C. ABDUL HAKEEM COLLEGE (AUTONOMOUS),
MELVISHARAM - 632 509.
SEMESTER EXAMINATIONS, NOVEMBER - 2018

M.Sc., MATHEMATICS **SEMESTER I / III**

P18MMA104 / P15MMA304 – MECHANICS

Time: Three Hours Maximum: 75 Marks

SECTION - A (5 X 6 = 30 Marks)

Answer **ALL** Questions.

1. a) Derive the Lagrangian form of d'Alembert's principle.

(Or)

b) State and prove Konig's theorem.

2. a) Find the differential equation of motion for a spherical pendulum of length *l*.

(Or)

b) A particle of mass m is connected by a massless spring of stiffness k and unstressed length r_0 to a point P which is moving along a circular path of radius 'a' at a uniform angular rate ω. Assuming that the particle moves without friction on a horizontal plane, find the differential equations of motion.

3. a) Find the stationary values of the function $f = z,$ subject to the constraints $\emptyset_1 = x^2 + y^2 + z^2 - 4 = 0$; $\emptyset_2 = xy - 1 = 0$.

(Or)

b) A particle of mass m is attracted to a fixed point O by an inverse square force, that is, $F_r = -\frac{\mu m}{r^2}$, where μ is the gravitational coefficient. Using the plane polar coordinates (r, θ) to describe the Position of the particle, find the equations of motion.

4. a) State and prove Jacobi's theorem.

(Or)

b) Derive the modified Hamilton – Jacobi equation.

5. a) Show that the rheonomic transformation $Q = \sqrt{2q}\, e^t \cos p$; $P = \sqrt{2q}\, e^{-t} \sin p$ is canonical.

(Or)

b) Using Poisson bracket, show that the transformation $Q = \sqrt{e^{-2q} - p^2}$, $P = \cos^{-1}(pe^q)$ is canonical.

SECTION - B (3 X 15 = 45 Marks)

Answer **ANY THREE** Questions.

6. Explain the principle of virtual work with an example.
7. Derive the standard form of Lagrange's equation for a holonomic system.
8. Sate and Prove Hamilton's Principle.
9. State and prove Stackle's theorem.
10. Obtain the four major types of generating functions associated with this transformation $Q = log\ sin\ \frac{p}{q}$; $P = q\ cot\ p$.

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