No. of Printed Pages : 4

ET-502(A)

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

Term-End Examination

00870

June, 2016

ET-502(A) : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Describe Hooke's law in the context of mild steel. 4

   (b) Two parallel walls are stayed together by a steel rod of 5 cm diameter passing through metal plates and nuts at both ends. The nuts are tightened when the rod is at 150°C, to keep the walls 10 m apart. Determine the stresses in the rod when the temperature falls down to 50°C if

   (i) the ends do not yield, and

   (ii) the ends yield by 1 cm.

   Take Young's modulus (E) and coefficient of thermal expansion (α) of the rod material as 2×10^5 N/mm^2 and 12×10^{-60} K^{-1} respectively. 10

2. (a) What do you understand by 'Poisson's ratio' ? Explain briefly. *4*

(b) In separate experiments, Young's modulus and Rigidity modulus of a material have been determined as 120 GPa and 50 GPa respectively. Calculate the Poisson's ratio and Bulk modulus of the material. *10*

3. (a) What is meant by the term 'Principal stress' ? Discuss briefly. *4*

(b) The state of stress at a critical point of a strained solid is given by $\sigma_x = 70$ kN/mm^2, $\sigma_y = -50$ kN/mm^2 and $\tau_{xy} = 45$ kN/mm^2. If the strengths of the solid in tension, compression and shear are 120 kN/mm^2, 90 kN/mm^2 and 75 kN/mm^2 respectively, verify the safety of the strained solid. *10*

4. (a) Draw neat sketches of different types of supports and show various possible reactions in each type of support for a plane beam structure. *4*

(b) Draw the shear force and bending moment diagrams for an overhanging beam shown in Figure 1.

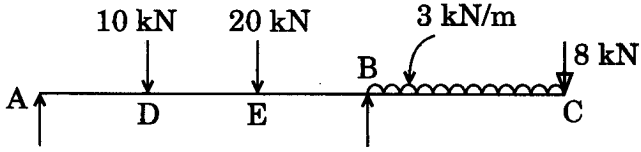


Figure 1

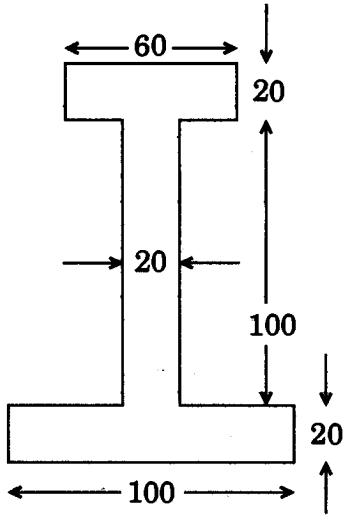
Distances AD, DE, EB and BC are 2 m, 2 m, 2 m and 4 m respectively. *10*

5. (a) What is the relationship between shear force and bending moment in flexure ? Explain briefly. *4*

(b) A timber beam, 150 mm wide and 300 mm deep, is simply supported over a span of 4 m. Find the maximum uniformly distributed load that the beam can carry, if the stress is not to exceed 8 N/mm^2. The UDL is to be applied over full length of the beam. *10*

6. (a) What is meant by 'Section Modulus' of a beam ? Explain with the help of an expression. *4*

(b) An I-section, shown in Figure 2, is subjected to a bending moment of 2·5 kNm at its neutral axis. Find the maximum stress developed in the beam section. *10*



(all dimensions are in mm)

Figure 2

7. (a) Show a pattern of shear stress distribution in a rectangular beam section. *4*

(b) Find the torque which a shaft of 250 mm diameter can safely transmit, if the shear is not to exceed 460 N/mm^2. *10*

8. Write short notes on any ***two*** of the following : *2×7=14*

(a) Euler's critical load for a column

(b) Stiffness of springs connected in series and parallel

(c) Composite section