No. of Printed Pages : 4

ET-502(A)

B.Tech. Civil (Construction Management)/ B.Tech. Civil (Water Resources Engineering)

Term-End Examination

00053

June, 2018

ET-502(A) : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted. Assume any missing data suitably.*

1. (a) What do you mean by the term "point of contraflexure" in a beam ?

(b) A 2 m steel bar of diameter 15 mm is subjected to an axial pull of 50 kN. Calculate the change in length, change in diameter of the bar if the Poisson's ratio is 0·25.

Take E = 200 kN/mm^2. *4+10*

2. (a) What do you understand by "propped cantilever" ?

(b) Draw the shear force and bending moment diagrams for the simply supported beam as shown in Figure 1. *4+10*

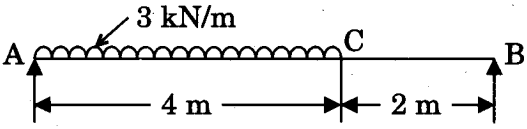

Figure 1

3. (a) Define the following terms :

(i) Principal planes

(ii) Principal stresses

(b) At a point in a strained material, the principal stresses are 100 N/mm^2 (tensile) and 60 N/mm^2 (compressive). Determine the normal stress, shear stress and resultant stress on a plane inclined at 50° to the axis of major principal stress. Also determine the maximum shear stress at that point. *4+10*

4. (a) What do you mean by "simple bending" or "pure bending" ? What are the assumptions made in the theory of simple bending ?

(b) A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress.

Take E = 200 kN/mm^2. *4+10*

5. (a) Show that for a rectangular section of the maximum shear, stress is 1·5 times the average stress.

(b) A rectangular beam 100 mm wide and 150 mm deep is subjected to a shear force of 30 kN.

Determine :

(i) Average shear stress

(ii) Maximum shear stress *4+10*

6. (a) Define the following terms :

(i) Resilience

(ii) Strain energy

(iii) Impact loading

(iv) Spring

(b) A tensile load of 50 kN is gradually applied to a circular bar of 5 cm diameter and 4 m length. If the value of E = 200 kN/mm^2, determine :

(i) Stretch in the rod,

(ii) Stress in the rod, and

(iii) Strain energy absorbed by the rod. *4+10*

7. (a) A rod is 2 m long at a temperature of 10°C. Find the expansion of the rod, when the temperature is raised to 80°C. If this expansion is prevented, find the stress induced in the material of the rod.

Take $E = 1{\cdot}0 \times 10^5$ MN/m^2 and $\alpha = 0{\cdot}000012$ per degree Centigrade.

(b) A solid shaft of 20 cm diameter is used to transmit torque. Find the maximum torque transmitted by the shaft if the maximum shear stress induced in the shaft is 50 N/mm^2. 7+7

8. (a) A leaf spring carries a central load of 3000 N. The leaf spring is to be made of 10 steel plates 5 cm wide and 6 mm thick. If the bending stress is limited to 150 N/mm^2, determine :

(i) Length of spring, and

(ii) Deflection at the centre of the spring.

Take $E = 2 \times 10^5$ N/mm^2.

(b) A cylindrical pipe of diameter 2·0 m and thickness 2·0 cm is subjected to an internal fluid pressure of 1·5 N/mm^2.

Determine :

(i) Longitudinal stress, and

(ii) Circumferential stress developed in the pipe material. 7+7
