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**School of Basic Sciences**Master of Science in Physics  
Mid Term Examination - Nov 2023Duration : 90 Minutes  
Max Marks : 50**Sem I - C1PO104T - Classical Mechanics**General Instructions

Answer to the specific question asked

Draw neat, labelled diagrams wherever necessary

Approved data hand books are allowed subject to verification by the Invigilator

- 1) Explain Lagrangian for a free particle in polar co-ordinates K2 (2)
- 2) For a particle moving in a central field of force list the physical quantities which are conserved. Why? K1 (3)
- 3) In which type of constraint, constraint relations depend explicitly on time? Illustrate with an example. K2 (4)
- 4) A particle is moving under the action of a generalized potential, K2 (6)  
$$V(q, \dot{q}) = \frac{1 + \dot{q}}{q^3}$$

Show that the magnitude of generalized force is  $2/q^3$
- 5) What is a cyclic coordinate? In central force construct the coordinate which is cyclic. K3 (6)
- 6) Find Lagrangian of simple pendulum for small amplitude oscillation and solve it to find equation of motion. Also solve it to find its time period. K3 (9)
- 7) Evaluate Lagrangian for one dimensional Linear Harmonic Oscillator and hence develop equation of motion using Hamilton's principle. K4 (8)
- 8) A particle of mass  $m$  is projected with initial velocity  $u$  at an angle  $\alpha$  with the horizontal. The resistance of the air is neglected. Construct its Lagrangian function. Analyse this to describe the motion of the projectile. K4 (12)

**OR**

What is meant by velocity dependent potential? Deduce velocity dependent potential for a charged particle moving in an electromagnetic field and hence obtain Lagrangian. K4 (12)