Enroll No. _____

Shree Manibhai Virani and Smt. Navalben Virani Science College (Autonomous)

Affiliated to Saurashtra University, Rajkot

SEMESTER END EXAMINATION NOVEMBER – 2016

M.Sc. Mathematics

16PMTDC01 - CLASSICAL MECHANICS–I

Duration of Exam – 3 hrs ***Semester – I*** ***Max. Marks – 70***

Part A ***(5x2= 10 marks)***

Answer **ALL** questions

1. State only the angular momentum conservation theorem for the system of particles.

2. Define configuration space.

3. Define monogenic system.

4. Define with example the degree of freedom.

5. State only the Kepler's first law of planetary motion.

Part B ***(5X5 = 25 marks)***

Answer **ALL** questions

6a. Explain in detail the conservation of total energy for a system of particles.

OR

6b. Explain in detail the principle of virtual work and D'Alemberts principle.

7a. Using D'Alemberts principle derive the Lagrange's equations of motion for general system.

OR

7b. State Hamilton's variational principle and using it derive the Lagrange's equations of motion.

8a. Discuss in detail the problem of Atwood machine.

OR

8b. Discuss in detail the Brachestochrone problem.

9a Find the equations of motion for a bead sliding on a uniformly rotated wire.

OR

9b. Obtain Lagrange's equations of motion for a simple pendulum.

10a. Find the shortest distance between two points in a plane.

OR

10b. Find the minimum surface of revolution about Y-axis.

***Part C** (5X7 = 35 marks)*

Answer **ALL** questions

11a. Derive the equations of motion and first integrals for the two body central force problem.

OR

11b. Show that central force motion of the bodies about their C.M. can always be reduced to an equivalent one body problem.

12a. A particle of mass m moves under a central force then show that

i) Its orbit is a plane curve.

ii) Its areal vector sweeps out equal area in equal time.

OR

12b Explain in detail the use of direction cosines to describe the independent co-ordinates relative to the rigid body motion.

13a. Define Euler angles and obtain the matrix of transformation from space axes to body axes.

OR

13b. Derive the matrix of transformation in terms of Cayley –Klein parameters.

14a. A particle falls a distance y_0 in a time $t_0 = \sqrt{2y_0/g}$. If the distance $y = at + bt^2$ then show that the integral $\int_0^{t_0} L dt$ has an extremum for real values of coefficients only when $a = 0$ and $b = \frac{g}{2}$.

OR

14b.. A hoop is rolling without slipping down an inclined plane then finds the force of friction acting the hoop.

15a. Define cyclic co-ordinate. Prove that the generalized momentum conjugate to a cyclic co-ordinate is conserved. Using this result deduce that if the component of the total applied torque vanishes the corresponding component of L along n is conserved.

OR

15b. If V being independent of velocities and L is not an explicit function of time then show that total energy is conserved.