JBH-003-1161006 Seat No. _____

M. Sc. (Sem. I) (CBCS) Examination

December – 2019

Mathematics : EMT-1001

(Classical Mechanic-I)

(Old & New Course)

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions :

(1) There are five questions.

(2) Attempt all the questions.

(3) Each question carries equal marks.

1 Attempt any seven : **14**

1. Define : Linear momentum and Angular momentum of a particle.
2. State minimum two differences between Holonomic constraints and non-Holonomic constraints.
3. Define with example: Scaleronomous constraints.
4. When a system is said to be a conservative?
5. Define: moment of force.
6. Define with example: Degrees of freedom.
7. Define: Configuration space.
8. Define: Cyclic co-ordinates.
9. State only the Hamilton's variational principle.
10. State only the Kepler's first law of planetary motion.

2 Attempt the following : **14**

(a) Derive the Lagrange's equations of motion for general system.

OR

(a) State and prove Angular momentum conservation theorem for a system of particles.

(b) Discuss in detail the conservation of total energy for a system of particles.

3 Attempt the following : **14**

(a) Derive the Lagrange's equations of motion using Hamilton's variational principle.

OR

(a) Discuss in detail the problem of Atwood machine and show that the tension of rope appears nowhere in the expression of acceleration.

(b) Find the shortest distance between two points in plane.

4 Attempt the following : **14**

(a) Derive the matrix of orthogonal transformation in terms of Cayley-Klein parameters.

(b) A hoop rolling without slipping down an inclined plane then find the force of friction acting on the hoop.

5 Attempt any two : **14**

(a) Derive the equations of motion and the first integrals for two bodies central force problem.

(b) Discuss in detail the use of direction cosines to describe the independent co-ordinates relative to the rigid body motion.

(c) Define Euler angles and obtain the transformation matrix from space axes to body axes.

(d) Define Coriolis force and discuss any one effect of the same.

(e) A particle falls a distance y_o 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 $b = \frac{g}{2}$.