JAYA GROUPS OF INSTITUTION- Thiruninravur

4^{th} Sem – B.E

INTERNAL ASSESMENT III (MODEL EXAMINATION III)

Sub. Title : **SOLID MECHANICS**
Sub. Code : **CE 6452**
Duration : **3 Hours**

Date: 09.04.2015
Branch: **TEXTILE ENGG.**
Max. Marks : **100**

Part A (10 X 2 = 20) (Answer All Questions)

1. What is bulk modulus?
2. A rod of 30mm and length 40mm was found to elongate 0.35mm when it was subjected to a load of 65kN. Compute the modulus of elasticity of the rod?
3. Draw the a typical shear force and bending moment of a simply supported beam of span 'L' of carrying a point load 'P' at mid span ?
4. Define point of Contraflexure.
5. Describe Double Integration Method.
6. State Mohr's theorem I and II.
7. Write the pure bending equation and write the torsional equation?
8. Compute the torsional rigidity of 100mm diameter, 4m length shaft, $C = 80\ kN/mm^2$
9. What is slenderness ratio of column?
10. Write the difference between open coil spring and closed coil spring?

PART B (5 X 16 = 80) Answer All Questions

11. a) i) An aluminium cylinder of diameter 60mm located inside a steel cylinder of internal diameter 60mm and wall thickness 15mm. The assembly is subjected to a compressive force of 200kN. What are the forces carried and stresses developed in steel and aluminium? Take Modulus of Elasticity for steel as 200GPa and aluminium as 50GPa. (8 marks)

ii) A solid circular bar of diameter 20mm when subjected to an axial tensile load of 40 kN, the reduction in diameter of the rod was observed as 6.4×10^{-3} mm. The bulk modulus of the material of the bar is 67GPa. Determine the following:

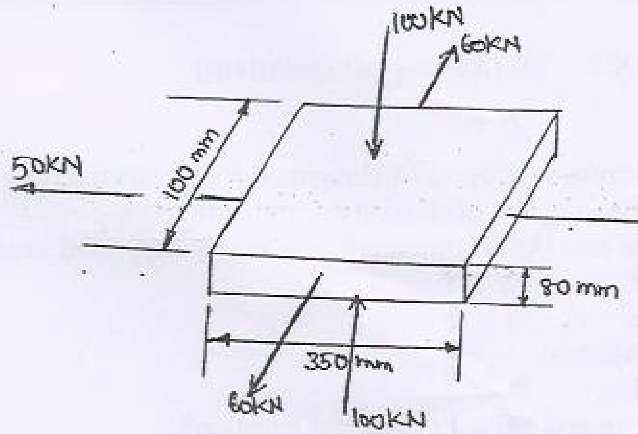
i. Young's Modulus,
ii. Poisson's ratio,
iii. Change in length per metre and
iv. Change in volume of the bar per metre length. (8 marks)

OR

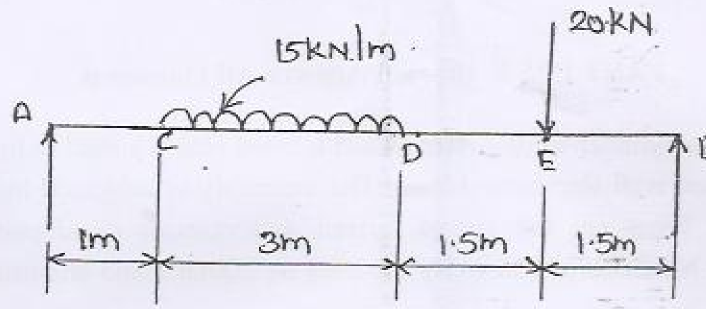
11. b) i) A steel tube of 30mm external diameter and 20mm internal diameter encloses a copper rod of 15mm diameter to which it is rigidly joined at each end. If, at a temperature of 10°C, there is no longitudinal stress. Calculate the stresses in the rod and the tube when the temperature is raised to 200°C. Take E for steel and copper as $2.1 \times 10^5 N/mm^2$ and $1 \times 10^5 N/mm^2$

respectively. The value of coefficient of linear expression for steel and copper is given as $11 x 10^{-6}$ per °C and $18 x 10^{-6}$ per °C respectively. (8 marks)

ii) A rectangular block 350mm long, 100mm wide and 80mm thick is subjected to axial load as follows. 50kN tensile in the direction of length, 100kN compression in the direction of thickness and 60kN tensile in the direction of breadth. Determine the change in volume, bulk modulus, modulus of rigidity. Take E = $2 x 10^5$ N/mm^2 and Poisson's ratio = 0.25. (8 marks)

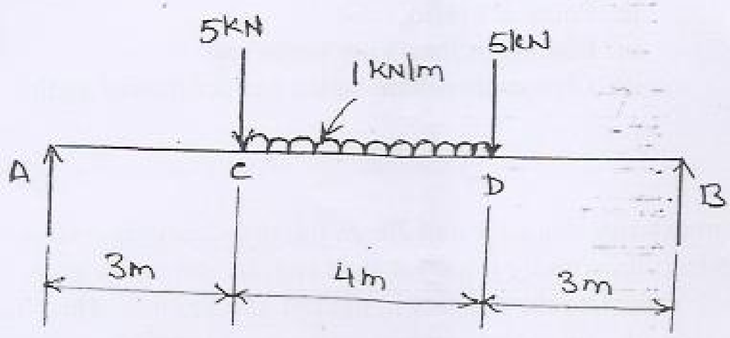


12. a) For the Simply supported Beam loaded as shown on Fig , draw the shear force diagram and bending moment diagram. Also, obtain the maximum bending moment. (16 marks)

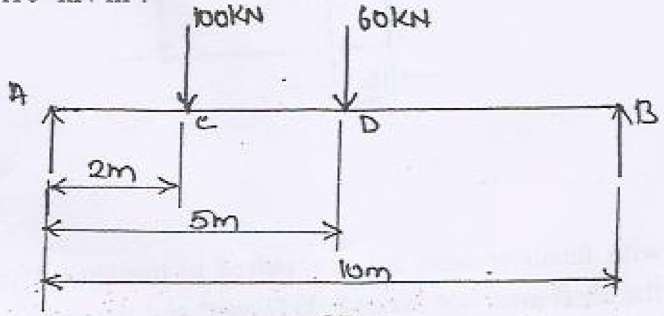


OR

12. b) For beam shown in Fig, draw the shear force diagram and bending moment diagram, Calculate the maximum bending moment. (16 marks)

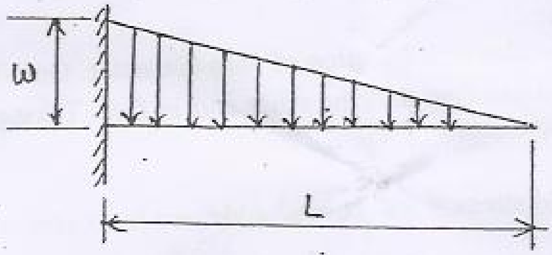


13. a) A beam is simply supported as its ends over a span of 10m and carries two concentrated loads of 100kN and 60kN at a distance of 2m and 5m respectively from the left support. Calculate (i) slope at the left support: (ii) slope and deflection under the 100kN load. Assume EI = 36×10^4 kN-m^2. (16 marks)



OR

13. b) i) Find the slope and deflection at the free end of the cantilever beam carrying uniformly varying load by double integration method. (10 marks)



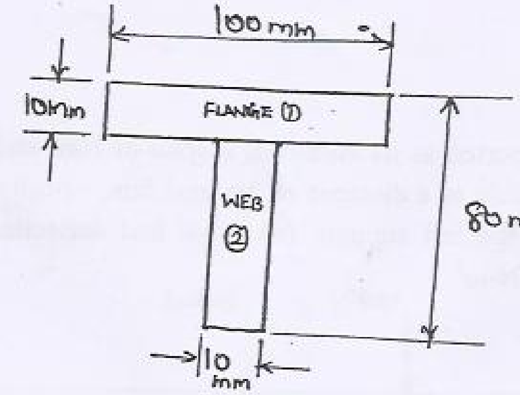
ii) Calculate the slope and deflection by moment area method for a cantilever beam carrying uniformly distributed load of 8kN/m for the full span of 4m. (6 marks)

14. a) A timber beam of rectangular section is to support load of 20kN uniformly distributed over a span of 3.6 m, when the beam is simply supported. If the depth of the section is to be twice the breadth and the stress in the timber is not exceed 7 N/mm^2, find the breadth and depth of the cross section. How will you modify the cross-section of the beam, if it carries a concentrated load of 30kN placed at the mid-span with the same ratio of breadth to depth. (16 marks)

OR

14. b) A T-section of a beam has the following dimensions. Width of the flange 100mm, overall depth 80mm, thickness of the web 10mm, thickness of flange 10mm. Determine the maximum bending stress in the beam, when a bending moment of 200 N-m is acting on the section. (16 marks)

23



15. a) A hollow shaft with diameter ratio 3/5 is required to transmit 450kW at 120 rpm. The shearing stress in the shaft must not exceed 60 N/mm^2 and the twist in a length of 2.5 m is not exceed 1°. Calculate the minimum external diameter of the shaft, C = 80 kN/mm^2.

(16 marks)

OR

15. b) A 1.5 m long column has a circular cross-section of 5cm diameter. One of the ends of the column is fixed in direction and position and the other end is free. Taking factor of safety as 3, calculate the safe load using:

i) Rankin's formula, take yield stress = 560 N/mm^2 and Rankine's constant a = 1/1600.

ii) Euler's formula, Elastic modulus = 1.2 x 10^5 N/mm^2.

(16 marks)