

DEBRA THANA S.K.S. MAHAVIDYALAYA

(Autonomous)

Debra, Paschim Medinipur, West Bengal



Department Of Physics

Proposed Curriculum & Syllabus (draft)

(w.e.f. Academic Year 2024-2025)

Based on
**Curriculum & Credit Framework for Undergraduate
Programmes (CCFUP), 2024 & NEP, 2020**

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(AUTONOMOUS)



SYLLABUS

B.VOC

Physics (General)

Paper I

Theory : 75 (Th - 60; IA – 10 ; CA - 5) [84 Lectures + 6 Tutorial]

Practical : 25

Theory

[84L]

Physics and Measurement : Physics, technology and society, SI units, Fundamental and derived units. Least count, Accuracy and precision. Significant figures. Error and uncertainty analysis. Types of errors: Gross error, systematic error, random error. Statistical analysis of data (Arithmetic mean, deviation from mean, average deviation, standard deviation). Dimensions of Physical quantities, dimensional analysis and its applications. [8L]

Vectors: Scalars and Vectors, Vector addition and Subtraction, Zero Vector, Scalar and Vector products, Unit Vector, Resolution of a Vector. Derivatives of a vector with respect to a parameter, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). [10L]

Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients. [6L]

Kinematics: Frame of reference. Motion in a straight line: Position-time graph, speed and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity Uniformly accelerated motion, velocity-time, position-time graphs, relations for uniformly accelerated motion. Relative Velocity, Motion in a plane. Projectile Motion, Uniform Circular Motion. [8L]

Laws of Motion : Force and Inertia, Newton's First Law of motion; Momentum, Newton's Second Law of motion; Impulse; Newton's Third Law of motion. Law of conservation of linear momentum and its applications, Equilibrium of concurrent forces. Static and Kinetic friction, laws of friction, rolling friction. Dynamics of uniform circular motion: Centripetal force and its applications. [10L]

Work, Energy and Power: Work done by a constant force and a variable force; kinetic and potential energies, work-energy theorem, power. Potential energy of a spring, conservation of mechanical energy, conservative and non-conservative forces; Elastic and inelastic collisions in one and two dimensions. [6L]

Rotational Motion: Centre of mass of a two-particle system, Centre of mass of a rigid body; Basic concepts of rotational motion; moment of a force, torque, angular momentum, conservation of angular momentum and its applications; moment of inertia, radius of gyration. Values of moments of inertia for simple geometrical objects, parallel and perpendicular axes theorems and their applications. Rigid body rotation, equations of rotational motion. [10L]

Properties of Solids and Liquids:

1. Elasticity: Hooks law. Young's modulus, bulk modulus, rigidity modulus, Poisson's ratio and their interrelations. Elastic potential energy: Strain energy expression for longitudinal, volume and shearing strain and due to twist. Bending of beam: Neutral layer, geometrical moment of inertia, bending moment and shearing force. Cantilever: Expression for depression of light cantilever due to load at the free end. Reciprocity theorem statement and proof (for light cantilever). Depression at the midpoint of a light beam supported at both the ends. [12L]

2. Surface tension : Molecular interpretation of surface tension. Surface tension and surface energy: Work done due to spraying, relation between surface tension and total surface energy. Excess pressure on a curved liquid surface. Curvature of contact surface of two soap bubbles. Liquid in a vessel with small hole at the bottom. Angle of contact. Expression of capillary rise (or fall). Jurin's law. Capillary rise in a short capillary tube. Height of liquid in a U tube with vertical arms of different radii. [8L]

3. Viscosity: Streamline and turbulent flow. Viscosity, coefficient of viscosity. Newtonian and non-Newtonian liquid. Critical velocity, Reynolds' number, Stokes' law. Flow of liquid in a narrow horizontal tube under constant pressure difference. Poiseuille's equation. [6L]

Suggested Readings:

1. Mathematical Methods in the Physical Sciences, M. L. Boas, 2005, Wiley
2. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier
3. Mathematical Methods for Physics and Engineering: A Comprehensive Guide by K. F. Riley, M. P. Hobson, S. J. Bence, Cambridge Univ. Press, 3rd Eds., 2006
4. Vector Analysis and an introduction to Tensor Analysis, S. Lipschutz, D. Spellman, M. R. Spiegel, Schaum's Outline Series, Tata McGraw Hill Education Private Limited, edition 2009
5. Mathematical Physics, A. K. Ghatak, I. C. Goyal, S. J. Chua, Macmillan India Ltd., 2016
6. Fundamentals of Mathematical Physics, A. B. Gupta, Books and Allied (P) Ltd. 2022

Classical Mechanics:

1. Classical Mechanics, N. C. Rana and P. S. Joag, McGraw-Hill Education
2. Classical Mechanics, A. K. Raychaudhuri, Oxford University Press, 1984
3. Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education
4. Classical Mechanics and General Properties of Matter. S. N. Maiti and D. P. Raychaudhuri, New Age International.
5. Introduction to Classical Mechanics, R. G. Takwale and P.S. Puranik, Tata McGraw-Hill Publishing Company Ltd.

Practical

- a. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
- b. To determine the Height of a Building using a Sextant.
- c. To determine the Elastic Constants of a Wire by Searle's method.
- d. To determine g by Bar Pendulum.
- e. To determine g and velocity for a freely falling body using Digital Timing Technique
- f. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g .
- g. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
- h. To determine the Young's Modulus of a Wire by Optical Lever Method.
- i. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
- j. Determination of rigidity modulus of material in the form of cylindrical wire by dynamical method. The mass of the heavy metallic oscillator should be supplied at venue.
- k. Determination of Young's modulus of material of a bar using method of bending beam loaded at middle of the bar.
- l. To determine the Moment of Inertia of a Flywheel.

Suggested Readings:

1. Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
2. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. Laboratory Manual of Physics, Madhusudan Jana, Books & Allied (P) Ltd., 2022, Kolkata.
5. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press
6. B.Sc. Practical Physics, C.L. Arora, S Chand and Company Limited

7. Physics in Laboratory, Mandal, Chowdhury, Das, Das, Santra Publication
8. Advanced Practical Physics Vol 1, B. Ghosh, K. G. Majumder, Sreedhar Publisher
9. Practical Physics, P.R. Sasi Kumar, PHI Learning Private Limited
10. B.Sc. Practical Physics, Harnem Singh, P.S. Hemne, S Chand and Company Limited.