Code No: 133BT **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, April/May - 2018

STRENGTH OF MATERIALS – I

(Common to CE, CEE)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each full question carries 10 marks.

PART- A

(25 Marks)

1.a) A circular steel bar of length '*L*' cross-sectional area '*A*' and weight '*W*' is fixed at its upper end and hangs vertically. Find the elongation of the bar under its own weight. [2]

b) A steel bar of diameter 20 mm and gauge length 100 mm is tested in UTM. Find the change in the diameter of the bar at 100 kN load if the Poisson's ratio is 0.25 and modulus of elasticity = 2×10^5 N/mm^2. [3]

c) Define the shear force and bending moment at a cross-section. [2]

d) Obtain the relation between shear force and rate of loading. [3]

e) A beam has a circular cross-section of diameter 300 mm and subjected to a shear force of 240 kN. Determine the ratio of average shear stress to the maximum shear stress. [2]

f) A simply supported beam has a T-section as shown in Figure 1 and carries uniformly distributed load. Determine the bending stress at the extreme top fibre if the stress at the extreme bottom fiber is 125 N/mm^2. The depth of the web of T-section is 150 mm. [3]

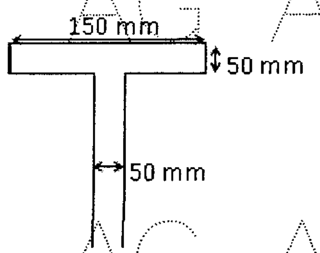

Figure 1

g) Distinguish between a real beam and a conjugate beam. [2]

h) A simply supported beam of span 3 m is subjected to a concentrated load of 50 kN at its mid-span. Determine the flexural rigidity if the maximum deflection is 20 mm. [3]

i) What is the importance of Mohr's circle of stress? [2]

j) Explain maximum principal strain theory of failure. [3]

PART-B

(50 Marks)

2. A solid steel bar 900 mm long and 75 mm diameter is placed concentrically inside an aluminium tube having 80 mm inside diameter and 100 mm outside diameter. The aluminum tube is 0.25 mm longer than the steel bar. Find the stresses in the steel bar and aluminium tube, if an axial compressive load of 600 kN is applied to the bar and tube through rigid cover plates attached at both ends. E_{Steel} = 200 GPa and $E_{Aluminium}$ = 70 GPa. [10]

OR

3.a) Derive the relation between the modulus of elasticity and bulk modulus.

b) A steel rod of length 1.25 m and 22 mm diameter hangs vertically with a collar firmly attached at the lower end of the rod. Find the maximum stress induced in the rod when a block of weight 25 kg falls on the collar from a clear height of 300 mm. Also find the energy absorbed and the modulus of resilience. Use modulus of elasticity = 2×10^5 N/mm^2. [5+5]

4. Draw the shear force and bending moment diagrams for a beam supported and loaded as shown in Figure 2. [10]

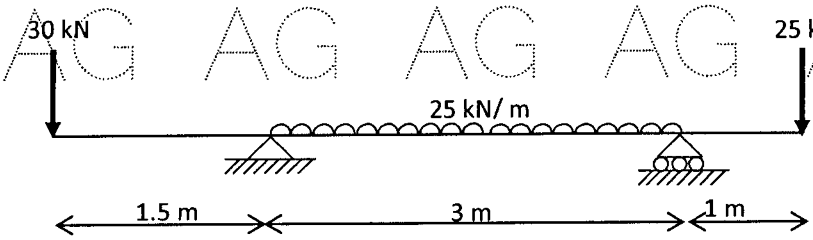

Figure 2

OR

5. Draw the shear force and bending moment diagrams for a beam of span 5 m supported and loaded as shown in Figure 3. [10]

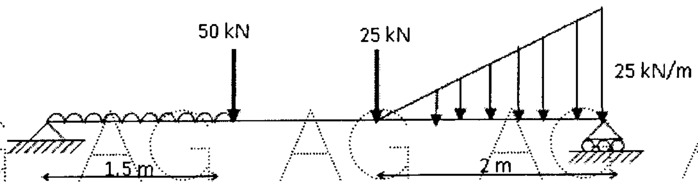

Figure 3

6. A beam of I-section has top flange 125 mm × 16 mm, bottom flange 150 mm × 20 mm and web of thickness 12 mm. The total depth of the beam is 250 mm and simply supported over a span of 5 m. The beam is subjected to uniformly distributed load of 50 kN/m over its entire span in addition to a concentrated load 60 kN at its mid-span. Draw the bending stress distribution across the depth of the beam cross-section at a section located 3 m from the left support. [10]

OR

7. A steel beam of depth 250 mm has cross-section as shown in Figure 4. The beam section is subjected to a shear force of 150 kN. Draw the shear stress distribution across the depth of the section. Also determine ratio of maximum shear stress to the mean shear stress. [10]

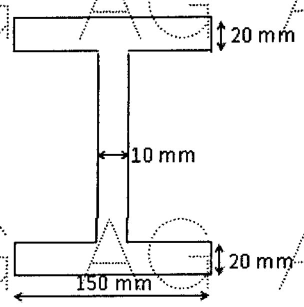

Figure 4

8. Determine the maximum deflection and the slopes at the supports of a beam supported and loaded as shown in Figure 5. [10]

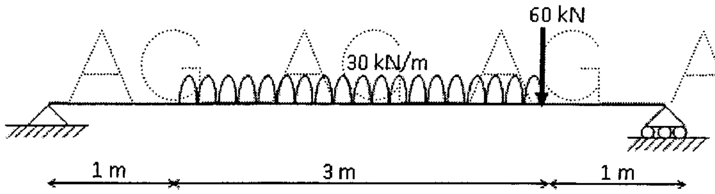

Figure 5

OR

9. Using the conjugate beam method, determine the maximum deflection and the slope at the free end of a beam supported and loaded as shown in Figure 6. [10]

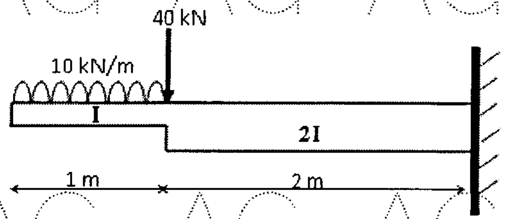

Figure 6

10. The state of stress at a point of a loaded member is shown in Figure 7, using the Mohr's circle of stresses, determine the
a) Stresses acting on a plane making an angle 30^0 with respect to horizontal in clock-wise direction
b) Magnitude of the maximum shear stress and
c) Magnitude and the direction of principal stresses. [10]

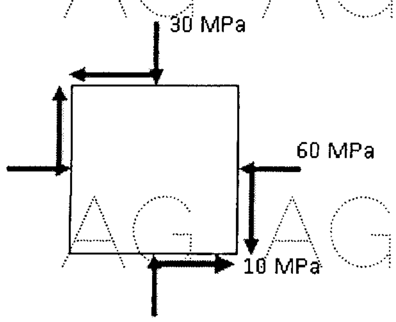

Figure 7

OR

11. Explain the following theories of failure:
a) Maximum principal stress theory and
b) Von-Mises theory. [5+5]

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