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Roll No. :

337354(37)

B. E. (Third Semester) Examination, Nov.-Dec. 2021

(New Scheme)

(Mech., Production & Automobile Engg. Branch)

MECHANICS of SOLIDS-I

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

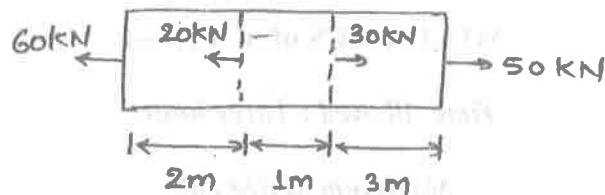
Note : Attempt all questions. Part (a) of each question is compulsory. Attempt any two parts from (b), (c) and (d) of each question. Assume suitable data if required.

1. (a) Write do you mean by tensile, compressive and shear forces. 2
- (b) Define bulk modulus. Deduce the relation 7

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$$E = 3K(1 - 2\nu)$$

- (c) Plot a tensile test diagram for steel. Explain its salient features. 7
- (d) A steel bar of 25 mm diameter is acted upon by forces as shown in figure. What is the total elongation of the bar? Take $E = 190 \text{ GPa}$ 7



2. (a) What do you mean by a statically indeterminate beam? 2
- (b) Indicate the shapes of bending moments diagram for point load and uniformly distributed loads. 7
- (c) Prove the relation $\frac{\sigma}{y} = \frac{m}{I} = \frac{E}{R}$ for simple bending. 7

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- (d) Develop relations for the shear stress across sections of : 7
- a square with a diagonal horizontal
 - a triangle, side as base.
3. (a) What is macaulay's method of beam deflection analysis? 2

Note : Attempt any one part :

- (b) A simply supported horizontal beam carries a load which varies from 20 kN at one end to 50 kN at the other. Determine the central deflection if the span is 10 m and the width 420 mm. The bending stress is limited to 84 MPa. $E = 210 \text{ GPa}$ 14
- (c) A simply supported beam of 5 m length carries a uniformly distributed load of 6 kN/M, over the whole span in addition to negative bending couples of 4 kN.m at each end. Determine the deflection at the midspan $EI = 100 \text{ MN.m}^2$. Use moment area method. 14
4. (a) What do you mean by equivalent torque? 2

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- (b) A hollow circular shaft of 180-mm outer diameter and 100 mm inner diameter is used to transmit power. Determine the maximum torque which can be safely transmitted if the shear stress is not exceed 50 MPa. 7
- (c) Show that a closed-coiled helical spring does not rotate under axial load and does not deflect under torque. 7
- (d) To coil diameter of a close-coiled helical spring having 10 coils is eight times the wire diameter. the spring absorbs 60 N.m of energy when compressed by 40 mm. Find the coil and the wire diameters and the maximum shear stress. $G = 85 \text{ GPa}$. 7
5. (a) Define principal stress and strain? 2

Note : Attempt any **one** part :

- (b) A rectangular block is subjected to two perpendicular stresses of 10 MPa tension and 10 MPa compression. Determine the stresses on planes inclined at : 14

[5]

- (i) 30°
- (ii) 45° , and
- (iii) 60° with the plane of compressive stress.
- (c) A piece of material is subjected to two perpendicular tensile stresses of 100 MPa and 60 MPa. Determine the plane on which the resultant stress has maximum obliquity with the normal. Also find the resultant stress on this plane. Draw Mohr's circle. 14