LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **PHYSICS**

FIRST SEMESTER – **NOVEMBER 2018**

16/17/18PPH1MC01/PH 1817 – CLASSICAL MECHANICS

Date: 25-10-2018 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

PART-A

Answer ALL Questions (10×2=20)

1.Shortly discuss whether the constraint is holonomic (or)non holonomic. Specify the constraint force also.

(a). A particle moving on an ellipsoid under the influence of gravity.

(b). A pendulum with variable length.

2.Deduce Newton's equation of motion from Lagrange's equations.

3.State Hamilton's principle.

4.Determine the number of degrees of freedom for

(a).A particle moving on a space curve.

(b).4 particle moving freely in space .

5.What are normal co-ordinates and normal frequencies.?

6.Define Hamilton's function.

7.Apply variational principle to find the equation of one dimensional harmonic oscillator.

8.Explain the principle of least action.

9.What is Inertia tensor ? Give its Physical significance.

10.Show that the constraints in a rigid body are conservative.

PART B

Answer ANY FOUR Questions (4×7.5=30)

11.Define Lagrange's equations from D'Alembert's principle.

12.Write the Hamiltonian for a simple pendulum and deduce its equation of motion.

13.A particle describes a conic $r = p/(1+e \cos \theta)$ where p and e involve constant quantities . Show that the force under which the particle is moving in a central force. Deduce the force law.

14.Using Possion brackets relation ,prove that $[J_x , J_y]=J_z$.

15.Prove that the Kinetic energy of a rotating rigid body can be expressed as T=1/2 **J. ω** .

16.Calculate the inertia tensor for the system of four point masses 1 gm,3 gm,4 gm and 5 gm located at the points (1 0 0) (1 1 0)(1 1 1) (1 1 -1) c.m.

PART C

Answer ANY FOUR Questions **(4×12.5=50)**

17.Obtain the equation of motion of a system of two masses connected by an inextensible string passing over a small pulley.

18. Consider the case of two coupled pendulums ,determine

a.T and V matrices.

b.The normal frequencies.

c.The normal co ordinates.

d.The equation of motion.

e.The eigen vectors.

f.The general solution.

19.Find the relation between the angular momentum vector ,the inertia tensor and the angular velocity vector.

20.Consider a rectangular parallelepiped of uniform density ρ ,mass M with sides a,b and c.For origin O at one corner ,find the moments and products of inertia of the parallelepiped by taking the co ordinate axes along the edges.If a=b=c (cube).Determine the inertia tensor.

21.Discuss the vibrations of the torque free motion of a rigid body.

22.When is Hamilton -Jacobi theory is more useful ?. Discuss the harmonic oscillator problem using Hamilton-Jacobi method.

$$$$$$$$$

\