K24P 3916

Reg. No. : .....

Name : .....

I Semester M.Sc. Degree (C. B. C. S. S. – OBE – Reg./Supple./Imp.) Examination, October 2024
(2023 Admission Onwards)
PHYSICS/PHYSICS WITH COMPUTATIONAL AND NANO SCIENCE SPECIALIZATION
MSPHN01C01/MSPHY01C01 : Classical Mechanics

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **any 5**, **each one** carries **3** marks.

1. Differentiating different types of constraints by using suitable examples.
2. Judging the value of eccentricity and energy determines the shape of the orbit in a central force problem.
3. Organizing stable, unstable, and neutral equilibrium by using suitable examples.
4. Abstracting Hamilton's equations of motion. Outlining their importance.
5. Detecting Euler's angles for the orientation of a rigid body by using a suitable diagram.
6. Explain the significance and role of action and angle variables in solving problems related to periodic motion and Hamiltonian mechanics. **(5×3=15)**

SECTION – B

Answer **any 3** questions, **each one** carries **6** marks.

7. Analyzing the equation of motion of a compound pendulum and finding the period of small amplitude oscillations of the compound pendulum.
8. Testing $q=\sqrt{2P}\sin Q$; $P=\sqrt{2p}\cos Q$ is canonical.

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9. Constructing the fundamental frequencies of a simple harmonic oscillator by setting up the action variables.
10. Explain the concept of Coriolis force and its significance in rotational motion. Analyse the effect of Coriolis force on projectile motion in both the northern and southern hemispheres of the Earth.
11. Equation of the orbit of a particle moving under the action of central force is given as $r = a(1 + \cos\theta)$. Find the corresponding force. **(3×6=18)**

SECTION – C

Answer **any 3** questions, **each one** carries **9** marks.

12. Generating the Lagrangian equation from the variation principle. Judging the shortest distance between two points in a plane is a straight line.
13. Producing the first integrals of motion of a heavy symmetric top under gravity. Testing steady precession and nutation of a heavy symmetric top.
14. Establish the Lagrangian and hence deduce Lagrange's equation of motion for small oscillations of a system in the neighbourhood of stable equilibrium.
15. Give first integral of motion and classify orbits based on solution obtained.
16. Define Poisson bracket and derive its important properties. Prove that Poisson bracket of two integrals of the equations of motion is also an integral of motion. **(3×9=27)**
