MANIPAL ACADEMY of HIGHER EDUCATION

Reg. No.										

DEPARTMENT OF SCIENCES, I SEMESTER M.Sc (PHYSICS)
END SEMESTER EXAMINATIONS, NOVEMBER 2018
SUBJECT [CODE- 4103]
(REVISED CREDIT SYSTEM-2018)

Time: 3 Hours **Date: 19/11/2019** **MAX. MARKS: 50**

Note: (i) Answer **ALL** questions
(ii) Draw diagrams, and write equations wherever necessary

1 A. (a). Obtain expressions for velocity and acceleration using polar coordinate system.

(b). Write an equation of motion for a body projected horizontally, subjected to a resistive force proportional to its velocity. Solve it to get the position at any time and halting distance.

[2+ 3 = 5]

1 B. (a). In a conservative central force field show that the total energy of a system of two bodies is constant.

(b). Show that the eccentricity $\varepsilon = \sqrt{1 + \frac{2EL^2}{\mu k^2}}$ in a central force field.

. **[3 + 2 = 5]**

2 A. (a). Show that the angular acceleration is the same in the fixed and rotating frames.

(b). Discuss the effect of Coriolis force on a missile fired Northwards. **[3 + 2 = 5]**

2 B. (a). What do mean by constraints? Explain with an illustration.
(b). Obtain Lagrange's Equations of motion for both conservative and non-conservative forces using D'Alembert's principle **[2 + 3 = 5]**

3 A. (a) What do you mean by symmetric functions? Explain.

(b). Obtain Lagrangian in the case of Atwood's machine and hence obtain the equation of motion. **[2 + 3 = 5]**

(PTO)

3 B. (a). Obtain expressions in the vector form for angular momentum and kinetic energy of a rigid body.

(b). Obtain Euler's equations of motion of a rigid body **[3 + 2 = 5]**

4 A.(a). Derive Hamilton's equations of motion using Lagrange's equations.

(b). What do you mean by phase space? Explain. Derive Hamilton's of motion for a simple pendulum. **[3 + 2 = 5]**

4 B. (a). Transform the coordinates of linear harmonic oscillator using the generating function (½) $m\omega q^2$ cot Q, obtain the new Hamiltonian and hence obtain its solution. Given: $H = \frac{p^2}{2m} + \frac{mw^2}{2}q^2$

(b). Prove the following properties of the poisson brackets:

(i) $[u, v] = -[v, u]$ (ii) $[u+v, w] = [u, w] + [v, w]$ **[3 + 2= 5]**

5 A. Prove the Jacobi identity satisfied by the Poisson brackets. **[5]**

5 B. (a) Show that the motion of two particles in a coupled oscillators is a superposition of two harmonic vibrations of frequencies.

(b). What do you mean by normal coordinates? Explain. **[3 + 2 =5]**

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