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

PART – A: INTRODUCTION

Program: Bachelor in science *(Honors/Honors with Research)*	**Semester: VII**	**Session: 2024-25**

1	Course Code	**PHSC-07**	
2	Course Title	**Classical Mechanics**	
3	Course Type	**Discipline Specific Course**	
4	Pre-requisite (if any)	**As per Program**	
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: ➢ The ideas and concepts in classical physics ➢ Explain Newtonian Mechanics, Lagrangian, and Hamiltonian formulation ➢ Gain knowledge about central force problems and its application in scattering phenomena ➢ Explain small oscillations and its applications. Apply mechanics to solve various physical problems	
6	Credit Value	**04 Credits**	**1 Credit = 15 Hours for Learning & Observation**
7	Total Marks	**Maximum Marks: 100**	**Minimum Pass Marks: 40**

PART – B: CONTENT OF THE COURSE

Total No. of Teaching-learning Periods (01 Hr. per period) – 60 Periods (60 Hours)

Unit	Topics	No. of Period
I	**Preliminaries of classical mechanics** Review of Newtonian Mechanics; Conservation laws; Constraints and their classification; Principle of virtual work; Generalized coordinates and velocities, D' Alembert's principle, Lagrangian and the Euler-Lagrangeequations, Simple applications of Lagrangian formulation, Hamilton's principle, Lagrange's equation from Hamilton's principle; Legendre transformations and Hamilton's equation of motion; Hamilton's equation from Hamilton's principle; The principle of least action simple applications of Hamiltonian formulation; Conservation theorems, cyclic coordinates and symmetry properties	15
II	**Canonical transformations and relativistic mechanics** Canonical transformations; Poisson's Bracket; equation of motion and Conservation theorems in the Poisson Bracket formulation; Hamilton Jacobi (HJ) theory; Harmonic oscillator as an example of HJ method Four vectors; Four velocity and acceleration; Lorentz Covariant form of equation of motion.	15
III	**Central forces** Two-body central force problems and their reduction to the equivalent one-body problem; The equations of motion and first integrals; one-dimensional problems and classification of orbits; The differential equation of the orbit, Closure and stability of orbits; Kepler's laws and planetary motion; Scattering in central force; Rutherford's scattering	15
IV	**Rigid body and Periodic motion** Euler's angles, Euler's theorem on the motion of a rigid body; The Coriolis force; The Euler equations of motion of rigid bodies; Small oscillations; normal modes; Formulation of the problem of small oscillations; Vibrating string; normal vibrations; dispersion; Coupled vibrating systems, free vibration of a linear triatomic molecule.	15

Keywords:	Newtonian Mechanics, Lagrangian formulation, Hamiltonian formulation, Poisson's bracket, central force problems, small oscillations

Signature of Convener & Members (CBoS):

10/6/24

PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Classical Mechanics by Herbert Goldstein, Charles Poole, and John Safko
2. Mechanics by L.D. Landau and E.M. Lifshitz
3. Classical Mechanics: Systems of Particles and Hamiltonian Dynamics by Walter Greiner
4. Introduction to Classical Mechanics: With Problems and Solutions by David Morin
5. Classical Dynamics of Particles and Systems by Jerry B. Marion and Stephen T. Thornton
6. Classical Mechanics by R. Douglas Gregory
7. Analytical Mechanics by Grant R. Fowles and George L. Cassiday

Reference Books Recommended

1. Classical Mechanics, H. Goldstein, C.P. Poole, J.L. Safko, 3rd Edn. 2002, Pearson Education.
2. Classical Mechanics, P.S. Joag, N.C. Rana, 1st Edn., McGraw Hall.
3. Classical Mechanics, R. Douglas Gregory, 2015, Cambridge University Press.
4. Classical Mechanics: An Introduction, Dieter Strauch, 2009, Springer.

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

1. Classical Mechanics-https://archive.nptel.ac.in/courses/115/106/115106123/
2. Classical Mechanics- https://archive.nptel.ac.in/courses/115/105/115105098/
3. Classical Mechanics- https://archive.nptel.ac.in/courses/122/106/122106027/

PART – D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Examination (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By course teacher)	Internal Test/ Quiz (2): **20+20** Assignment/ Seminar (1): **10** Total Marks: **30**	Better marks out of the two Test / Quiz + marks obtained in Assignment shall be considered against **30** Marks
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, **1 out of 2** from each unit- **4 x 10 =40 Marks**	

Name and Signature of Convener & Members of CBoS: