C 32344 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2017

(CUCSS)

Physics

PHY 1C 01—CLASSICAL MECHANICS

(2017 Admissions)

Time : Three Hours Maximum : 36 Weightage

Section A

Answer **all** *questions.*

Each question carries weightage 1.

1. Explain the significance of Rayleigh's dissipation function in setting up the equations of motion.
2. State and explain the Hamilton's principle.
3. A Lagrangian is given as $L=\frac{1}{2}m\left(\dot{x}^2-\omega^2x^2\right)e^{\gamma t}$ where the particle of mass m moves in one direction. Find the equations of motion.
4. Give the physical significance of Hamilton's Principal Function and Hamilton's Characteristic Function.
5. Explain angular momentum commutator in Poisson Brackets.
6. Get the relation between Lagrange bracket and Poisson bracket.
7. Describe the direction cosines of the body set of axes relative to space fixed axes.
8. Find the rate of change of a vector with respect to a rigid body.
9. Define normal frequency and discuss its significance.
10. Express kinetic energy and potential energy of a two coupled oscillator in terms of normal co-ordinates.
11. What are Feignbaum number and Lyapunov exponent ?
12. Describe the fixed point in the case of damped oscillator.

(12 × 1 = 12 weightage)

Turn over

Section B

Answer any **two** *questions.*
Each question carries weightage 6.

13. Discuss Hamilton Jacobi Equation and hence solve Harmonic Oscillator problem.

14. What are Euler angles ? Discuss infinitesimal rotations of a rigid body.

15. Discuss the oscillation of a linear triatomic molecule.

16. Discuss Pitch Fork bifurcation, period doubling and fixed points with respect to logistic Map.

(2 × 6 = 12 weightage)

Section C

Answer any **four** *questions.*
Each question carries weightage 3.

17. Show that the generating function F_1 and F_2 can generate exchange and identity transformations respectively.

18. Solve Brachistochrone problem by the method of calculus of variations.

19. Show that the transformation $P = \frac{1}{z}\left(p^2 + q^2\right), Q = \tan^{-1}\frac{q}{p}$ is canonical.

20. Consider a particle falling freely from a height h at latitude a. Find its deflection from the vertical due to Coriolis force.

21. Arrive the phase space diagrams for undamped, damped and forced oscillations.

22. Derive the Lagrang's equation of motion for small oscillations.

(4 × 3 = 12 weightage)