

**FOUR YEARS UNDERGRADUATE PROGRAM (2024-28)**  
**DEPARTMENT OF PHYSICS**  
**COURSE CURRICULUM**

<b>PART – A: INTRODUCTION</b>			
<b>Program: Bachelor in Science (Certificate/ Diploma/ Degree/ Honors)</b>		<b>Semester: I</b>	<b>Session: 2024-25</b>
1	<b>Course Code</b>	<b>PHSC-01T</b>	
2	<b>Course Title</b>	<b>Mechanics</b>	
3	<b>Course Type</b>	<b>Discipline Specific Course</b>	
4	<b>Pre-requisite (if any)</b>	<b>As per Program</b>	
5	<b>Course Learning Outcomes (CLO)</b>	<p><i>After going through the course, the student should be able to:</i></p> <ul style="list-style-type: none"> <li>➤ Analyze and apply the laws of motion to various dynamical situations.</li> <li>➤ Explain and demonstrate the principle of conservation of momentum and energy including their application in real-world scenario such as collision and energy transformation.</li> <li>➤ Evaluate and calculate moment of inertia for objects of different shapes and analyze how these properties affect the motion of rotating bodies.</li> <li>➤ Analyze flow of fluids.</li> <li>➤ Describe special relativistic effects and their effects on the mass and energy of a moving object.</li> </ul>	
6	<b>Credit Value</b>	<b>03 Credits</b>	<b>1 Credit= 15 Hours for Learning &amp; Observation</b>
7	<b>Total Marks</b>	<b>Maximum Marks: 100</b>	<b>Minimum Pass Marks: 40</b>

**PART – B: CONTENT OF THE COURSE**

**Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)**

<b>Unit</b>	<b>Topics (Course contents)</b>	<b>No. of Periods</b>
<b>I</b>	<b>Historical Background:</b> Contribution of Aryabhata and Varahmihir to science and society, Brief biography of Vikram Sarabhai with his contribution. <b>Vectors:</b> Scalar and vector quantities & fields, Scalar & Vector products of two vectors, Derivatives of a vector, Gradient of scalar field and its physical significance. <b>Laws of Motion:</b> Review of Newton's Laws of motion, Dynamics of a system of particles, Concept of Center of Mass, Motion of center of mass, Conservation of linear momentum, Motion of Rocket. <b>Work and Energy:</b> Work-Energy theorem for conservative forces, Force as a gradient of Potential Energy, Conservation of energy, Elastic and in-elastic Collisions	12
<b>II</b>	<b>Rotational Dynamics:</b> Angular momentum, Torque, Conservation of angular momentum, Moment of Inertia, Theorem of parallel and perpendicular axes (statements only), Calculation of Moment of Inertia of discrete and continuous objects (Rectangular lamina, disc, solid cylinder, solid sphere). <b>Elasticity:</b> Stress & Strain, Hooke's law, Elastic constants, Poisson's Ratio, Relationship between various elastic moduli (without derivation), Work done in twisting a cylinder. <b>Fluid Dynamics:</b> Flow of fluids, Coefficient of viscosity, Derivation of Poiseuille's formula, Motion of a spherical body falling in a viscous fluid, Stoke's law, Expression for terminal velocity.	12
<b>III</b>	<b>Gravitation:</b> Newton's Law of Gravitation, Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant), Kepler's Laws (statements only), Satellite in circular orbit and applications, Geosynchronous orbits. <b>Oscillations:</b> Simple harmonic motion, Differential equation of SHM and its solutions, Kinetic and Potential Energy, Total Energy and their time averages, Compound pendulum, Differential equations of damped oscillations and forced oscillations (Conceptual only).	11
<b>IV</b>	<b>Special Theory of Relativity:</b> Frame of reference, Galilean Transformations, Inertial and Non-inertial frames, Outcomes of Michelson Morley's Experiment, Postulates of Special Theory of Relativity, Lorentz Transformation, Length contraction, Time dilation, Relativistic transformation of velocity, Relativistic variation of mass, Mass-energy equivalence, Transformation of Energy and Momentum.	10

**Keywords:** Aryabhata, Vectors, Newton's Laws, Angular Momentum, Elasticity, Gravitation, Oscillations, Relativity

**Signature of Convener & Members (CBoS):**

## PART – C: LEARNING RESOURCES

### Text Books, Reference Books Recommended and Others

#### Text Books Recommended-

1. Mechanics & Properties of matter, D.C. Tayal & P. Tayal, 2023, Pub. By Authors.
2. Unified Physics I –R.P.Goyal, Shivalal Agrawal Publication
3. Unified Physics I, Navbodh Publication

#### Reference Books Recommended-

1. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
2. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
3. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.

#### Online Resources (e-books/ learning portals/ other e-resources)

1. All e-books of physics <https://www.e-booksdirectory.com/listing.php?category=2>
2. Free physics text book in PDF
3. [https://www.motionmountain.net/?gclid=CjwKCAjwmq3kBRB\\_EiwAjkNDp5v8Yy6xK1s0Kma0VR0AWGlichRwFfCC0-vpZK1jrPoEOAnBq8fcqRoCILsQAvD\\_BwE](https://www.motionmountain.net/?gclid=CjwKCAjwmq3kBRB_EiwAjkNDp5v8Yy6xK1s0Kma0VR0AWGlichRwFfCC0-vpZK1jrPoEOAnBq8fcqRoCILsQAvD_BwE)
4. Cambridge University Books for Physics <https://www.cambridgeindia.org/>
5. Books for solving physics problems <https://bookboon.com/en/physics-ebooks>
6. NPTEL Online courses <https://nptel.ac.in/courses/115105098;>  
[https://archive.nptel.ac.in/courses/115/106/115106123/;](https://archive.nptel.ac.in/courses/115/106/115106123/)
7. BSc Lectures by Prof. H C Verma: <https://bsc.hcverma.in/index.php/course/relativity;>  
<https://bsc.hcverma.in/index.php/course/cm1>

## PART – D: ASSESSMENT AND EVALUATION

### Suggested Continuous Evaluation Methods:

Maximum Marks: 100Marks

Continuous Internal Assessment (CIA):30 Marks

End Semester Examination (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By course teacher)	Internal Test/ Quiz (2): <del>20</del> 20	Better marks out of the two Test / Quiz + marks obtained in Assignment shall be considered against 30 Marks
	Assignment/ Seminar (1):10 Total Marks: 30	
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type, 1out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:







