MANIPAL UNIVERSITY

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DEPARTMENT OF SCIENCES

FIRST SEMESTER M.SC(PHYSICS) END SEMESTER EXAMINATION, NOVEMBER 2017

SUB: CLASSICAL MECHANICS (PHY- 4103)
(REVISED CREDIT SYSTEM-2017)

TIME: 3 HRS. DATE: 18-11-2017 MAX. MARKS : 50

NOTE: ANSWER ALL FIVE FULL QUESTIONS.

1A Discus the nature of the projectile trajectory under resistive force. [5]

1B Write the equations governing the particles in Atwood's machine. Solve them to get acceleration of the particles and tension in the string. [3]

1C When a force field is said to be conservative? Give illustrations. [2]

2A Obtain an expression for radial velocity of a body in a two-body system in a conservative central force field. [5]

2B Assuming the Lagrange's equation for the general force field obtain the Lagrange's equation of motion for the conservative force field. [3]

2C 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? [2]

3A Obtain expressions for angular velocity components of a rigid body rotation in terms of Euler's angles. [5]

3B Explain the terms: moments of inertia and products of inertia. When are the products of inertia zero? Explain with suitable examples. [3]

3C Show that the angular acceleration is the same in the fixed and rotating frames. [2]

4A Obtain Hamilton's canonical equations of motion. [5]

4B Prove the following properties of the poisson brackets:
$[u, v] = -[v, u]$ $[u+v, w] = [u, w] + [v, w]$ [3]

4C Prove that $[L_x, L_y] = L_z$ using the properties of the poisson brackets (x, y, z are cyclic). [2]

5A State and prove Bernoulli's theorem. [5]

5B Explain the four components of a homogeneous strain. [3]

5C Write the characteristic equation of normal modes of vibration of 3 particles (mass = m, separation = ℓ) in a stretched string (tension = F). Obtain the frequencies in various modes for this case in terms of $\omega_o^2 = F/(m\ell)$. [2]

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