(6 pages) **Reg. No. :** .....

Code No. : 7856 **Sub. Code : PPHM 11**

M.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2019.

First Semester

Physics

CLASSICAL MECHANICS

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. If a generalised coordinate has the dimensions of momentum, the generalised velocity will have the dimension of ————

(a) Velocity (b) Acceleration

(c) Force (d) Torque

2. The product of any generalised momentum and the associated coordinate must have the dimensions of ————

(a) Energy (b) Angular momentum

(c) Linear momentum (d) Force

3. The α – particle scattering cross-section and hence the number of α – particle scattered must be proportional to ————

(a) E (b) E^{-1}

(c) E^2 (d) E^{-2}

4. For orbits under inverse square law of force, the effective potential energy is given by ————

(a) $\frac{K}{r}+\frac{l^2}{2mr^2}$ (b) $\frac{K}{r}-\frac{l^2}{2mr^2}$

(c) $\frac{l^2}{2m}$ (d) $\frac{-l^2}{2mr^2}$

5. The motion in which the distance between two bodies never exceeds a finite limit is ————

(a) Unbound motion

(b) Bound motion

(c) Fixed motion

(d) Rotational motion

6. A single particle in phase space is specified by

(a) 6 coordinates

(b) 3 coordinates

(c) 9 coordinates

(d) 12 coordinates

7. For a conservative system, Hamiltonian is

(a) $H = T - V$ (b) $H = 2T - V$

(c) $H = T + V$ (d) $H = T - 2V$

8. The Hamiltonian is defined as

(a) $H = \sum_K p_K \dot{q}_K + L$

(b) $\sum_K p_K \dot{q}_K - L$

(c) $\sum_K q_K \dot{p}_K + L$

(d) $\sum_K q_K \dot{p}_K - L$

9. Moment of inertia tensor has

(a) 3 independent components

(b) 6 independent components

(c) 9 independent components

(d) 36 independent components

10. When the two frequencies are identical in small oscillations, the system is known as

(a) resonance (b) oscillator

(c) degenerate (d) linear

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) State and prove D'Alembert's principle.

Or

(b) State and prove conservation theory of energy.

12. (a) State and prove virial theorem.

Or

(b) Explain equivalent one body problem.

13. (a) Explain Euler's angles and represent them on a diagram.

Or

(b) Explain infinitesimal rotations.

14. (a) Derive Hamilton's equations from variational principle.

Or

(b) Deduce equation of motion interms of poisson's brackets.

15. (a) Derive Lagrange's equations of motion for small oscillations.

Or

(b) Discuss the properties of T,V and W.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Obtain Lagrange's equation of motion for a Holonomic conservative system using D'Alemberts principle.

Or

(b) What are constraints? Classify the constraints with some examples.

17. (a) Discuss the scattering of α – particles under a central force field and hence obtain the expression for putherford scattering cross-section.

Or

(b) Explain the general features of central force motion.

18. (a) Discuss in detail the coriolis effect.

Or

(b) Explain the orthogonal transformations.

19. (a) State and prove principle of least action.

Or

(b) What are generating functions? Give the canonical transfermations of the first two types of generating functions.

20. (a) Discuss the oscillations of a symmetric linear triatomic molecule (CO_2) and find the eigen values and corresponding eigen vector.

Or

(b) Give the theory of double pendulum.

———————