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

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Civil Engineering

Semester End Examination; Dec - 2017/Jan - 2018

Strength of Materials

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Draw the stress-strain curve for mild steel specimen subjected to axial tension and indicate the salient points. 6

b. Derive an expression for the deformation of a uniformly varying circular bar subjected to an axial force P. 6

c. Determine the magnitude of load P necessary to produce no change in the length of the bar. Take C/s area = 400 mm^2 and E = $2x10^5$ MPa. 8

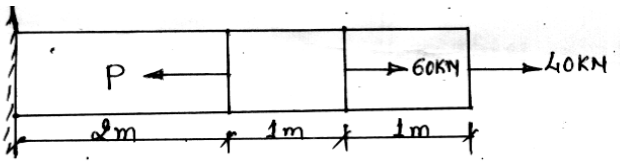

Fig 1(c)

2 a. Derive the relationship between modulus of rigidity (shear modulus) and modulus of elasticity. 6

b. For a given material E = $1x10^5$ N/mm^2 and modulus of rigidity C = $0.4x10^5$ N/mm^2. Find the bulk modulus and lateral contraction of round bar of 50 mm dia and 2.5 m long when stretched to 2.5 mm. 6

c. A bar of brass 25 mm dia enclosed in a steel tube 50 mm external dia and 25 mm internal dia. The bar and the tube are rigidly connected at both ends and are initially 1000 mm long. Determine the stress in both the materials when the temperature is raised by 100ºC. Take $E_S = 2x10^5$ N/mm^2, $E_b = 1x10^5 mm^2$, $\alpha_s = 18.7x10^{-6}$/ºC and $\alpha_b = 11.6x10^{-6}$/ºC. 8

UNIT - II

3 a. What are principal stresses and principal planes? 4

b. Explain the construction of Mohr's circle for compound stress in two-dimensional system. 8

c. A rectangular block of material is subjected to a tensile stress of 110 N/mm^2 on one plane and the tensile stress of 47 N/mm^2 on the plane at right angle to the former. Each of the above stresses is accompanied by a shear stress of 63 N/mm^2 and associated with the former tensile stress tends to rotate the anticlockwise. Find; 8

i) The direction and magnitude of each of the principal stress

ii) Magnitude of the greatest shear stress.

Contd…2

4 a. Derive the expression for circumferential stress for the thin cylinder. 5

b. A Boiler shell is to made of 15 mm thick plate having a limiting tensile stress of 120 N/mm^2. If the efficiencies of the longitudinal and circumferential Joints are 70% and 30% respectively. Determine; 6

i) The maximum permissible diameter of the shell for an internal pressure of 2 N/mm^2

ii) Permissible intensity of internal pressure when the shell diameter is 1.5 m.

c. Derive Lame's equation for hoop stress and radial pressure in a thick cylinder. 9

UNIT - III

5 a. Explain: i) Bending moment ii) Shear force iii) Point of contraflexure. 6

b. Draw SFD and BMD for a cantilever beam of length L subjected to a uniformly distributed load over its entire length. 6

c. A simply supported beam of length 10 m, carries point load of 30 kN and 50 kN at distance of 3 m and 7 m from the left end. Draw the shear force and bending moment diagrams for the beam. 8

6 a. Establish the relationship between intensity of udl, shear force and bending moment. 6

b. Draw SFD and BMD for the beam shown in figure and locate point of contra flexure. 14

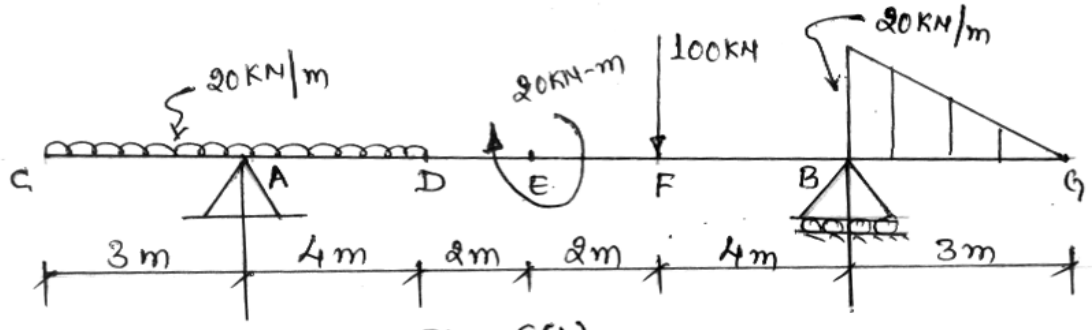

Fig. 6(b)

UNIT - IV

7 a. Explain: i) Pure bending ii) Neutral axis
iii) Section modulus iv) Moment of resistance. 6

b. State the assumptions made in the theory of pure bending. 4

c. A Rolled steel joist of symmetrical I section has the following dimensions :
Flanges: 250 mm wide and 24 mm thick; Web: 12 mm thick; Overall depth: 600 mm
If this beam carries a uniformly distributed load of 50 kN/m run on a span of 8 m, calculate the maximum stress produced due to bending. 10

8 a. Show that maximum shear stress is 1.5 times the average shear stress for a rectangular section. 6

b. Find the ratio between Q_{Max} and Q_{avg}. 4

Contd…3

c. Draw shear stress distribution for a beam of I-section shown in figure and calculate the ratio of maximum and average shear stress. 10

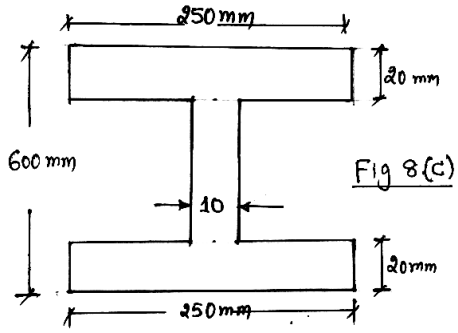

Fig 8(c)

UNIT - V

9 a. Define: i) Stiffness ii) Elastic line. 4

b. Derive the differential equation for deflection curve. 6

c. A Simply supported beam has a span of 6m. It carries two concentrated load of 40 kN and 10 kN at a distance of 2 m and 4 m from left support. Find the deflection under 40 kN load, the position and magnitude of maximum deflection. E= 200 GPa and I = 40×10^{-6} m^4. 10

10 a. Derive an expression for torsion for a circular shaft of length L and torque T. 10

b. Calculate the dimensions of a hallow shaft to transmit 60 kW at a speed of 120 rpm. The maximum torque being 1.12 times the mean torque. The internal dia of shaft is 60% outside. The greater intensity of the shear stress is limited to 28 MPa. 10

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