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MANIPAL UNIVERSITY, MANIPAL

FIRST SEMESTER M.SC(PHYSICS) END SEMESTER EXAMINATION, NOVEMBER, 2016

SUB: CLASSICAL MECHANICS (PHY- 603)
(REVISED CREDIT SYSTEM)

TIME: 3 HRS. **MAX.MARKS : 50**

NOTE:(A) ANSWER ANY FIVE FULL QUESTIONS. (B) EACH QUESTION CARRIES 10 MARKS.

1A A projectile motion in a resistive medium is described by $x = \frac{U}{k}\left(1 - e^{-kt}\right)$ and $y = -\frac{gt}{k} + \frac{kV+g}{k^2}\left(1 - e^{-kt}\right)$, where $x = U, y = V$ when $t = 0, k =$ resistive force per unit velocity per unit mass. Obtain an expression for its time of flight when the air resistance is small. [5]

1B In a conservative central force field show that the total energy of a system of two bodies is constant. [5]

2A State the Kepler's laws of planetary motion. Prove the Kepler's 3RD law of planetary motion.
A double star is formed of two components, each having a mass equal to mass of the Sun. The distance between them is same as that between the Earth and the Sun. What is its orbital period? [5]

2B Obtain an expression for Hamiltonian in terms of kinetic energy and potential energies. [5]

3A Obtain an expression for the velocity dependent potential of electromagnetic field and hence write an expression for Lagrangian in terms of this potential. [5]

3B Explain inertia tensor. Write an expression for angular momentum of a rigid body in terms of inertia tensors. Obtain Euler's equations of motion of a rigid body. [5]

4A Obtain Hamiltonian for a free particle in (i) cartesian coordinate system
(ii) cylindrical polar coordinate system (iii) spherical polar coordinate system. [5]

4B Prove this property of the poisson brackets: [u, v] = −[v, u]
Prove the Jacobi identity satisfied by the poisson brackets: [5]

5A Discuss the theory of oscillations of particles on a string. Obtain the expressions for frequencies in various modes in the case of 2 particles. [6]

5B Explain the strain ellipsoid. [4]

6A Discuss the elastic properties of general solids. [5]

6B Obtain an expression for the group speed of gravity waves on water surface. [5]

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