Name.....

(Pages : 2)

Reg. No.....

D 32730

FIRST SEMESTER M.Sc. (CBCSS) REGULAR/SUPPLEMENTARY DEGREE EXAMINATION, NOVEMBER 2022

Physics

PHY1C01—CLASSICAL MECHANICS

(2019 Admission onwards)

Time : Three Hours

Maximum Weightage : 30

Section A

Answer all questions. Each question carries 1 weightage.
8 short questions answerable within 7.5 minutes

1. What are generalized co-ordinates ?
2. Evaluate the Poisson bracket $[J_x, P_y]$.
3. Define inertia tensor.
4. Discuss the significance of normal co-ordinates and normal modes of vibrations.
5. Give an example for nonlinear oscillations. Describe the conditions under which those oscillations turn into chaotic.
6. What is Legendre Transformation ? Explain how Hamiltonian of a system can be obtained from Lagrangian.
7. What are cyclic co-ordinates ? How are they related to conservation laws ?
8. What is the physical significance of Hamilton's characteristic functions ?

(8 × 1 = 8 weightage)

Section B

Answer any **two** *questions. Each question carries 5 weightage.*
4 essay questions answerable within 30 minutes

9. Obtain Lagrange's equation from Hamilton's principle.
10. Discuss linear Harmonic oscillator problem using Hamilton-Jacobi theory.
11. Discuss the case of logistic map, find the fixed points and describe the onset of chaos through period doubling.
12. Discuss the rigid body motion in terms of direction cosines and Euler angles, Infinitesimal rotation.

(2 × 5 = 10 weightage)

Turn over

16

Section C

Answer any **four** *questions. Each question carries 3 weightage*
7 problems within 15 minutes

13. A simple pendulum has a bob of mass m with a mass m_1 at the moving support (pe with moving support) which moves on a horizontal line in the vertical plane in wh pendulum oscillates. Find the Lagrangian and Lagrange's equation of motion.

14. Discuss the motion of a disc of mass m and radius b rolling down an inclined plane w sliping. Also, find the force of constraint using the Lagrange method of undeter multipliers.

15. Consider scattering of particles by a rigid sphere of radius R and calculate the diffe and total cross-sections.

16. Find the canonical transformation generated by the generating function $F_1 = q_i Q_i$

17. Find the possible fixed points of a damped pendulum with damping force proportio velocity. Discuss their stability.

18. Find the maximum values possible for the centrifugal force acting on a body of $m = 20$ kg. due to the spin of the earth as the equator given that the radius of the ea R = 6400 km.

19. Obtain Hamilton's equations for a particle of mass m moving in a plane about a fixed by an inverse square force. Hence, obtain the radial equation of motion.

(4 × 3 = 12 weig