Code: 13A01308

R13

B.Tech II Year I Semester (R13) Supplementary Examinations November/December 2016

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)

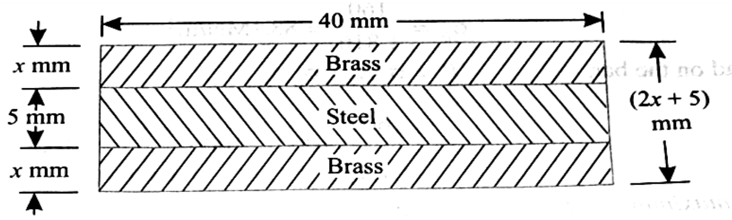
- (a) Define Poisson's ratio.
- (b) Define Principal plane.
- (c) Define point of contraflexure.
- (d) Draw the shear force and bending moment diagram for cantilever subjected to concentrated load at free end.
- (e) What is meant by beam of uniform strength?
- (f) Draw the shear stress distribution diagram for 'T' section.
- (g) What are the assumptions made in torsion equation in case of pure torsion?
- (h) Write the expression for slope and maximum deflection when the cantilever beam is subjected to concentrated load at free end.
- (i) Define volumetric strain.
- (j) Mention the assumptions made in Lame's theory in case of thick cylinder.

PART – B

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

UNIT – I

2 A compound bar consists of a central steel strip 40 mm wide and 5 mm thick placed between two strips of brass each 40 mm wide and x mm thick. The strips are firmly fixed together to form a compound bar of rectangular section 40 mm wide and (2x + 5mm) thick. Take: E_s = 207 GN/m^2 and E_b = 114 GN/m^2. Determine: (i) The thickness of the brass strips which will make the apparent modulus of elasticity of the compound bar equal to 160 x 10^3 MN/m^2. (ii) The maximum axial pull the bar can then carry if the stress is not to exceed 160 MN/m^2 in either the brass or the steel.

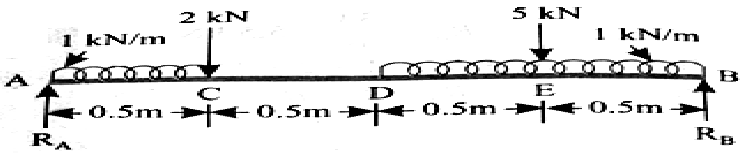


OR

3 The principal tensile stresses at a point across two perpendicular planes are 120 MN/m^2 and 60 MN/m^2. Find: (i) The normal and tangential stresses and the resultant stress and its obliquity on a plane 20° with the major principal plane. (ii) The intensity of stress which acting along can produce the same maximum strain. Take poisson's ratio = 1/4.

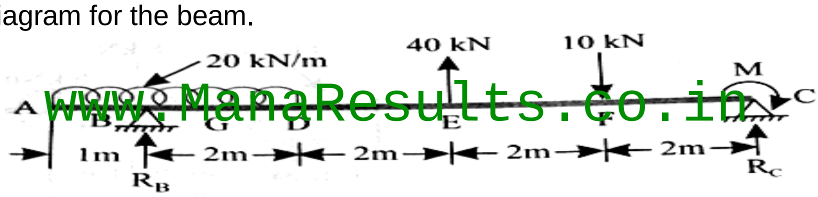
UNIT – II

4 Draw the shear force and bending moment diagram for a simply supported beam shown in figure below. Also calculate the maximum bending moment on the section.



OR

5 A beam ABC is loaded and supported as shown in figure. Find the magnitude of the clockwise moment M to be applied at C so that the reaction at B will be 30 kN upward and then draw the shear force and bending moment diagram for the beam.



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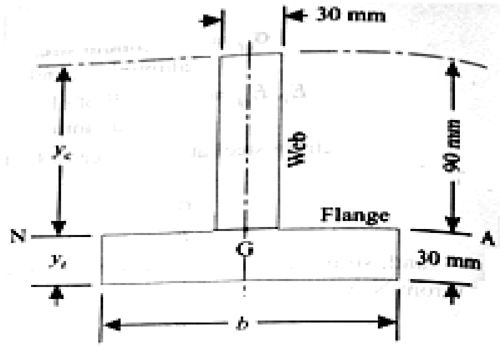
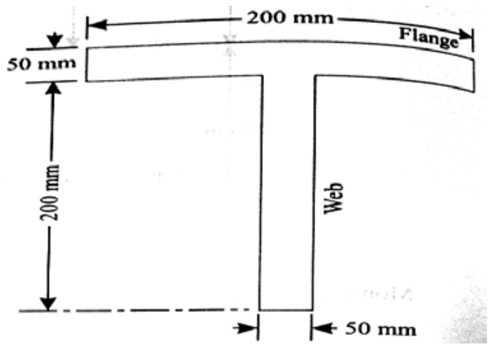
UNIT – III

6 Figure shows a T-beam (120 mm Deep) used as a beam with simply supported ends, so that the flange comes under tension. The material of the beam can be subjected to 75 Mn/m^2 in compression and 25 MN/m^2 in tension. It is desired to achieve a balanced design so that the largest possible bending stresses are reached simultaneously. Find: (i) The width of the flange. (ii) The magnitude of the concentrated load that can be applied to the beam at its centre if the span length is 6 metres.



OR

7 A T-shaped cross section of a beam shown in figure is subjected to a vertical shear force of 100 kN. Calculate the shear stress at the neutral axis and at the junction of the web and the flange. Moment of inertia about the horizontal neutral axis is 0.0001134 m^4.

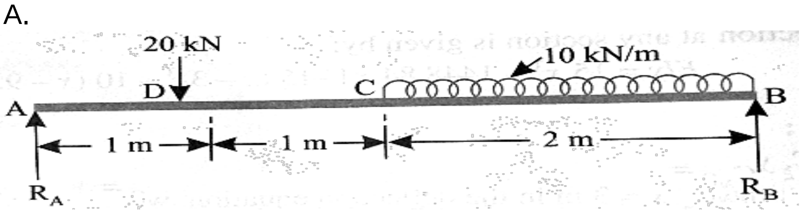


UNIT – IV

8 A hollow steel shaft is made to replace a solid wrought iron shaft of the same external diameter, the material being 35 percent stronger than the iron. Find what fraction of the outside diameter, the internal diameter may be. Also, neglecting the coupling, find the percentage saving in weight by the substitution, assuming that steel is 2 percent heavier than wrought iron.

OR

9 A beam AB of 4 metres span is simply supported at the ends and is loaded as shown in figure. Given: E = 200 x 10^6 kN/m^2, and I = 20 x 10^{-6} m^4. Determine: (i) Deflection at C. (ii) Maximum deflection. (iii) Slope at the end A.



UNIT – V

10 A cylindrical vessel whose ends are closed by means of rigid flange plates is made of steel plate 3 mm thick. The internal length and diameter of vessel are 50 cm and 25 cm respectively. Determine the longitudinal and circumferential stresses in the cylindrical shell due to an internal fluid pressure of 3 MN/m^2. Also calculate increase in length, diameter and volume of the vessel.

OR

11 A thick cylinder of 150 mm outside radius and 100 mm inside radius is subjected to an external pressure of 30 MN/m^2 and internal pressure of 60 MN/m^2. Calculate the maximum shear stress in the material of the cylinder at the inner radius.

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