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Total No. of Pages : 02

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B.Tech (Civil Engg.) (2018 Batch) (Sem.-1,2) **MECHANICS OF SOLIDS** Subject Code : BTPH-101-18 M.Code: 75351

Time: 3 Hrs.

Roll No.

INSTRUCTIONS TO CANDIDATES :

- SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks 1. each.
- 2. SECTION - B & C. have FOUR questions each.
- Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each. 3.
- Select atleast TWO guestions from SECTION B & C. 4.

SECTION-A

Write briefly : 1.

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

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Max. Marks: 60

 $(2 \times 10 = 20)$

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- 3. a) State Newton's laws of motion and discuss their limitations in describing particle motion.
 - b) Discuss about the conservation of angular momentum and energy during the motion of a body.
- 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.
- 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.

SECTION-C

- 6. a) Define a rigid body. Prove that the total internal forces and torques for these forces are always zero.
 - 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.
- 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.
- 8. a) Define angle of friction and angle of repose (with neat diagrams) and derive relation between them.
 - 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.
 - 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.