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

Total No. of Questions : 09

B.Tech (Civil Engg.) (2018 Batch) (Sem.–1,2)

MECHANICS OF SOLIDS

Subject Code : BTPH-101-18

M.Code : 75351

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.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

1. **Write briefly :** **(2×10=20)**

   a) Give the physical significance of gradient, divergence and curl of a field.

   b) Distinguish between conservative and non-conservative forces.

   c) Define Coriolis force.

   d) Distinguish between heavy, critical and light damping.

   e) Define quality factor for damped oscillations.

   f) Explain the concept of centre of mass.

   g) State theorems of parallel axes and perpendicular axes for moment of inertial.

   h) Write Euler's equations of motion.

   i) Write the laws of limiting friction.

   j) Explain stress-strain curve.

SECTION-B

2. a) Express gradient, divergence and curl of a field in spherical coordinates. 5

   b) Find constants a, b and c so that the vector A = $(x+2y+az)i + (bx-3y-z)j + (4x+cy+2z)k$ is irrotational, where i, j, k are rectangular unit vectors. 3

3. a) State Newton's laws of motion and discuss their limitations in describing particle motion. 4

   b) Discuss about the conservation of angular momentum and energy during the motion of a body. 4

4. a) Derive a general differential equation of motion for a simple harmonic oscillator and obtain its solution. 5

   b) The total energy of particle executing a S.H.M. of period 2π seconds is 10.24×10^{-4} Joule. The displacement of a particle at $\pi/4$ second is $0.08\sqrt{2}$m. Find the amplitude and mass of the particle. 3

5. a) Explain free vibrations, damped vibrations, forced vibrations and resonance, giving one example of each. 4

   b) Find the maximum velocity and acceleration of a particle executing S.H.M. of period 10π seconds and amplitude 5×10^{-2}m. 4

SECTION-C

6. a) Define a rigid body. Prove that the total internal forces and torques for these forces are always zero. 4

   b) Prove that angular momentum of a system of particles can be expressed as the sum of angular momentum of the system of centre of mass and angular momentum of system about the centre of mass. 4

7. a) Derive the expression for moment of inertia of a plane lamina about an axis lying in its plane parallel to one of its sides and passing through its centre of mass. 4

   b) A uniform thin bar of mass M and length L is bent to make a square. Calculate its moment of inertia about an axis passing through the centre of mass perpendicular to the square thus formed. 4

8. a) Define angle of friction and angle of repose (with neat diagrams) and derive relation between them. 4

   b) "*Friction is a necessary evil*", comment on this statement. Give some methods to reduce friction. 4

9. a) Distinguish between the concepts of elasticity and plasticity with appropriate examples. 4

   b) Differentiate between bending moment and twisting moment. 4

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