Course Syllabus
Gyanmanjari Science College
Semester-2 (M.Sc.)

Subject: Classical Mechanics (MSCMA12510)

Type of course: Major

Prerequisite: Solid foundation in calculus, physics (Newtonian mechanics), mathematical methods, vector analysis, and mechanics concepts for a Classical Mechanics course.

Rationale: Classical Mechanics serves as the theoretical foundation of calculus. It aims to provide a rigorous framework for the concepts introduced in calculus, such as limits, derivatives, and integrals. By establishing a solid mathematical basis.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	0	4	60	30	10	-	50	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No.	Course content	Hrs	% Weightage
1	**CHAPTER 1:** Newton's Law of Motion, Mechanics of Particle Motion in a Central Force Field, Equivalent One-Body Problem.	15	25
2	**CHAPTER 2:** Motion in a Central Force Field, General Features of the Motion, Equation of the Orbits, Kepler's Laws of Planetary Motion.	15	25
3	**CHAPTER 3:** Lagrangian Formulation: Constraints, Generalized Coordinates, D'Alembert's Principle, Lagrange's Equations, A General Expression for Kinetic Energy, Symmetries and Laws of Conservation, Cyclic Coordinates, Rayleigh's Dissipation Function.	15	25
4	**CHAPTER 4:** Hamilton's Formulation, Hamilton's Principle, Lagrange's Equations for Non-holonomic Systems and Its Applications, Hamilton's Equations of Motion and Its Application, Canonical Transformation, Condition for a Transformation to be Canonical, Canonical Equations in Terms of Poisson Bracket Notations.	15	25

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1.	**Analysis :** Faculty will assign scientific pictures and students will analyze and prepare a report in 100 words and upload it to the GMIU web portal.	10
2.	**Concept mapping :** Faculty will assign real time project / problem that Students map their Idea, Solution for real time project / problem and upload it to the GMIU web portal.	10
3.	**Puzzle :** Various problems based on series, geometry, clock, calendar, etc. will be assigned to the students. Students need to submit Mathematical logic and Solution via the GMIU web portal.	10
4.	**Model making :** Model making upon any formula of mathematics like Pythagoras, any Quadratic equation, Sum, Multiplication etc. Photo/Video must be uploaded on the GMIU web portal.	10
5.	**Brain writing :** Faculty will provide a picture, text passage or video clip, student observe, analyze and write about it.	10
Total		**50**

Course Outcome:

After learning the course the students should be able to:	
CO1	Apply Newton's laws to analyze particle motion in central force fields and solve one-body problems.
CO2	Analyze motion in central force fields, derive orbit equations, and understand Kepler's laws.
CO3	Understand Lagrangian formulation, solve complex mechanical systems, and grasp conservation laws.
CO4	Apply Hamilton's formulation, understand canonical transformations, and use Poisson bracket notations.

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	10%	40%	20%	10%	20%	-

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MCQ etc.
From the content 10% topics are suggested for flipped mode instruction.
Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

Reference Books:

1. H. Goldstein, Classical mechanics, Wesley.
2. Synge and Griffith, Principle of Mechanics, Mcgraw-Hill,1980.
3. Gupta and Satya Prahash, Classical Mechanics, Kedarnath, Ramanath Meerut.
4. Gupta, Kumar and Sharma, Classical Mechanics, Pragati Prakashan.
5. Classical Mechanics by J.C.Upadhyay.