PG Odd Semester (CBCS) Exam., December—2016

PHYSICS

(1st Semester)

Course No. : PH–101 (C)

(Classical Mechanics)

Full Marks : 75
Pass Marks : 30

Time : 3 hours

The figures in the margin indicate full marks for the questions

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

UNIT—I

1. What are constraints? What type of difficulties arise due to constraints in the solution of mechanical problems and how these are removed? Classify the constraints with examples. 2+6+7=15

2. What is Hamiltonian function? Derive Hamilton's canonical equations of motion. Derive Legendre's transformation and using it find a relation between H and L. 2+6+7=15

UNIT—II

3. What do you mean by a central force? How will you reduce the two-body problem into one-body problem? Define reduced mass in such a system. 1+9+5=15

4. Derive the Lagrangian of a charged particle moving in an electromagnetic field, hence obtain Hamilton's equations of motion for the same particle. 8+7=15

UNIT—III

5. Show that the Poisson's bracket of two dynamical variables is invariant under a canonical transformation. Derive Hamilton's equation of motion in Poisson's bracket notation. 8+7=15

6. Define infinitesimal canonical transformation. Find the conditions for a transformation to be canonical. Solve the problem of harmonic oscillator by using canonical transformation. 2+8+5=15

UNIT—IV

7. What is Hamilton's characteristics function? Use Hamilton-Jacoby method to solve Kepler's problem of a particle in a inverse square central force field. 3+12=15

8. What are action-angle variables? How can they be used to obtain the frequency of periodic motion? Determine the frequency of a linear harmonic oscillator. 2+8+5=15

UNIT—V

9. Find the equations of motion of a coupled oscillator system and solve these equations to define normal modes and normal coordinates. 7+8=15

10. Discuss the motion of a heavy symmetrical top and define nutation and precession. Find the condition for steady motion of the top. 9+6=15

★ ★ ★