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MANIPAL UNIVERSITY, MANIPAL

FIRST SEMESTER M.SC(PHYSICS) END SEMESTER EXAMINATION, DECEMBER, 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 range of flight when the air resistance is small. [6]

1B Obtain the general expression for kinetic energy in the case of a double pendulum in terms of generalized coordinates. [4]

2A Discuss the general features of motion of a body in a two-body system in a conservative central force field with arbitrary potential energy values. [5]

2B How does a two-body problem reduce to a one-body problem in a central force field? Explain. [5]

3A Obtain Lagrangian for a spherical pendulum and hence obtain the equations of motion. [5]

3B Obtain the expressions for the angular velocity components (ω_3 & A) of a rigid body rotation in terms of angular momentum and kinetic energy. [5]

4A Using variational principle, obtain the path of a particle moving in minimum transit time, in a conservative force field, starting from rest. [5]

4B Explain stress tensor. [5]

5A In the case of oscillations in 2 coupled simple pendulums, obtain the expressions for normal coordinates. Find the expressions for the case of (i) bobs displaced by q_o in the same direction, (ii) bobs displaced by q_o in opposite directions, and released at t=0. [4]

5B Obtain the canonical equations of motion in terms of poisson bracket notation. Prove that poisson bracket of 2 constants of motion is itself a constant of motion. [state & prove Poisson's theorem]. [6]

6A Obtain an expression for the speed of elastic waves in isotropic elastic media. [5]

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

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