PG Odd Semester (CBCS) Exam., December—2018

PHYSICS

(1st Semester)

Course No. : PHYCC–101

(Classical Mechanics)

Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, selecting **one** from each Unit

UNIT—I

1. Two mechanical situations are described as follows :

(a) A bead moves horizontally along a wire fixed at two ends.

(b) The wire is also rotating on a vertical plane about a horizontal axis with the bead in it.

Considering the two situations of the bead and the wire, discuss different types of constraints involved in the problems. Derive the Lagrange's equation of motion for the forces not derivable from potential function.

7+7=14

2. What are the generalized co-ordinates? How do they help to solve a mechanical problem? What are the generalized co-ordinates associated with simple pendulum? Find the equation of motion in terms of these.

2+3+1+8=14

UNIT—II

3. Derive Lagranges equation from Hamilton's principle. How can the Hamilton's principle be used for non-holomonic system? 5+9=14

4. What is a central force? Show that the central force problem is always confined on a plane. Find out the condition for elliptical orbit in planetary motion. 2+3+9=14

UNIT—III

5. Derive the canonical transformation equations from different generating functions. Show that Poisson's brackets are invariant under canonical transformation.

8+6=14

6. Find the generator for infinitesimal canonical transformation. Derive a condition to verify the canonical property of a transformation. Show that the following transformation is canonical : 3+5+6=14

$$P \quad q\cos p$$

$$Q \quad \log \frac{1}{q}\sin p$$

UNIT—IV

7. Derive Hamilton-Jacobi equation and apply it to find the equation of motion of a particle falling vertically in a uniform gravitational field. 7+7=14

8. Define action angle variables and use it to solve the simple harmonic oscillator problem. 5+9=14

UNIT—V

9. *(a)* Derive the expression for Coriolis force. Discuss the motion of a symmetrical top. 2+5=7

(b) What are Eulerian angles? Find the rotation matrix for them. 7

10. What do you mean by stable and unstable equilibria? Obtain Lagrange's equation of motion for the small oscillation of a system. 4+10=14

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