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Roll No.

72602

M. Sc. (Physics) 1st Sem.

Examination – December, 2015

CLASSICAL MECHANICS

Paper : II

Time : Three Hours]

[Maximum Marks : 80

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt five questions in all. Question No. 1 is compulsory. Attempt one question from each Unit. All questions carry equal marks.

1. (a) Define constraints of motion. 4
- (b) Show the equivalence of Newton's and Lagrange's equation. 4
- (c) State Hamilton's principle. 4
- (d) Evaluate the Poisson's bracket $[p_y, L_z]$ 4

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UNIT - I

2. Explain symmetry of space and time. Show their relation with different conservation laws. 16

3. (a) Show the invariance of Lagrangian under Galilean Transformation. 8

(b) Show that if a displacement co-ordinate is cyclic in Lagrangian, the conjugate linear momentum is conserved. 8

UNIT - II

4. Define differential and total scattering cross-section. Derive an expression of total scattering cross-section for α -particles in Rutherford scattering experiment. 16

5. (a) Derive the equation of motion of a particle in a rotating frame. 8
 (b) Show that a two body central force problem can be reduced to an equivalent one body problem. 8

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UNIT - III

6. What is Δ -variation? State and prove the principle of least action. 16

7. (a) Obtain Hamilton's Equation of motion for a simple pendulum. 8
 (b) Prove that the shortest distance between two points is a straight line. 8

UNIT - IV

8. (a) What are canonical transformations? Obtain the condition for a transformation to be canonical. 8
 (b) Show that $P = q \cot p$ and $Q = \log \left(\frac{q}{\sin p} \right)$ in canonical. 8

9. (a) Prove Jacob's Identity. 8
 (b) Show that Poisson's Bracket obeys the distributive law of Algebra. 8

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