(6 pages)

Reg. No. : .....

Code No. : 6838 **Sub. Code : PMAM 23**

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2021.

Second Semester

Mathematics — Core

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. The moment of force about 0 is defined by N = _____.

   (a) $r \cdot F$ (b) $r \times F$

   (c) $r \times P$ (d) None

2. The scalar quantity $mv^2/2$ is called the _____.

   (a) Kinetic energy (b) Potential energy

   (c) Torque (d) Mass

3. The Lagrangian function L = _____.

(a) T – V (b) T + V

(c) TV (d) T ÷ V

4. The equation of motion is _____.

(a) $F_i - p_i = 0$ (b) $F_i - t_i$

(c) $F_i \delta r_i$ (d) F_{ij}

5. Generalized momentum conjugate to a cyclic co-ordiante is _____.

(a) conserved (b) variable

(c) zero (d) none

6. Curves that give the shortest distance between two points on a given surface are called the _____ of the surface.

(a) perpendicular (b) geodesics

(c) torque (d) mass

7. Conservation of total energy T + V = _____.

(a) 0 (b) 1

(c) constant (d) none

8. All point transformations are _____.

(a) canonical (b) non-canonical

(c) both (d) none

9. The potential force under inverse square law of force is _____.

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

(c) Kr (d) Kr^2

10. The nature of orbit when $e = 1$ and $E = 0$ is _____.

(a) elliptic (b) parabola

(c) hyperbola (d) circle

PART B — ($5 \times 5 = 25$ marks)

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

11. (a) State and prove conservation theorem for total angular momentum.

Or

(b) Prove that if the total force F is zero then $P = 0$ and the linear momentum P is conserved.

12. (a) Derive D'Alembert principle.

Or

(b) Write about the Atwood's machine.

13. (a) Explain about the Brachistochrone problem.

Or

(b) Show that the minimum surface of revolution is a catenary.

14. (a) Find the total number of integral exponents resulting in elliptic functions.

Or

(b) Prove that the central force motion of two bodies about their centre of mass can always be reduced to an equivalent one body problem.

15. (a) Derive the Kepler's equation $wt = \psi - e\sin\psi$.

Or

(b) Derive the condition $E = \frac{-mK^2}{2e^2}$ for circular motion.

PART C — ($5 \times 8 = 40$ marks)

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

16. (a) State and prove conservation theorem for the angular momentum of a particle.

Or

(b) Show that for a single particle with constant mass the equation of motion implies the following differential equation for the kinetic energy $\frac{dT}{dt} = F \cdot V$ while if the mass varies with time the corresponding equation is $\frac{d(mT)}{dt} F \cdot P$.

17. (a) Derive Lagrange's equation from DAlembert's principle.

Or

(b) Derive equation of motion interms of Lagrangian and Dissipation function.

18. (a) Find the shortest distance between two points in a plane.

Or

(b) Derive Lagrange's equation from Hamilton's principle for nonholonomic system.

19. (a) Discuss about the equivalent one dimensional problem.

Or

(b) State and prove viral theorem.

20. (a) Discuss Kepler Problem.

Or

(b) Explain about Laplace Runge Lenz Vector.

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