M.Sc. Math. with Comp. Sc.
M. Sc. Mathematics

Roll No. .....

2015

78452

M. Sc. Mathematics 4th Sem.

Examination – May, 2014

CLASSICAL MECHANICS

Paper : MM-522

Time : Three hours] *[Maximum Marks : 80*

Before answering the question, 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, selecting *one* question from each Unit. Question No. 9 of Unit - V is *compulsory*. All questions carry equal marks.

UNIT – I

1. (a) Define constraints. How they are classified ?

   (b) Define virtual displacement, virtual work, possible velocity and possible acceleration.

2. (a) Prove D'Alembert's principle.

   (b) Discuss the general equation of dynamics and define ideal constraints.

UNIT – II

3. (a) Derive Lagranges equations of the second kind.

(b) Derive the differential equation of motion for a simple pendulum of length l, using lagrange equations.

4. (a) Define Lagrangian function and Hamiltonian function. If Lagrangian of a dynamical system is given by :

$$L(x,\dot{x}) = \frac{1}{2}\dot{x}^2 - \frac{1}{2}w^2x^2 - \alpha x^3 + \beta x\dot{x}^2$$

Find the corresponding Hamiltonian.

(b) The length of a plane simple pendulum changes with time such that $l = a + bt$, where a and b are constants. Find the Lagranges equations of motion.

UNIT – III

5. (a) Derive Routh's equations.

(b) State and prove Poisson's identity for Poisson brackets.

6. Describe Poincare-Carton integral invariant.

UNIT – IV

7. (a) Discuss the conditions of canonicity of a transformation in terms of poisson Brackets.

(b) Show that the transformation :

$Q = \frac{1}{p}, P = qp^2$ is Canonical.

8. Discuss the Canonical character of a transformation in terms of Lagrange Brackets.

UNIT – V

9. (a) Define generalized Co-ordinater.

(b) Prove that in the absence of any nonpotential forces, the generalized momentum corresponding to any cyclic Coordinate is a Conserved quantity.

(c) Define independent Coordinates and ignorable coordinates.

(d) Show that the transformation :

$\tilde{q}_i = \alpha pi,\ \tilde{p}_i = \beta q_i; (i = 1,2,3,.....n;\ \alpha \neq 0, \beta \neq 0)$ is a free

Canonical transformation.