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Total No. of Printed Pages: [01]

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B.Tech. (Civil, Aeronautical & Aerospace Avionics) (Semester – 1/2)

PHYSICS (MECHANICS AND MECHANICS OF SOLIDS)

Subject Code: BPHYS4101

Paper ID: [19110013]

Time: 03 Hours

Maximum Marks: 60

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A

(2 marks each)

Q1. Attempt the following:

- a. Distinguish between static and kinetic friction.
- b. What is a bending moment, and how does it influence beam deformation?
- c. Explain the significance of quality factor of harmonic oscillators?
- d. Briefly explain the difference between Galilean and Lorentz transformations.
- e. Differentiate between conservative and non-conservative forces with one example each.
- f. How do Newton's laws contribute to the completeness in describing particle motion?
- g. Define the potential energy function V and explain the relationship $F = -\nabla V$.
- h. Describe rotation in the plane and its effect on a rigid body's motion.
- i. Describe the phenomenon of resonance in electrical circuits. How is it achieved and utilized?
- j. Define centripetal force and provide an application where this force is crucial.

Section – B

(5 marks each)

- Q2. Discuss the effects of friction on motion across both horizontal and inclined planes.
- Q3. Explain the concept of damping in oscillatory systems and describe the effect of each damping type on the amplitude and energy of the oscillator.
- Q4. Explain the concept of form invariance of Newton's second law under different transformations, including its significance in the study of particle dynamics.
- Q5. Discuss the phenomena of material failure through fracture or yielding and explain the Generalized Hooke's Law with reference to the one-dimensional stress-strain curve.
- Q6. Define a rigid body and its motion in a two-dimensional plane. Discuss how rotation occurs within the plane and the concept of angular momentum about a point.

Section – C

(10 marks each)

- Q7. Define equipotential surfaces and explain their significance in representing regions of constant potential energy. Discuss the relationship between equipotential surfaces and the gradient of the potential energy function
- Q8. Elaborate one-dimensional stress-strain curve and explain its components, including the elastic region, yield point, plastic region, and fracture point.
- Q9. Discuss the advantages and disadvantages of Cartesian, spherical, and cylindrical coordinate systems and provide examples of when each is most appropriate.