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M.Sc. DEGREE EXAMINATION, NOVEMBER 2017

THIRD SEMESTER

Branch – Mathematics/Applied Mathematics

Paper IV — CLASSICAL MECHANICS

Time : 3 Hours *Max. Marks : 80*

PART – A

Answer any FOUR questions. Each question carries 5 marks.

(Marks : 4 × 5 marks = 20 marks)

1. Define the following with examples :

   (a) Generalised co-ordinates.

   (b) Holonamic and non-holonamic constraints.

2. Explain D'Alembert's principle.

3. Derive the Lagrange's equations of motion for a conservative holonamic system.

4. Discuss about calculus of variations.

5. If H is not an explicit function of 't' then prove that H is a constant of the motion.

6. Derive Hamilton's equation of motion from Hamilton's principle.

7. Prove that $\sum_{l=1}^{2n} \{u_l, u_i\} [u_l, u_i] = \delta_{ij}$.

8. Prove that : (1 + 2 + 2)

   (a) $[u, u] = 0$

   (b) $[u + v, w] = [u, w] + [v, w]$

   (c) $[u, c] = 0$, 'c' is constant.

PART – B

Answer FOUR questions. Each question carries 15 marks.

(Marks : 4 × 15 marks = 60 marks)

UNIT – I

9. Derive the Lagranges equations of motion for conservative non-holonamic system. (15)

Or

10. (a) Discuss about harmonic oscillator. (6)

    (b) Find the differential equation for a compound pendulum which oscillates in a vertical plane above a fixed horizontal axis using Lagranges equations. (9)

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UNIT – II

11. (a) Discuss about conservation of energy in Lagrangian formulation.

(b) Find the curve for which the surface of revolution is minimum.

Or

12. State and prove Branchistochrone problem.

UNIT – III

13. State and prove principles of least action.

Or

14. (a) Derive Hamilton's equations of motion using Lagrange's equations.

(b) Explain Routh's procedure.

UNIT – IV

15. State and prove Jacobi's Identify for Poisson's brackets.

Or

16. State and prove Poincare theorem.

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