

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2018

(CUCSS-PG)

Physics

PHY 1C 01—CLASSICAL MECHANICS

(2017 Syllabus Year)

Time : Three Hours

Maximum : 36 Weightage

Section A

*Answer all questions.
Each carries weightage 1.*

1. What is principle of virtual work and D' Alembert's principle ?
2. Describe Hamilton's Canonical equations.
3. Discuss the Lagrange's equations of motion in the presence of generalized potentials.
4. Suggest a generating function which generates the identity transformation. Explain.
5. Briefly explain Canonical Transformation.
6. Describe the significance of action -angle variables.
7. Derive the equation for Coriolis force. What is its effect on projective shot on earth ?
8. Describe Euler angles with respect to rotation of rigid body.
9. Discuss the significance of normal co-ordinates and normal modes of vibrations.
10. What do you mean by symmetric and unsymmetric modes in a two coupled oscillator ?
11. Give examples for nonlinear oscillations. Describe conditions under which those oscillations turn into chaotic.
12. Describe the universality of chaotic systems.

(12 × 1 = 12 weightage)

Section B

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

13. Discuss scattering in a central force field. Derive Rutherford expression for differential scattering cross section.
14. Discuss the properties of Poisson Brackets. Show that Poisson Brackets are invariant under canonical transformation.

Turn over

15. Discuss and obtain the Lagrange's equation of motion for small oscillations.
16. Describe the Logistic Map. Discuss fixed points, universal constants and bifurcation diagram for it.
(2 × 6 = 12 weightage)

Section C

Answer any **four** questions.

Each carries weightage 3.

17. Find the shortest distance between any two points by the method of calculus of variations.
18. Prove that the transformation $q = \sqrt{\frac{2p}{k}} \sin Q$ and $p = \sqrt{2pk} \cos Q$ is canonical and hence obtain the generating function.
19. Four mass points each of mass m are placed at $(a, 0, 0)$, $(0, a, 0)$, $(0, 0, a)$ and (a, a, a) . Evaluate the inertia tensor of the system.
20. Describe infinitesimal rotations of rigid body.
21. Describe the possible attractors for pendulum motion under various conditions.
22. Derive the expressions for normal frequencies and for normal co-ordinates for the vibrations of linear tri atomic molecule.

(4 × 3 = 12 weightage)