Code: 15A01308 **R15**

B.Tech II Year I Semester (R15) Supplementary Examinations June 2017

MECHANICS OF SOLIDS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is Hooke's law?

(b) What is working stress and factor of safety?

(c) What is the significance of shear force & bending moment diagram?

(d) How does the mending moment diagram vary on application of point load and uniformly distributed load?

(e) Define section modulus.

(f) Define shear centre.

(g) Write the assumptions in the theory of pure torsion.

(h) Write the relation between slope deflection and radius of curvature of a beam.

(i) What is longitudinal stress for a thin cylinder?

(j) What is the significance of Lame's equation?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Show that minor principal stress is equal to zero.

(b) A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm 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 tube when the temperature is raised to 200°C. Take E for steel and copper as 2.1 x 10^5 N/mm^2 and 1 x 10^5 N/mm^2 respectively. The value of co-efficient of linear expansion for steel and copper is given as 11 x 10^{-6} per °C and 18 x 10^{-6} per °C respectively.

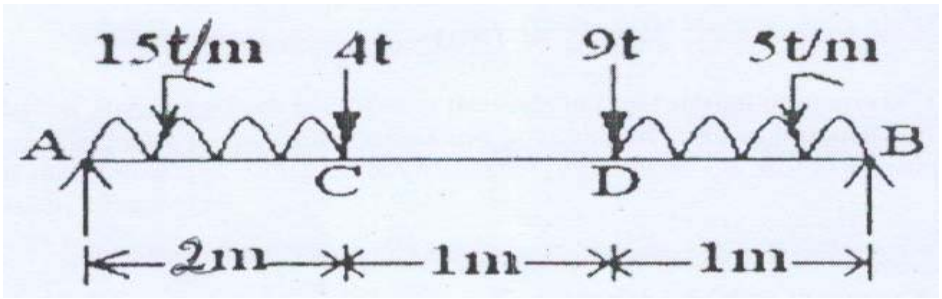
OR

3 (a) At a certain point in a strained material the principal stresses are 100 N/mm^2 and 40 N/mm^2 both are tensile. Find the normal, tangential and resultant stresses across a plane through the point at 48° to the major principal plane, using Mohr's circle of stress.

(b) Explain Mohr's circle for the general case of plane stress.

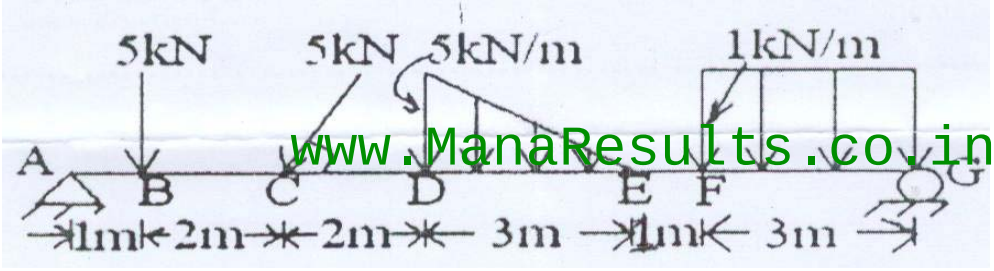
UNIT – II

4 Explain point of contraflexure. Also draw S.F.D and B.M.D.



OR

5 Find the shear force at the supports of the beam given below.



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UNIT – III

6 (a) What are the assumptions made in bending theory?

(b) A cast iron pipe has 300 mm bore and 10 mm metal thickness and is supported at two points 8 m apart. Find the maximum stress in the metal when it is running full. Take unit weight of cast iron as 70 kN/m^3 and that of water as 9.81 kN/m^3.

OR

7 (a) Derive shear stress distribution in a beam of rectangular section.

(b) A simply supported beam of span 3 m and c/s 150 x 250 mm carries a u.d.l. of 5 kN/m over entire span. Find maximum intensity of shear stress in beam at a section at 0.75 m from any of the support.

UNIT – IV

8 A solid steel shaft is subjected to a torque of 45 kNm. If the angle of twist is 0.5° per meter length of the shaft and the shear stress is not to be allowed to exceed 80 N/mm^2, find suitable diameter of shaft, maximum induced shear stress and angle of twist. Also find the maximum shear strain in the shaft. Take N = 8 x 10^4 N/mm^2.

OR

9 A horizontal beam AB is simply supported at A and B, 6 m apart. The beam is subjected to a clock wise couple of 300 kNm at a distance of 4 m from the left end. If E = 2 x 10^5 N/mm^2.and I = 2 x 10^8 mm^4. Determine: (i) Deflection at the point where couple is acting. (ii) Maximum deflection.

UNIT – V

10 A cylindrical shell 3 m long which is closed at the ends has an internal diameter of 1m and a wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and also change in the dimensions of the shell if it is subjected to an internal pressure of 1.5 MN/m^2. Take: E = 200 GN/m^2, arid Poisson's ratio 0.3.

OR

11 A thick steel cylinder closed at the ends has its outer diameter 1.5 times the inner diameter and is subjected to internal pressure only. Another cylinder having the same dimensions is subjected to an external pressure only. Determine the ratio of these pressures if:

(i) The maximum hoop stress has the same numerical value.

(ii) The maximum hoop strain has the same numerical value.

(iii) Poisson's ratio is 0.3.

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