Roll No .....

CE/FT - 303

B.E. III Semester Examination, December 2014

Strength of Materials

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each question are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

1. a) Explain the difference between upper yield point and lower yield point.

   b) Define principal planes and principal stress.

   c) Derive relationship among E, G, and M.

   d) A steel tie rod of diameter 20 mm is encased in a copper tube of external diameter 36mm and internal diameter 24 mm with the help of Washer's and nuts. The nut on the tie rod is tightened so on to produce a tensile stress of 50 N/mm^2 in steel rod. Now the combination is subjected to a temperature rise of 80°C. Determine the resultant stresses developed in the rod and the tube take

$$\alpha_s = 11\times10^{-6}/_{\circ C}, \alpha_\omega = 18\times10^{-6}/_{\circ C}, E_s = 2E_\omega = 210GPa$$

OR

A copper bar of 200 mm long with section 50 × 50mm is subjected to stresses of +20 N/mm^2 along the axis and –40 and +40 N/mm^2 along sides. The increase in volume was observed to be 183 mm^3. Determine the value of Poisson's ratio, modulus of rigidity and bulk modulus if E = 105 GPa.

2. a) What is neutral layer? Why stress and strain are zero in the neutral layer?

   b) What is a conjugate beam? How reactions at ends give the slope at ends of the beam.

   c) A rectangular section of a beam is subjected to a bending moment 'm' and a shear force 'F'. Why bending stresses are maximum at extreme layer while shear stress is zero at these layers.

   d) A C.I. beam of unequal I-section with top flange 150 mm × 10 mm bottom flange 200 mm × 14 mm and web 275mm × 10 mm is supported on a cantilever of length 3m. What load can be applied at the free end of the cantilever if the tensile stress in the section is limited to 80 N/mm^2. The top flange of the beam comes under tension?

OR

A beam 6m long is simply supported at ends carries a U.D.L. of 4 kN/m throughout its length. Draw B.M. diagram of the beam using conjugate beam method determine the slope at the ends and deflection in the centre EI is the flexural rigidity of the beam EI. = 10500 kN m^2.

3. a) Give assumptions made in theory of torsion.

   b) Why is a thin cylinder wire wound.

   c) Write a note on leaf springs.

   d) A solid shaft of 100 mm diameter, 2 m long is subjected to a torque of 8000 N-m calculate the maximum shear stress and angle of twist. If the central 1m length of the shaft in reduced to 60 mm diameter and same torque applied. What would be the change in shear stress and angle of twist.

OR

For a close coiled helical spring with stiffness 10 N/mm and length of spring coil touching 400 mm determine

i) Mean coil diameter and wire diameter if this ratio D/d = 10.

ii) If gap between two adjacent coils is 2 mm find maximum load and corresponding maximum shear stress in spring wire when coil touching each other take $G = 8 \times 10^4$ N/mm^2

4. a) What are the reasons of unsymmetrical bending?

   b) Reference to a curved beam theory the radial stress is zero why?

   c) What do you understand by shear centre?

   d) A chain link is made of round steel rod diameter 12 mm. If R = 40 mm and l = 60 mm determine the extreme stresses along the introdus. If the link is subjected to a tensile load of 1 kN.

OR

Consider a rectangular section of 6 cm width and 12 cm depth determine I_{xx}, I_{yy} and I_{xy} about X-X and y-y axis inclined at an angle of 45° to the principal axis.

5. a) What do you mean by equivalent length of column?

   b) Define crippling load.

   c) What are the merits of Rankine's load over Eulers load in buckling?

   d) What are the various end conditions for a column? Write formula for Euler's critical load for each condition.

OR

What is Rankine's formula for column? Explain its application to long and short columns.

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