Unique Paper Code	:	3124611101
Name of the Paper	:	Engineering Physics - I
Name of the Course	:	**B. Tech. (IT and Mathematical Innovations)**
Semester	:	I

Duration : 2 Hours Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. **Question No. 1** is compulsory.

3. Answer any **FOUR** questions from **Question No. 2** to **Question No. 6.**

P.T.O.

1. Explain any **TWO** of the following experiments (theory, experimental set up, procedure, observations, calculations, errors). (10×2=20)

   (a) Use of least square method in measurement of g using simple pendulum

   (b) Study of friction

   (c) Spring constant by dynamic method

   (d) Measurement of g by Kater's pendulum

2. What is a compound pendulum? Prove that there are four points of oscillation about which the time period of a compound pendulum is identical. How do we use this information to construct a bar pendulum and use it to measure *g*? (10)

3. Draw the diagram of a coupled pendulum and formulate the equations of motion. Solve the coupled equations using the method of normal modes. Draw

the symmetric, anti- symmetric and general behaviour, and explain the physics behind these specific oscillations. (10)

4. Derive the general equation of rocket motion and find the final velocity of the rocket after time t_f in the presence of earth's gravitational field. Why do we need to burn the fuel rapidly? Determine the centre of mass of a two-dimensional uniform right triangular plate of mass M, base b, height h, and small thickness t. (10)

5. Formulate and solve the equation of motion for the damped harmonic oscillator. Prove that the energy dissipates exponentially. Derive the expression for the Q-factor and state how it is useful. What is *damping time* and how can we measure it experimentally for a damped harmonic oscillator? (10)

6. Conceptualise a Start-up based on an innovation that uses Physics concepts from mechanics. State the novelty of the product/solution, how user will benefit from it, design, mass production, and commercialization plans. (10)