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

Code No. : SS 5838 Sub. Code : PMAM 23

M.Sc. DEGREE (Special Supplementary)
EXAMINATION, APRIL 2020.

Second Semester

Mathematics

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 zero level of the potential energy V is _____.

(a) arbitrary

(b) fixed

(c) zero

(d) a constant

2. Weak law of action and reaction stats that $F_{ij} + F_{ji} =$ ————————.

(a) a constant (b) zero

(c) $F_i^{(e)}$ (d) $F_j^{(e)}$

3. The equation $\sum_i F_i^{(a)} \cdot \delta r_i = 0$ is called the ————————.

(a) conservation of angular momentum

(b) conservation of linear momentum

(c) hamilton's principle

(d) principle of virtual work

4. $F = q\left\{E + \frac{1}{C}(v \times B)\right\}$ is called the ———————— force.

(a) Rayleigh's (b) Hamilton's

(c) Lorentz (d) Lagrangian

5. The geodesics of a spherical surface are ————————.

(a) Straight lines (b) Circles

(c) Great circles (d) Spheres

6. Where the potential is an explicit function of position coordinates only, then a monogenic system is ————————.

(a) conserved (b) zero

(c) vanished (d) implicit

7. If the forces F_i are the sum of nonfrictional forces F_i' and frictional forces f_i proportional to the velocity, then the virial depends only on ————————.

(a) f_i (b) F_i'

(c) F_i' and f_i (d) none

8. The requirement for circular orbit is $f(r) =$ ————————.

(a) $-\frac{l^2}{mr^3}$ (b) 0

(c) $\frac{l^2}{mr^3}$ (d) $-\frac{m^2}{lr^3}$

9. The complete orbit can be traced if the portion of the orbit between any two ———————— is known.

(a) points (b) focii

(c) end points (d) turning points

10. In Kepler's equation, the quantity wt is known as ———————— anomaly.

(a) eccentric (b) circular

(c) mean (d) kepler's

PART B — ($5 \times 5 = 25$ marks)

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

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

Or

(b) Prove that the kinetic energy is the kinetic energy obtained if all the mass were concentrated at the centre of mass, plus the kinetic energy of motion about the centre of mass.

12. (a) Discuss on D'Alembert's principle.

Or

(b) Explain the motion of one particle using plane polar coordinates.

13. (a) Derive the Hamilton's principle.

Or

(b) Find the curve between two fixed end points for which the surface of revolution is minimum.

14. (a) Derive Boyle's law.

Or

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

15. (a) Derive the differential equation for the orbit if the potential V is known.

Or

(b) Explain the Laplace – Runge – Lenz vector.

PART C — ($5 \times 8 = 40$ marks)

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

16. (a) Discuss in detail on constraints.

Or

(b) State and prove the conservation theorem for the linear momentum of a system of particles.

17. (a) Derive the Lagrange equations interms of Rayleigh's dissipation function.

Or

(b) Explain the motion of a bead sliding on a uniformly rotating wire in a force – free space.

18. (a) Derive the Lagrange's equations from Hamilton's principle.

Or

(b) Show that Hamilton's principle can be extended to nonholonomic systems.

19. (a) State and prove the virial theorem.

Or

(b) Derive two first integrals.

20. (a) Prove that the total number of integral exponents resulting in elliptic functions is $n = +5, +3, 0, -4, -5, -7$.

Or

(b) Explain the inverse square law of force.

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