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ET-502(A)

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

Term-End Examination

00183 **December, 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) Explain with the help of neat sketches, various types of supports in beams.

(b) A 3 m solid rectangular bar of cross-section 10 mm × 15 mm is subjected to a compressive force of 150 kN. What is the change in length of the bar ? Also find the strain and stress produced in the bar.

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

2. (a) Briefly explain with neat sketches the various types of loads acting on a beam.

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

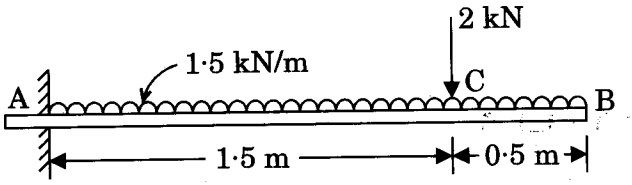

Figure 1

3. (a) Define and explain the following terms :

Longitudinal strain, Lateral strain, and Poisson's ratio.

(b) The tensile stresses at a point across two mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2. Determine the normal, tangential and resultant stresses on a plane inclined at 30° to the axis of the minor stress. *4+10*

4. (a) Define the terms : bending stress in a beam, neutral axis and section modulus.

(b) A simple steel beam of 4 m span carries a uniformly distributed load of 6 kN/m over its entire span and a point load 2 kN at its centre. If the permissible stress does not exceed 100 MPa, find the cross-section of the beam assuming depth to be twice of breadth. *4+10*

5. (a) Prove that the maximum shear stress in a circular section of a beam is $\frac{4}{3}$ times the average shear stress.

(b) A rectangular beam 100 mm wide is subjected to a maximum shear force of 100 kN. Find the depth of the beam if the maximum shear stress is 6 N/mm^2. 7+7

6. (a) Find an expression for the strain energy stored in a body when the load is applied suddenly.

(b) A tensile load of 50 kN is applied suddenly to a circular bar of 5 cm diameter and 4 m long. If the value of E = 2·0 × 10^5 N/mm^2, determine :

(i) maximum instantaneous stress induced,

(ii) instantaneous elongation in the rod, and

(iii) strain energy absorbed in the rod. 7+7

7. (a) A rod is 3 m long at a temperature of 15°C. Find the expansion of the rod, when the temperature is raised to 95°C. If this expansion is prevented, find the stress induced in the material of the rod. Take E = 1 × 10^5 N/mm^2 and α = 0·000012 per degree Centigrade.

(b) Find the maximum shear stress induced in a solid circular shaft of diameter 20 cm when the shaft transmits 187·5 kW at 200 rpm. 7+7

8. (a) A vessel in the shape of a spherical shell of 1·4 m internal diameter and 4·5 mm thickness is subjected to a pressure of 1·8 N/mm^2. Determine the stress induced in the material of the vessel.

(b) A leaf spring carries a central load of 2·5 kN. The leaf spring is to be made of 10 steel plates 6 cm wide and 5 mm thick. If the bending stress is limited to 100 N/mm^2, determine :

(i) length of the spring, and

(ii) deflection at the centre of the spring.

Take E = 200 kN/mm^2. 7+7