

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech (Only for Civil) (2018 Batch) (Sem.-1)

MECHANICS OF SOLIDS

Subject Code : BTPH-101-18

Paper ID : [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 :**

- a) Define the gradient of a scalar field.
- b) Show that the velocity vector does not necessarily point in the same direction as the displacement vector.
- c) Define the term 'central force' and show that it is conservative in nature.
- d) What is the physical significance of Q-value of a forced oscillator?
- e) Name the periodic motion which is not oscillatory.
- f) What is a rigid body?
- g) Moment of inertia plays the same role in rotation as mass does in translation. Justify.
- h) A cyclist is riding a bicycle without holding the handle. He wishes to turn to one side. Explain how.
- i) List the factors on which friction force depends.
- j) Differentiate between normal and shear stress.

SECTION-B

2.
 - a) What are spherical coordinates? How are these related to the rectangular Cartesian coordinates?
 - b) Discuss the effect of Coriolis force on the setting up of cyclones and trade winds.
3.
 - a) State and explain the law of conservation of angular momentum. Illustrate with examples.
 - b) Distinguish between inertial and non-inertial frames of reference. Give one example of each. Is earth an inertial frame?
4. Assuming damping to be proportional to velocity, write down the differential equation for a damped harmonic oscillator. Solve the differential equation so obtained and discuss in detail the case of heavy damping and critical damping.
5.
 - a) A 0.3 kg mass is attached to a spring and oscillates at 2 Hz with a Q of 60. Find the spring constant and damping constant.
 - b) Prove that the displacement resonant frequency of driving force is less than the natural frequency of the undamped oscillator.

SECTION-C

6.
 - a) Define a rigid body and justify the fact that total internal forces and torques for these are zero. (4)
 - b) State and prove theorem of parallel axes for moment of inertia. (4)
7.
 - a) Derive Euler's equations of rotation of a rigid body about a fixed point. (5)
 - b) Find the moment of inertia of a uniform rectangular lamina about diagonal as principal axis. (3)
8.
 - a) A block of mass 10 kg is sliding on a surface inclined at an angle of 30° with the horizontal. Calculate the acceleration of the block. The coefficient of kinetic friction between the block and the surface is 0.5. (4)
 - b) Friction is a necessary evil, comment. Mention some ways of reducing friction. (4)
9.
 - a) Three bars of equal length and having cross sectional area in the ratio 1:2:4 are all subjected to equal load, compare their strain energy. (4)
 - b) A rectangular beam of 200 mm in width and 400 mm in depth is simply supported over a span of 4m. and carries a distributed load of 10 kN/m. Determine the maximum bending stress in the beam. (4)