credit 02**

**Marks 50 (CA=10, ESE 40)**

**Course Outcome:**

- Develop an understanding on the concepts of Heat and Thermodynamics.
- Describe and apply the physical concepts of heat, transport phenomena and laws of thermodynamics.
- Perform calculations of heat conduction in various geometries.
- To develop ability among the students to identify, remember and grasp the meanings, definitions and laws of heat and thermodynamics.
- To develop attitudes such as concern for accuracy and precision, objectivity and enquiry.

**Unit – I: Thermometry and Thermal conductivity**

**[12 L]**

Principal of thermometry, Celsius, Fahrenheit and Kelvin scale, types of thermometers (Mercury thermometer and platinum resistance thermometer), transference of heat, coefficient of thermal conductivity, rectilinear flow of heat along a metal bar, methods of radial flow of heat, (i) spherical shell method and (ii) flow of heat along the wall of a cylindrical tube, comparison of conductivities of different metals (Ingen-Housz experiment), Problems.

**Unit – II: Real Gas:**

**[10 L]**

Introduction, change of state, behavior of gases at high pressure, reason for modification of a gas equation, Van-der Waal's Equation of state, comparison with experimental curves (Andrews Experiment), critical point and critical constants, estimation of critical constants, constants of Van-der Waal's equation, Problems.

**Unit – III: Transport Phenomena:**

**[10 L]**

Introduction, Mean free path, sphere of influence, expression for mean free path, variation of mean free path with temperature and pressure, transport phenomena, viscosity, thermal conductivity, self diffusion (and their interrelationships, effect of temperature and pressure), Problems.

**Unit - IV: Thermodynamics:**

**[13 L]**

Thermodynamic system, Zeroth law of thermodynamics, adiabatic process, adiabatic equation of a perfect gas, isothermal process, indicator diagram, first law of thermodynamics, work done during isothermal process and adiabatic process, reversible and irreversible process, second law of thermodynamics (Kelvin and Clausius statement), Heat engines, Carnot's ideal heat engine, Carnot's cycle (work done and efficiency).

**Reference Books:**

- 1) Heat, Thermodynamics and Statistical Physics – Brijlal, N. Subrahmanyam, P. S. Heme, (S. Chand, 2007 Edition)
- 2) Text Book of Heat and Thermodynamics – J. B. Rajam, C. L. Arora (S. Chand 9<sup>th</sup> Edition)
- 3) Heat and Thermodynamics – S. S. Singhal, J. P. Agarwala, S. Prakash (Pragati Prakashan)
- 4) Thermodynamics and Statistical Physics – S. L. Kakani

**B.Sc. First Year Physics (Semester – I)**

**(Physics Practical)**

**Course Code: PHY-121**

**Credit 1.5**

1. Determination of acceleration due to gravity by using Kater's Pendulum.
2.  $\Delta$  by bending loaded at center
3.  $\Delta$  by cantilever (Oscillation method)
4. Moment of inertial by using fly wheel.
5.  $\eta$  by Maxwell's needle
6. Determination of ' $\Delta$ ' and ' $\eta$ ' by flat spiral spring
7. Surface tension of a liquid by using Jaeger's method
8. Viscosity of a liquid by using Poiseuille's method
9. To find the co-efficient of thermal conductivity of copper using Searle's apparatus.
10. Thermal conductivity of a bad conductor by using Lee's disc method.

**Note:** Students should perform at least six experiments

**Books:**

1. B. Sc. Practical Physics – C. L. Arora (S. Chand Publications)
2. College Practical Physics – Khanna and Gulati (S. Chand Publication)
3. Practical Physics – Gupta and Kumar (Pragati Prakashan, Meerut)
4. A text book of Practical physics – Shrinivasan and Balsubramanyam.

**B. Sc. F. Y. Physics (Semester –II)**

**(Optics)**

**Course Code-PHY-211**

**Periods 45**

**Credit 02**

**Marks 50 (CA=10, ESE 40)**

**Course Outcome:** On successful completion of this course the student will able to

- Acquire the basic concept of optics and its applications.
- Explain how image formation takes place in lenses
- Understand the operations of many modern optical devices
- Understand the optical phenomenon such as interference and diffraction

**Unit 1 - Geometrical Optics**

**[12 L]**

Introduction to lenses, Location of the image, sign conversions, Thin Lens, Lens Equations, Lens Makers formula, Cardinal points of optical system (Six Points) and corresponding planes, Deviation by Lens, Coaxial Lens System (equivalent focal length and cardinal points), Problems

**Unit 2 - Lens Aberrations**

**[08 L]**

Introduction, Types of aberrations: Monochromatic and Chromatic aberration, methods to minimize Chromatic and spherical aberration, Problems

**Unit 3 - Optical Instruments**

**[12 L]**

Introduction, The Simple Magnifier, Field of View, stop and pupils, Objective and eyepiece, Need of multiple lens eye piece, Huygen's Eye-piece, Ramsden's Eye-piece, Comparison of Ramsden's eyepiece with Huygen's Eyepiece, Gauss Eye-piece, Problems

**Unit 4 – Interference and Diffraction**

**[13 L]**

Interference in thin film due to reflected and transmitted light, wedge shaped thin film, Newton's rings by reflected light, determination of wavelength, Michelson's Interferometer, type of fringes, determination of wavelength and difference in wavelength, Types of Diffraction, Plane diffraction grating, Rayleigh's Criterion for resolution, Resolving power of prism and grating, Problems

**Reference Books:**

1. Optics - A.R. Ganesan, 4<sup>th</sup> edition, Pearson Education.
2. A Textbook of Optics - N. Subhramanyam, Brijlal, M.N. Avadhanulu, S. Chand Publication.
3. Physical Optics - A.K. Ghatak, McMillan, New Delhi
4. Fundamental of Optics - F.A. Jenkins, H.E.White, Mc Graw-Hill International edition
5. Principles of Optics - D.S. Mathur, Gopal Press, Kanpur.

**B.Sc. First Year Physics (Semester – II)**  
**(Electricity and Magnetism)**

**Course Code: PHY-212**

**Periods 45**

**Credit 02**

**Marks 50 (CA=10, ESE 40)**

**Course Outcome:**

- Develop an understanding on the concepts of Electricity and magnetism.
- To understand the knowledge of various mathematical operations required for electrostatics and magnetostatics.
- Explain the fundamental concepts and operations of vector analysis.
- To increase the ability to perform calculations of various mathematical expressions and laws.
- To develop ability among the students to identify, remember and grasp the meanings, definitions and laws of electricity and magnetism.

**Unit – I: Mathematic foundation (Vector Algebra)**

**[15 L]**

Introduction, scalar (dot) and vector (cross) product, scalar triple product and its geometrical interpretation, vector triple product, scalar and vector field, differentiation of vector with respect to scalar, partial differentiation and gradient of a scalar field, divergence and curl of a vector field and their physical significance, vector integrations (line, surface and volume integrals), Gauss divergence theorem, Stoke's theorem, Problems.

**Unit – II: Electrostatics**

**[10 L]**

Coulomb's law, electric field, field due to point charge, electric flux, Gauss law (with proof), differential form of gauss law, electric potential, potential due to a point charge, field and potential due to a point charge, Problems.

**Unit – III: Dielectrics**

**[08 L]**

Introduction, polar and non-polar molecules, fundamental definitions of dielectrics (dielectric constant, dielectric polarization, polarizability, polarization vector, and dielectric displacement), Relation between D, E and P, molecular field in a dielectric (Clausius – Mossotti relation), Problems.

**Unit – IV: Magnetostatics**

**[12 L]**

Introduction, magnetic field, magnetic flux, magnetic induction, Biot and Savart law, magnetic induction at a point due to straight conductor carrying current, magnetic field at the center of circular coil carrying current, magnetic induction on the axis of solenoid, Ampere's law, differential form of Ampere's law, torque on a current loop in uniform magnetic field, moving coil ballistic galvanometer – expression for charge, Problems.

**References:**

1. Mathematical Methods in Physics – D. Biswas (New Central book agency, 2009 edition)
2. Electricity and Magnetism – R Murugesan (S. Chand, 2008 edition)
3. Electrodynamics – Gupta, Kumar, Singh (Pragati Prakashan, Merrut, 18<sup>th</sup> Edition, 2005)
4. Foundation of Electromagnetic theory – Reitz, Milford, Chirstey IIIrd Edition)
5. Fundamentals of Physics – Halliday Rensik and Walkar, 8<sup>th</sup> Edition
6. Electromagnetic – B. B. Laud
7. Electricity and Magnetism – Brijlal, Subramanyan (Ratan Prakashan (Revised edition, 1997)
8. Electricity and Magnetism – Edward M. Purcell, 1986, McGraw – Hill Education
9. Electricity and Magnetism – D. C. Tayal, 1988, Himalaya Publishing house.

**B. Sc. F. Y. II Semester Physics**

**PHY-221**

**Credit 1.5**

**List of experiment**

1. Use of multimeter for measuring voltage, current and resistance.
2. Determination of dielectric constant of liquid/solid.
3. I-H curve.
4. Field along the axis of circular coil.
5. Determination of wavelength of light by Newton's rings.
6. Resolving power of telescope.
7. Specific rotation by Laurent's half shade polarimeter.
8.  $\lambda$  by grating (normal incidence)
9. Determination of frequency of AC mains by sonometer
10. Comparison of capacitor using De'Sauty's method
11. Measurement of constants of B. G.

Note: - At least six experiments should be performed.

**Books:**

1. B. Sc. Practical Physics – C. L. Arora (S. Chand Publications)
2. College Practical Physics – Khanna and Gulati (S. Chand Publication)
3. Practical Physics – Gupta and Kumar (Pragati Prakashan, Meerut)
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Nature of Question Paper for choice based credit system (CBCS) semester pattern.

**Subject: Physics**

Time: 2 hours

Max. Marks: 40

**Instructions:**

1. All questions are compulsory.
2. All questions carry equal marks.
3. Draw neat diagrams and give equations wherever necessary.
4. Figures to the right indicate full marks.
5. Use of logarithmic table and calculator is allowed.

Q. 1)	Long answer questions (Solve any one)	10
	A. Question from Unit – I	
	2. Question from Unit – III	
Q. 2)	Long answer questions (Solve any one)	10
	1. Question from Unit – II	
	2. Question from Unit – IV	
Q. 3)	Short answer questions / problems	10
	a. Short answer question / problem from Unit – I	
	b. Short answer question / problem from Unit – III	
	OR	
	a. Short answer question / problem from Unit – II	
	b. Short answer question / problem from Unit – IV	
Q. 4)	Multiple Choice Questions (MCQ)	10

**Note:** Ten MCQ's having four alternatives based on theory and numerical.  
(Minimum two MCQ's from each chapter)