SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL No: | | | | | | | | | | | | Total number of pages:[3]

May 2018
Reppear.
2.11 Batch onwards

B. Tech. || ME || 3rd Semester
Strength of Materials-I
Subject Code: BTME-301A / 301
Paper ID:

Time allowed: 3 Hrs **Max Marks: 60**

Important Instructions:

- **All questions are compulsory**
- **Assume any missing data**

PART A (10×2marks)

Q1. Answer in brief:.

(a) What do you mean by Poisson' ratio?

(b) What do you understand by Volumetric Strain?

(c) What do you mean by Polar Modulus?

(d) Describe Principal Stress and Principal Plane.

(e) What do you understand by Point of Contraflexure? Show with neat diagram.

(f) Calculate the length of a steel wire hanging under its own weight. The allowable stress is $300MPa$ and specific weight of steel is $100kN/m^3$.

(g) What are the end conditions of a column?

(h) For an element under a biaxial state of stress $\sigma_x = -\sigma_y$ in the xy plane and $\tau_{xy} = 0$. Calculate the radius of the Mohr's circle.

(i) What are the boundary conditions for a cantilever in double integration method?

(j) Draw Stress-Strain diagram for ductile and brittle materials by indicating all the important points.

Section B (5×8 marks)

Q2. Derive an expression for deflection of vertical bar of length "L", area of cross section "A", subjected to axial load "P".

OR

A steel beam $150mm$ wide, $16mm$ thick and $6000mm$ long caries a pull of $300\ kN$ along its length. Find extension in length, contraction in width and thickness under the pull. The Poisson's ratio is 0.3 and $E = 200GPa$. (CO1)

Q3. A solid shaft transmits 120 kW of power at 350 rpm. If the allowable shear stress in the material of the shaft is 80 MPa and the allowable twist is 2° in a length of $5m$. Determine, the diameter of the shaft. Take Modulus of rigidity, $G = 80\ GPa$.

OR

State the assumptions made in deriving the Bending Formula. Also Derive the Bending Formula for a straight beam under pure bending *i.e.* $\frac{\sigma_{max}}{y_{max}} = \frac{M}{I} = \frac{E}{R}$.

(CO2)

Q4. A beam AB of $5m$ span is simply supported at the ends and is loaded as shown in Figure No.1. Determine the maximum deflection in the beam using Macaulay's Method. Take $E = 210 \times 10^6\ kN/m^2$ and $I = 20 \times 10^{-6}\ m^4$.

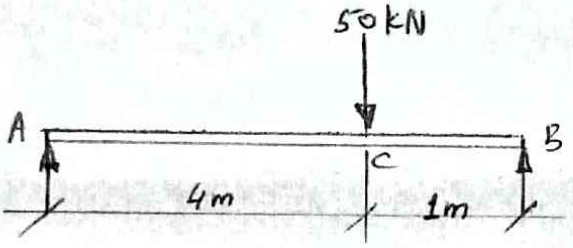

Figure No. 1

OR

Construct the shear force diagram and bending moment diagram for the simply supported beam as shown in Figure no.2. The beam is subjected to uniformly distributed load of intensity $w = 2kN/m$ on the length of $1m$ from each end.

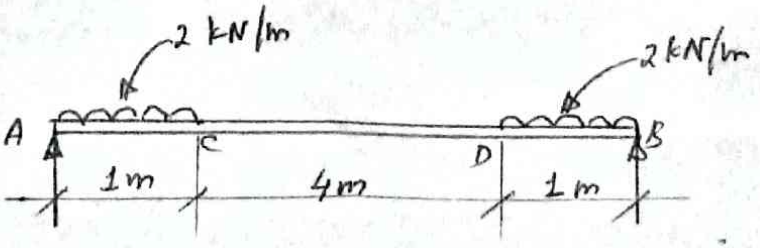

Figure No. 2

(CO3)

Q5. The state of stress at a point in a material is, $\sigma_x = 20MPa$; $\sigma_y = 10MPa$; $\tau_{xy} = 15MPa$. Using Mohr's circle of stress, determine the magnitude of principal stresses in the

material. Also find out the maximum shearing stress and associated normal stress. Show the results on properly oriented elements.

OR

At a point on a stressed body the normal stresses are $80MPa$ (tensile) on $40MPa$ (compressive). A shearing stress of 40 MPa also acts at this point. Determine analytically, the Principal stresses, Principal Planes, and maximum shearing stress and associated normal stress, planes of maximum shearing stress. Also show the results on properly oriented elements.

(CO4)

Q6. Derive an expression for the buckling load for a pin end column, according to Euler's theory. State the assumptions made in deriving this formula.

OR

A pin end tubular strut of outer diameter $50mm$ and inner diameter 40 mm respectively, is $2m$ long. Compare the buckling loads given by Euler's and Rankine's formula. Take crushing strength of column material as 300 MPa, Rankine's constant = 1/7500 and $E = 200\ GPa$.

(CO5)

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