Roll No. | | | | | | | | | | | | | **Total No. of Pages: 02**

Total No. of Questions: 09

B.Tech (Sem. – 1,2)

MECHANICS OF SOLIDS

Subject Code: BTPH-101-18

M Code: 75351

Date of Examination : 20-01-23

Time: 3 Hrs. **Max. Marks: 60**

INSTRUCTIONS TO CANDIDATES:

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C have FOUR questions each, carrying EIGHT marks each.**
3. **Attempt any FIVE questions from SECTION B & C, selecting atleast TWO questions from each of these SECTIONS B & C.**

SECTION-A

1. Write briefly:

   a) Define equipotential surfaces.

   b) Explain different forces in Nature.

   c) Differentiate between inertial and non-inertial frames of reference.

   d) Give essential conditions for an oscillation to occur.

   e) Distinguish between free, damped and forced oscillations.

   f) Define momentum of inertia of a body.

   g) State Euler's laws of motion.

   h) "Friction is a necessary evil", comment on this statement.

   i) What do you understand by strain hardening?

   j) Differentiate between bending moment and twisting moment.

SECTION-B

2. a) Express gradient, divergence and curl of a field in cylindrical coordinates.

   b) Define the total potential energy of a system, when the internal and external forces are conservative in nature. Deduce the law of conservation of energy for the system of particles. (4+4)

3. a) Derive the relationship between angular momentum (J) and angular momentum about centre of mass (J_{cm})

b) Aparticle of mass m is moving along a path given by the equation $\mathbf{r} = \mathbf{a}\cos(\omega t)\mathbf{i} + b\sin(\omega t)\mathbf{j}$. Calculate the angular momentum and torque about the origin. (4+4)

4. a) Derive a general differential equation of motion for a damped harmonic oscillator and obtain its solution explaining conditions for heavy, critical and light damping.

   b) A mass of 6kg stretches a spring 0.3m from its equilibrium position. The mass is removed and another body of mass 1.0kg is hanged from the spring. What would be the period of motion if the spring is now stretched and released? (5+3)

5. a) Derive a general differential equation of motion for forced mechanical oscillator and obtain its solution explaining conditions for heavy, critical and light oscillations.

   b) Considering quality factor of sonometer wire of frequency 260Hz as 2000 , calculate the time in which the amplitude decreases to $1/e^2$ of its initial value. (5+3)

SECTION-C

6. a) Derive the expression for angular momentum and rotational kinetic energy of a rigid body.

   b) Define terms:

      i) Centre of mass

      ii) Radius of gyration

      iii) Moment of force and couple. (4+4)

7. a) State theorem of parallel axes for moment of inertia and prove it.

   b) Derive the expression for moment of inertia of a circular ring about an axis passing through its centre and perpendicular to its plane. (4+4)

8. a) Differentiate between static and kinetic friction.

   b) Derive the expression for minimum force required to move a block on rough horizontal surface. (4+4)

9. a) Define stress and strain and explain the stress-strain curve.

   b) **Write short notes on:** (4+4)

      i) Strain energy

      ii) Yield criteria

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.