MAY 2025 **P/ID 37519/PMA4V**

Time : Three hours Maximum : 80 marks

PART A — (10 × 2 = 20 marks)

Answer any TEN questions.

1. Define degrees of freedom.

2. Define holonomic constraints.

3. Define the integrals of the motion.

4. Define a natural system.

5. Define a constraint stationary value of a function.

6. What is the multiplier rule?

7. Define a canonical transformation.

8. What is the pfaffian differential forms.

9. Define a Hamilton's principal function.

10. Define a separability of a Function.

11. What is a Mathieu transformation?

12. Write the Lagrange Brackets.

PART B — (5 × 6 = 30 marks)

Answer any FIVE questions.

13. Derive the principle of work and kinetic energy.

14. Explain generalized momentum.

15. Discuss the Kepler problem in terms of polar coordinates.

16. Discuss the brachistochrone problem.

17. Explain the Liouville's systems.

18. Show that the transformation $Q = \sqrt{2q}e^{t} \cos p$ and $P = \sqrt{2q}\, e^{-t} \sin p$ is canonical.

19. Derive the Poisson brackets.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

20. A particle of mass m is suspended by massless wire of length $r = a + b\cos wt$, $(a > b > 0)$ to form a spherical pendulum. Find the equation of motion.

21. Derive the standard form of Lagrange equation for a holonomic system.

22. State and prove Hamilton's principle.

23. State and prove the Jacobi's theorem.

24. Prove that the transformation $Q = \tan q$ and $P = (p - mv_0)\cos^2 q$ is canonical.

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