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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Mechanical Engineering

Semester End Examination; June - 2017

Mechanics of Materials

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Any missing data may be assumed suitably.

UNIT - I

1 a. Explain Saint Versant's principle. 4

b. Explain resilience with the help of stress-strain diagram and write the equation for it. 4

c. A bar of uniform cross section is attached rigidly as shown in Fig. Q1(c). If Young's modulus of the material is 200 GPa, determine the reactions at the ends. If the dia of the bar is 25 mm. Determine the stress in each portion of the bar. 12

2 a. Derive an expression relating modulus of elasticity and modulus of rigidity. 10

b. Determine the change in volume in the rectangular bar shown in Fig. Q2(b), if $E = 2x10^5$ N/mm^2 and $\mu = 0.3$. 10

UNIT - II

3 a. Derive expression for normal and tangential stresses acting on any plane in a general biaxial stress element. 12

b. Determine the resultant stress acting on plane AC shown in Fig. Q3(b). 8

4. Determine principal stresses, maximum shear stress and their planes analytically and using Mohr's Circle, for the element shown in Fig. Q4. 20

UNIT - III

5 a. Derive the expression relating load intensity shear force and bending moment. 6

b. The simply supported beam AD is subjected to loading as shown in Fig. Q5(b). Draw SFD and BMD for the beam. Also determine the location and magnitude of maximum bending moment. 14

6. Draw SFD and BMD for the beam shown in Fig. Q6. Determine maximum bending moment and locate points of contra flexure. 20

UNIT - IV

7. A simply supported beam of I-Section as shown in Fig. Q7 is subjected to a point load of 80 kN at the midpoint of the beam. The length of the beam is 8 m. Determine the values of maximum bending stress and shear stresses in the beam. 20

Contd….2

8. A simply supported beam of 6 m span is subjected to a concentrated load of 18 kN at 4 m from left support. Calculate;
   (i) Position and value of maximum deflection
   (ii) Slope at mid span
   (iii) Deflection at the load point.
   Assume E = 200 GPa; I = $15x10^6 mm^{4.}$ 20

UNIT - V

9 a. Derive torsion equation relating torsional shear stress, regidity modulus and applied torque. 10

b. Derive Euler's equation for buckling load of a column hinged at both ends. 10

10 a. A hollow shaft transmits 200 kW of power at 150 rpm. The total angle of twist in a length of 5m is 3º. Find the inner and outer diameters of the shaft of the permissible shear stress is 60 MPa and modulus of rigidity is 80 GPa. 8

b. A hollow cylinder 4.5m long, with outside diameter of 200 mm and thickness 20 mm is fixed at both ends. Calculate the safe load by Rankine's formula using a factor of safety of 2.5. Also find the ratio of Euler's to Rankine's loads. Take E = $1x10^5$ N/mm^2, Rankine's constant = 1/6000 and crushing strength of 550 N/mm^2. 12

Contd….3

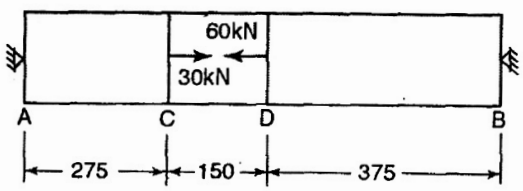


Fig.Q1(c)

All dimensions are in mm

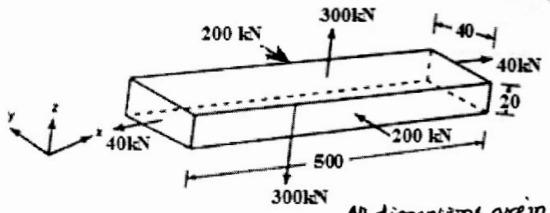


Fig.Q2(b) All dimensions are in mm

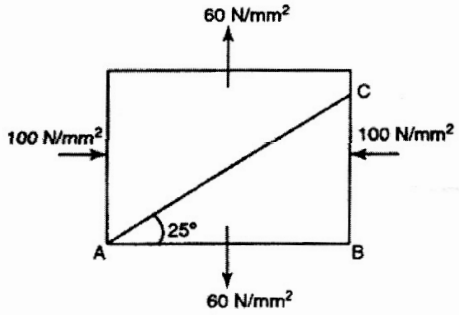


Fig.Q3(b)

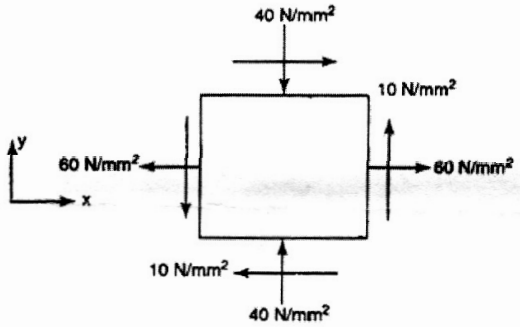


Fig.Q.4

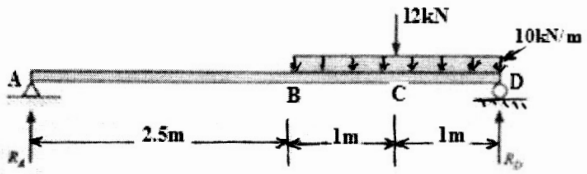


Fig.Q.5(b)

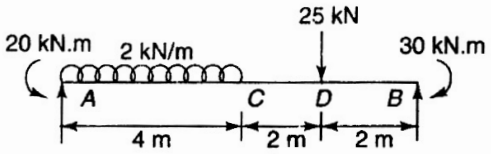
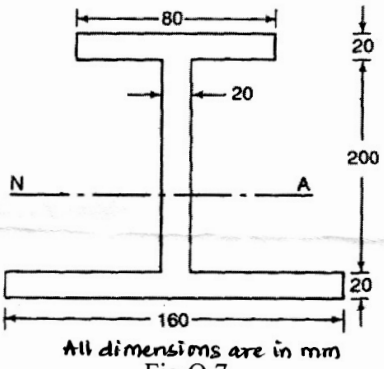


Fig.Q.6



All dimensions are in mm

Fig.Q.7

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