Code No:A109210304 | R09 | SET-1

B.Tech II Year - I Semester Examinations, May-June, 2012
MECHANICS OF SOLIDS
(COMMON TO AE, AME, MCT, ME, MMT, MIM)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) A tie bar has enlarged ends of square section 60 mm × 60 mm as shown in Fig.1.If the middle portion of the bar is also of square section, find the size and length of the middle portion if the stress there is 140N/mm^2 and the total extension of the bar is 0.14mm.
Take E= 2.0×10^{5}N/mm^2.

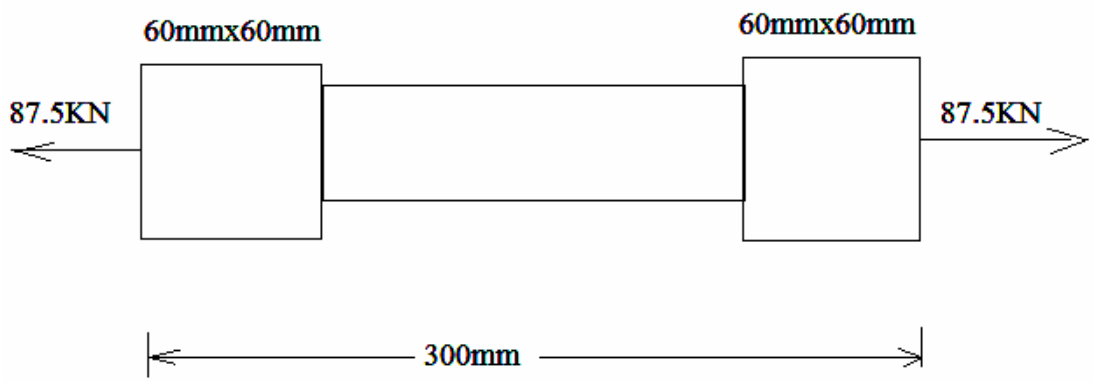

Fig.1

b) A straight bar of steel rectangular in section is 4m long and is 18mm thick. The width of the rod varies uniformly from 130mm at one end 250mm at the other. If the rod is subjected to an axial tensile load of 50KN, find the extension of the rod.
Take E= 2.0×10^{5}N/mm^2. [7+8]

2. Analyse the beam shown in Fig.2. Draw S.F.D, B.M.D and Thrust Diagram. [15]

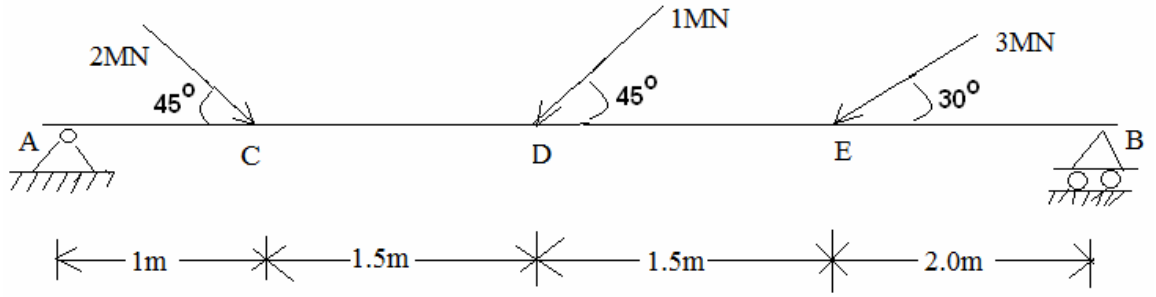

Fig.2

3.a) What do you mean by simple bending or pure bending?
b) What are the assumptions made in the theory of simple bending?
c) Prove the relation M/I =f/y=E/R
Where M=Bending moment, f= Bending stress, E= Young's modulus
I= Moment of Inertia, y= Distance from N.A., and R= Radius of curvature.
[2+5+8]

4. A timber beam of rectangular section is simply supported at the ends and carries a point load at the center of a beam. The maximum bending stress is 12N/mm^2 and maximum shearing stress is 1 N/mm^2, find the ratio of the span to the depth.(Fig.3). [15]

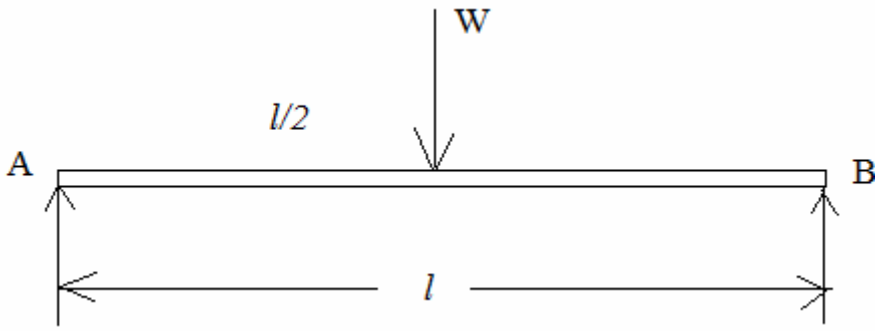

Fig.3

5. Find the forces in the members of the truss shown in Fig.4, using Method of Joints. [15]

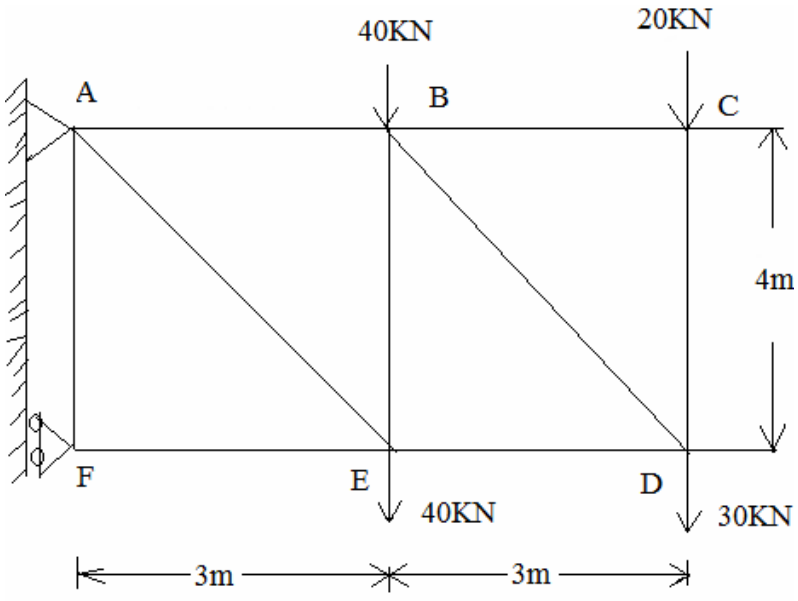

Fig.4

6.a) State Mohr's theorem I and II?

b) Determine the slope and deflection at the free end of a cantilever beam as shown in Fig.5 by moment area method. Take EI=8000KN-m^2. [5+10]

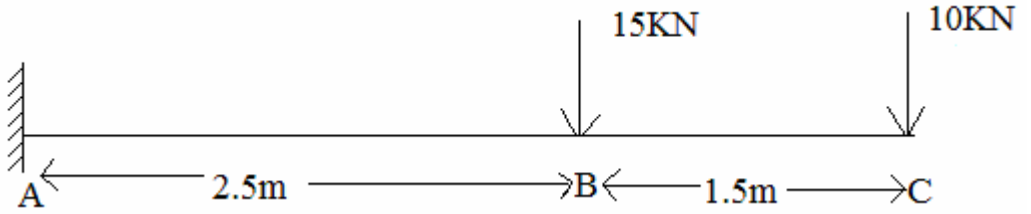

Fig.5

7.a) A thin cylindrical shell with following dimensions is filled with a liquid at atmospheric pressure: length = 1.2m, External diameter=20cm, Thickness of metal=8mm.

Find the value of the pressure exerted by the liquid on the walls of the cylinder and the hoop stress induced if an additional volume of 25 cm^3 of liquid is pumped into the cylinder.
Take $E=2.1\times10^5$ N/mm^2 and Poisson's ratio=0.33.

b) Explain briefly about the effect of internal pressure on the dimensions of a thin cylindrical shell. [10+5]

8.a) What do you mean by Lame's equations? How will you derive these equations?

b) A thick cylinder of internal diameter 160mm is subjected to an internal pressure $40N/mm^2$. If the allowable stress in the material is $120N/mm^2$, find the thickness required. [8+7]

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Code No:A109210304 | R09 | SET-2

B.Tech II Year - I Semester Examinations, May-June, 2012
MECHANICS OF SOLIDS
(COMMON TO AE, AME, MCT, ME, MMT, MIM)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) A rectangular block 250 mm × 100 mm × 80 mm is subjected to axial loads as follows:
i) 480KN tensile in the direction of its length
ii) 900KN tensile on the 250mmx80mm faces
iii) 100KN compressive on the 250mmx100mm faces.
Assuming Poisson's ratio as 0.25, Find in terms of the modulus of Elasticity E of the material, the strains in the direction of each force, If $E=2.0x10^5 N/mm^2$, Find the values of the modulus of rigidity and bulk modulus for the material of the block. Also, calculate the change in the volume of the block due to the applications of the loading specified in Fig.1.

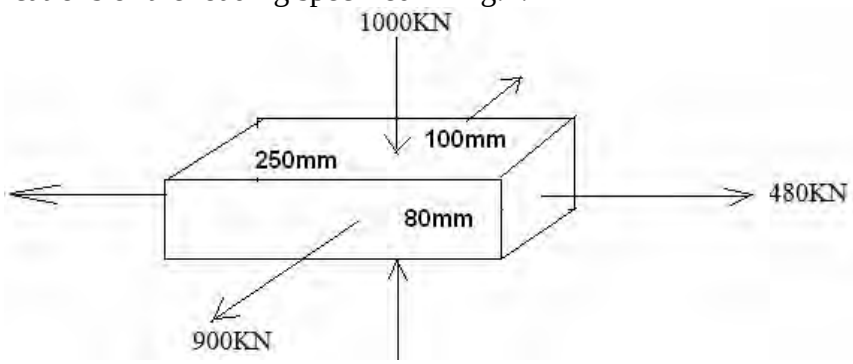

Fig.1

b) A solid conical bar of circular section is suspended vertically as shown inFig.2. If the length of the bar is 'l' and the weight per unit volume of the material of the bar is 'w', determine the total elongation of the bar due to its own weight. [15]

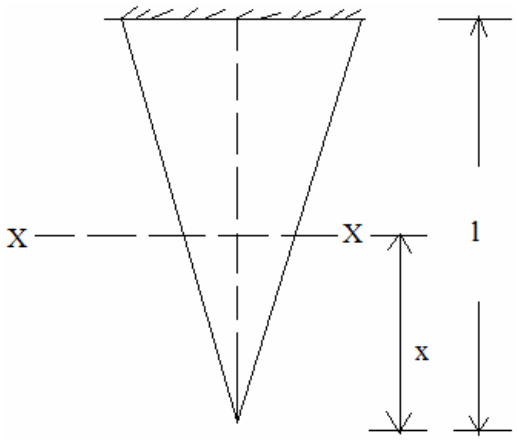

Fig.2

2. A Beam of length 6.0m is simply supported at the ends and carries a u.d.l of intensity 1.5KN/m run and three concentrated loads of 1KN, 2KN and 3KN acting at a distance of 1.5m, 3.0m and 4.5m respectively from left end. Draw the S.F.D and B.M.D and also determine the maximum bending moment. [15]

3.a) Show that for a beam subjected to pure bending, neutral axis coincides with the centroid of the cross-section.

b) A cantilever of square section 200 mm × 200 mm, 2.0 m long, just fails in flexure when a load of 12KN is placed at its free end. A beam of the same material and having a rectangular cross-section 150 mm wide and 300 mm deep is simply supported over a span of 3.0 m.Calculate the minimum central concentrated load required to break the beam. [5+10]

4.a) A circular beam of 100mm diameter is subjected to a shear force of 5KN. Calculate:
i) Average shear stress,
ii) Maximum shear stress, &
iii) Shear Stress at a distance of 40mm from N.A.

b) Derive an expression for the shear stress at any point in a circular section of a beam, which is subjected to a shear force 'F'. [9+6]

5. Find the forces in the members BC, HG, BG &DG of the truss shown in the Fig.3 Using Method of sections. [15]

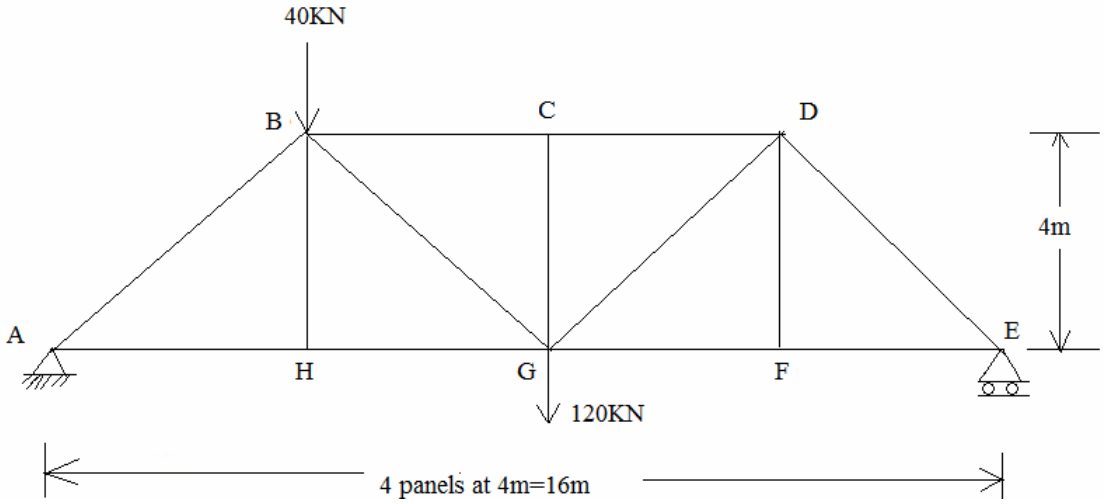

Fig.3

6.a) Compute the slope and deflection at the free end of cantilever beam shown in the Fig.4 by Moment area method.

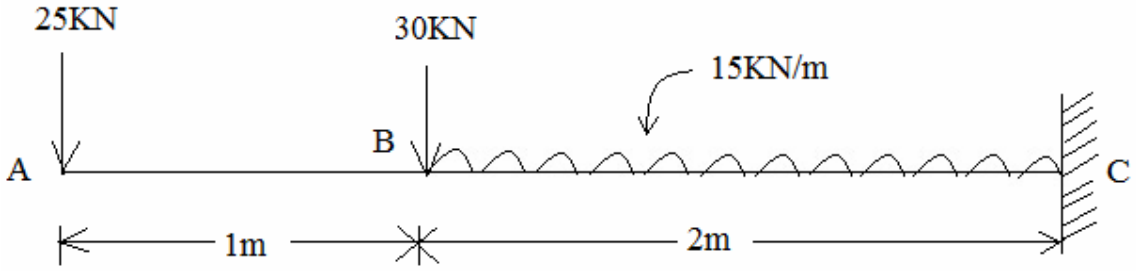

Fig.4

b) What are the limitations of moment area method? [12+3]

7. A closed cylindrical vessel made of steel plates 4mm thick with plane ends, carries fluid under a pressure of $3N/mm^2$.The diameter of the cylinder is 25cm and length is 75cm,Calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and volume of the cylinder.
Take $E=2.1\times10^5 N/mm^2$ and 1/m=0.286(Poisson's ratio). [15]

8. A compound cylinder has inner radius 200mm, radius at common surface 260mm and outer radius is 300mm.Initial pressure at common surface is $6N/mm^2$.What are the final hoop stresses after a fluid is admitted at a pressure of $80N/ mm^2$? Sketch the variation of hoop and radial stresses. [15]

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Code No:A109210304 | R09 | SET-3

B.Tech II Year - I Semester Examinations, May-June, 2012
MECHANICS OF SOLIDS
(COMMON TO AE, AME, MCT, ME, MMT, MIM)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) A 60 mm diameter bar carries an axial tensile load of 180KN. Find the normal and tangential stress intensities across planes at 30^0,45^0 and 60^0 with the normal section of the bar

b) A bar of 30mm diameter is subjected to a pull of 60KN. The measured extension on a gauge length of 200mm is 0.09mm and the change in diameter is 0.0039mm. Calculate the Poisson's ratio and the values of the three moduli (E,G & K). [7+8]

2. Calculate the reactions at the supports A and B of the beam shown in Fig.1. Draw the B.M.D and S.F.D. Determine also the points of contra flexure within the span AB and show their positions on the bending moment diagram. [15]

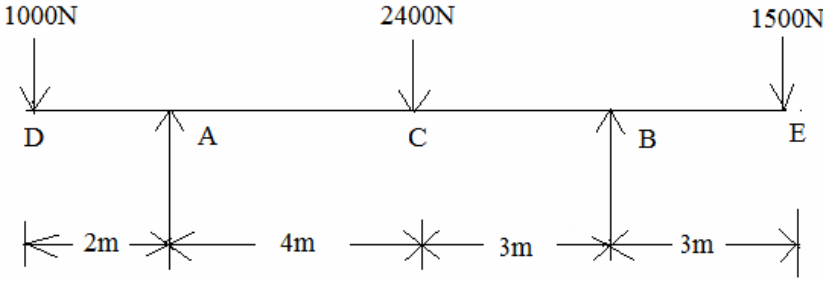

Fig.1

3.a) Compare the section moduli of two beams of the weight and length and the beam is solid circular beam of diameter 'd' and the second is a circular tube of outer diameter 'D_1' and inner diameter 'D_2'.

b) Find the width 'x' of the flange of a cast iron beam having the section shown in Fig.2, so that the maximum compressive stress is three times the maximum tensile stress the member being in pure bending subjected to sagging moment.The depth 'h' of the beam is 100mm,the thickness 't' of the web and flange is 25mm. [7+8]

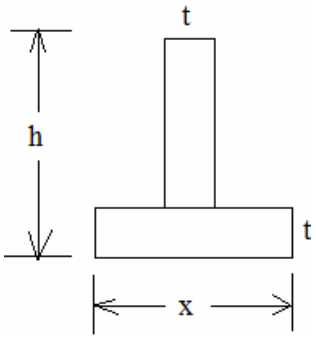

Fig.2

4. A steel beam of I-section is 600mm deep. Each flange is 250mmwide and 25mm thick. The web is 15mm thick. The beam section is subjected to a shear force of 500KN. Determine the shear stress distribution for the beam section.
i) When the web is vertical
ii) Web is horizontal. [8+7]

5. Calculate the forces induced in the members of the pin-jointed truss shown in Fig.3 by Method of Joints. [15]

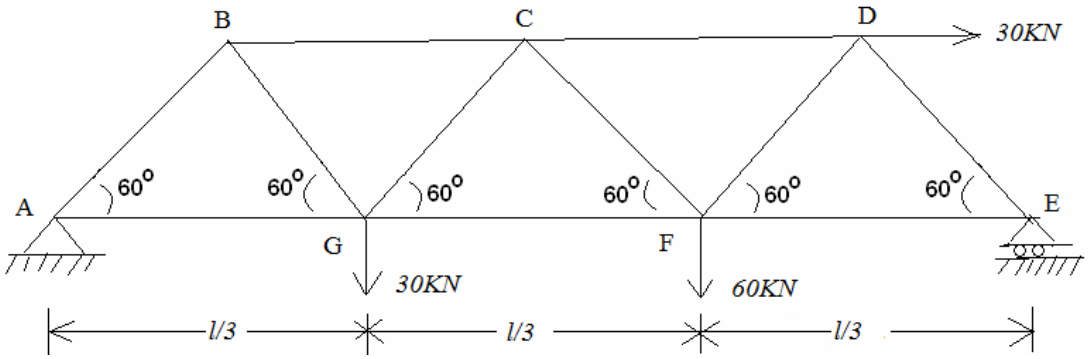

Fig.3

6. Find the slope and deflection at the points 'B' & 'C' of a cantilever beam by Moment area method. (Fig.4) [15]

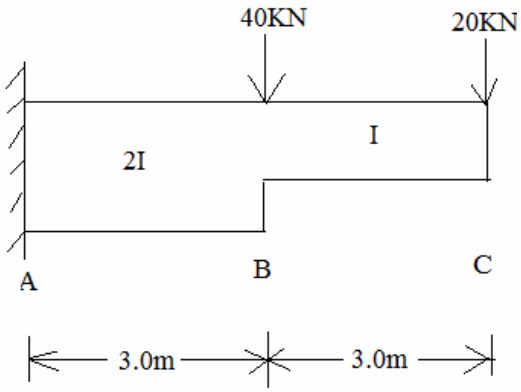

Fig.4

7. A shell 3.25m long and 1.0m diameter is subjected to an internal pressure of 1.2N/mm^2.If the thickness of the shell is 10.0mm find the circumferential and longitudinal stresses. Find also the maximum shear stress and changes in dimensions of the shell. Take E=200KN/mm^2, and Poisson's ratio=0.3. [15]

8. A thick cylindrical pipe of outside diameter 300mm and internal diameter of 200mm is subjected to an internal fluid pressure of 20N/mm^2 and external fluid pressure of 5 N/mm^2. Determine the maximum hoop stress developed and draw the variation of hoop stress and radial stress across the thickness. Indicate values at every 25mm interval. [15]

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Code No:A109210304 | R09 | SET-4

B.Tech II Year - I Semester Examinations, May-June, 2012
MECHANICS OF SOLIDS
(COMMON TO AE, AME, MCT, ME, MMT, MIM)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) A steel rod 25m long is at a temperature of 20^0C. Find the free expansion of the rod when the temperature is raised to 65^0C. Find the temperature stress produced:
i) When the expansion of the rod is prevented, and
ii) When the rod is allowed to expand by 6.0mm.
Take $\alpha=12.0\times10^{-6}$per^0 C and $E=2.0\times10^5$N/mm^2.

b) A steel tube 50mm in external diameter and 3.0mm thick encloses centrally a solid copper bar of 35mm diameter. The bar and the tube are rigidly connected together at the ends at a temperature of 20^0C.Find the stress in each metal when heated to 170^0C.Find the stress in each metal when heated to 170^0C .Also find the increase in length, if the original length of the assembly is 350mm.Coefficients of expansion for steel and copper are 1.08×10^{-5} per^0 C and 1.7×10^{-5} per^0 C respectively.
Take $E_s=2.0\times10^5$N/mm^2, $E_c=1.0\times10^5$N/mm^2. [5+10]

2. The intensity of loading on a simply supported beam of 5.0m span increases uniformly from 8KN/m at one end to 16KN/m at the other end as shown in Fig.1. Find the position and magnitude of the maximum bending moment. Also draw S.F.D and B.M.D. [15]

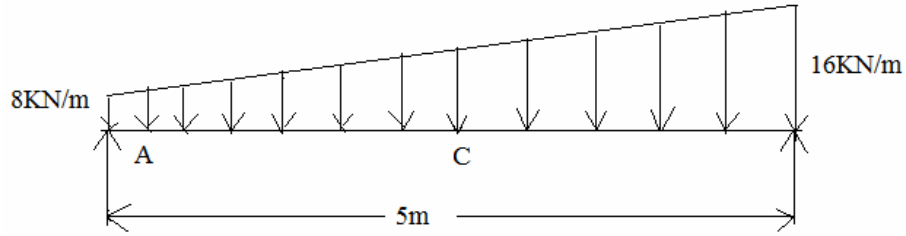

Fig.1

3.a) A rectangular beam 300mm deep is simply supported over a span of 4.0m.Determine the uniformly distributed load per meter which the beam may carry, if bending stress should not exceed 120N/mm^2. Take I=8.0x10^{6}mm^4.

b) The cross-section of beam is as shown in Fig.2, if permissible stress is 150 N/mm^2, find its moment of resistance. Compare it with equivalent section of same area but (a) Square section (b) Rectangular section with depth twice the width and (c) Circular section. [7+8]

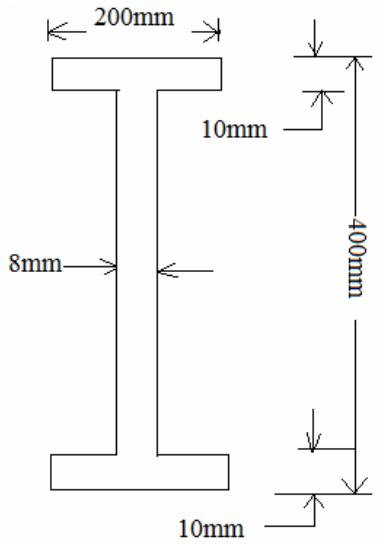

Fig.2

4.a) The shear force acting on a section of a beam is 100KN. The section of the beam is of T-shaped of dimensions 200 mm × 250 mm × 50 mm. The flange thickness and web thickness are 50 mm. Moment of inertia about the horizontal neutral axis is $1.134\times10^{8}mm^{4}$. Find the shear stress at the neutral axis and at the junction of the web and the flange. [15]

5. Analyse the truss shown in Fig.3, by Method of Joints.

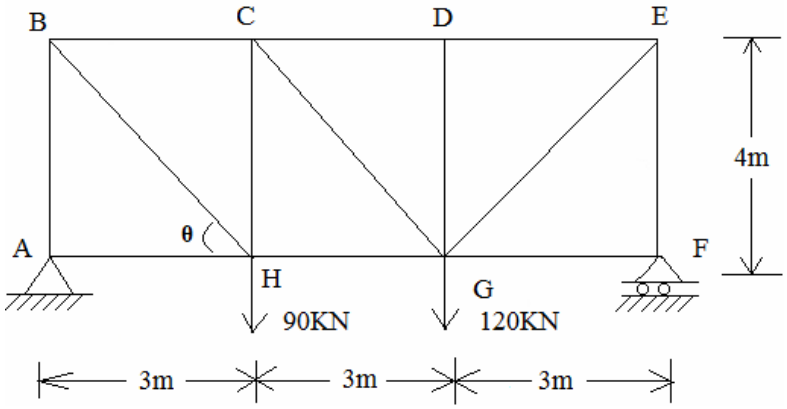

Fig.3

6. Compute the slopes and deflections at A and at mid-span E for the simply supported beam. The span of the beam is 1.8m and the beam is of 150 mm × 300 mm, $E=30KN/mm^{2}$. (Fig.4). [15]

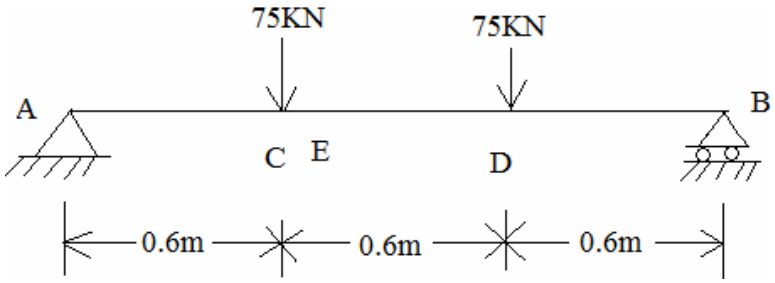

Fig.4

7.a) A spherical shell of 1.0m diameter is subjected to an internal pressure of 1.2N/mm^2. Taking the maximum allowable stress as 100N/mm^2, find the necessary thickness of plate. Take the joint efficiency at 75%.

b) A copper tube of 50mm internal diameter, 1.0m long and 1.25mm thick has closed ends and is filled with water under pressure. Neglecting any distortion of the end plates, determine the alteration of pressure when an additional volume of 3cm^3 of water is pumped into the tube. Modulus of Elasticity for copper=1.03×10^{5}N/mm^2, poisson's ratio=0.3, Bulk modulus of water=2.1×10^{3}N/mm^2. [7+8]

8. A compound cylinder, formed by shrinking one tube on to another, is subjected to an internal pressure of 60 N/mm^2.Before the fluid is admitted, the internal and external diameter of the compound cylinder are 120mm and 200mm and diameter at the junction is 160mm.If after shrinking on, the radial pressure at the common surface is 8.0 N/mm^2, calculate the final stress setup by the section. [15]

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