Code No: R22031 **R10** SET - 1

II B. Tech II Semester Supplementary Examinations January - 2014
MECHANICS OF SOLIDS
(Com. to ME, AME, MM)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
~~~~~~~~~~~~~~~~~~~~~~

1. a) What is the procedure of finding the thermal stresses in a composite bar?
   b) The extension in a rectangular steel bar of length 1000mm and thickness of 20mm is found to be 0.21mm. The bar tappers uniformly in width from 80mm to 40mm. If E of the bar is $2x10^5 N/mm^2$ determine the axial tensile load of the bar.

2. a) What are the different types of beams? Differentiate between a cantilever and simply supported beam?
   b) A simply supported beam of length 8m rests on its supports 8m apart, the right hand end is over hanging at 3m.the beam carries a uniform distributed load of 1600 N/m over the entire length. Draw S.F and B.M diagrams and find the point of contra flexure, if any.

3. a) What do you mean by simple bending or pure bending? What are the assumptions made in the theory of simple bending?
   b) A timber beam of rectangular section is to support a load of 25kN over a span of 5m. If the depth of the section is to be twice the breadth, and the stress in the timber is not to exceed $75N/mm^2$, find the dimensions of the cross section.
   How would you modify the cross section of the beam if it were a concentrated load placed at the centre with the same ratio of breadth to depth?

4. Sketch the distribution of shear stress across the depth of the beams of the following cross sections:
   i) T-section and

   ii) Square section with diagonal vertical.
~~~~~~~~~~~~~~~~~~~~~~

5. Determine the forces in the various members of the truss shown in the below Figure1.

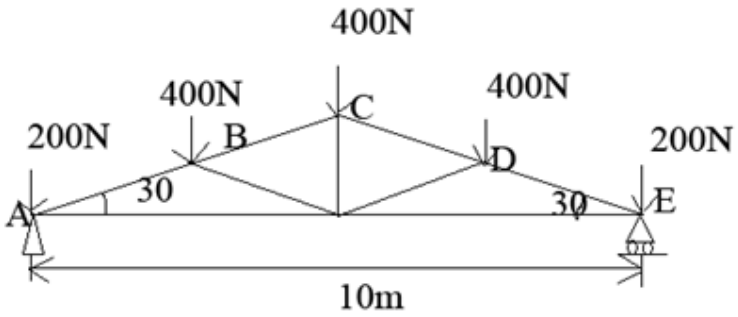


Figure1

6. a) Prove that the deflection at the centre of the simply supported beam, carrying a point load at the centre is given by

$Yc = WL^2/48EI$

Where W= point load.

L= length of beam.

b) A beam of length 20m is simply supported at its ends and carries two point loads of 6kN and 12kN at a distance of 8m and 12m from left end respectively. Calculate

i) Deflection under each load. ii) Maximum deflection.

Take $E=2x10^6$ N/mm^2 and $I=1x10^9$ mm^4

7. a) A cylindrical shell is subjected to internal fluid pressure, find an expression for change in diameter and change in length of the cylinder.

b) A thin cylinder of internal diameter 2.0m contains a fluid at an internal pressure of 4kN/mm^2. Determine the maximum thickness of the cylinder if

i) The longitudinal stress is not to exceed 30kN/mm^2 and

ii) The circumferential stress is not to exceed 40kN/mm^2.

8. Two thick steel cylinders A and B, closed at the ends, have the same conditions the outer diameter of each being 1.6 times the inner diameter. The cylinder A is subjected to internal fluid pressure only B to external fluid pressure only. Find the ratio of the pressure on these cylinders.

i) When the greatest circumferential stress has the same numerical value for each cylinder.

ii) When the greatest circumferential strain has the same numerical value for each cylinder.

Passion ratio=0.304

Code No: R22031 **R10** SET - 2

II B. Tech II Semester Supplementary Examinations January - 2014
MECHANICS OF SOLIDS
(Com. to ME, AME, MM)

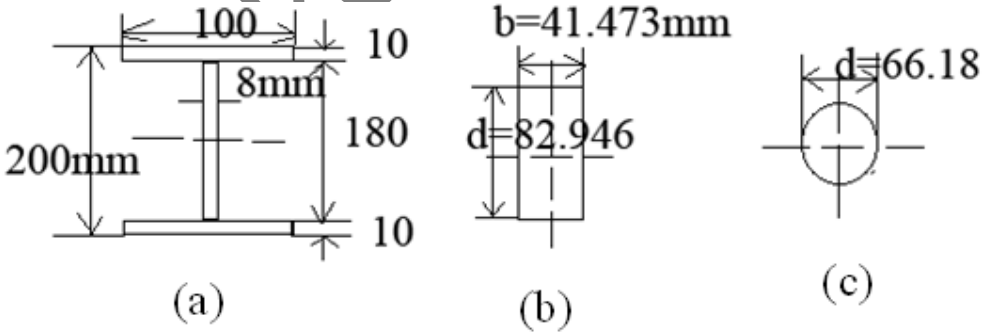
Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
~~~~~~~~~~~~~~~~~~~~~~

1. a) Find an expression for the total elongation of a bar due to its own weight, when the bar is fixed at its upper end and hanging freely at the lower end.
   b) A rectangular bar is made of steel is 4m long and 10mm thick. The rod is subjected to an axial tensile load of 60kN. The width of the rod varies from 70mm at one end to 28mm at the other. Find the extension of the rod if $E=2x10^5 N/mm^2$.

2. a) What are the sign conventions for shear force and bending moment in general?
   b) A beam of length 12m is simply supported and carries point loads of 6kN each a distance of 3m and 7m from the left support and also a uniform distributed load of 1KN/m between the point loads. Draw the S.F and B.M diagrams for the beam.

3. a) What do you mean by section modulus? Find an expression for section modulus for rectangular circular and hollow circular sections?
   b) Compare the flexural strength of the following three beams of equal weight
   i) I section 100mmX200mm having 10mm flange thickness and 8mm thickness.
   ii) A rectangular section having depth equal to twice the width. iii) Solid circular section.



4. Show the ratio of maximum shear stress to mean shear stress in a rectangular cross-section is equal to 1.50 when it is subjected to a transverse shear force F. plot the variation of shear stress across the section.
~~~~~~~~~~~~~~~~~~~~~~

5. Determine the forces in all the members of a cantilever truss shown in Figure 2 below.

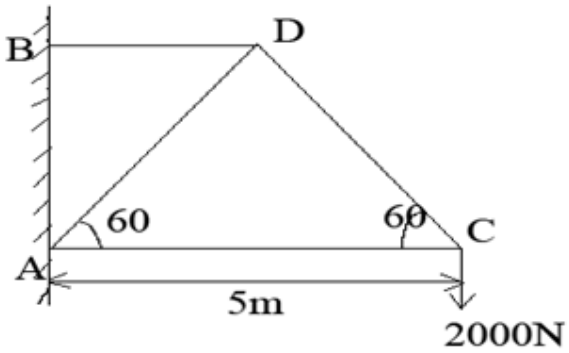


Figure 2

6. a) Find the expression for the slope at the supports of a simply supported beam, carrying a point load at the centre.
   b) A beam of length 5m and of uniform rectangular section is simply supported at its ends. It carries a uniformly distributed load of 12KN/m run over the entire span of 4m. Find the deflection at the centre if $E=1.1x10^6$ N/mm^2.

7. a) Find the expression for circumferential stress and longitudinal stress for a longitudinal joint and circumferential joint.
   b) A boiler is subjected to an internal steam pressure of 4KN/ mm^2. The thickness of the boiler plate is 3cm and the permissible stress is 125N/mm^2. Find out the maximum diameter, when efficiency of longitudinal joint is 90% and that of circumferential joint is 35%.

8. A compound cylinder is made by shrinking on outer tube of 240mm external diameter on to an inner tube of 120mm internal diameter. Determine the common diameter at the junction if the greatest circumferential stress in the inner tube is to be two thirds of the greatest circumferential stress in the outer tube.

Code No: R22031 **R10** SET - 3

II B. Tech II Semester Supplementary Examinations January - 2014
MECHANICS OF SOLIDS
(Com. to ME, AME, MM)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
~~~~~~~~~~~~~~~~~~~~~~

1. a) What do you mean by a bar of uniform strength?
   b) Find the modulus of elasticity of a rod, which tapers uniformly from 40 to 25mm diameter in a length of 500mm. The rod is subjected to a load of 8kN and the extension of the rod is 0.04mm.

2. a) What are the different types of loads acting on a beam? Differentiate between a point load and a uniformly distributed load.
   b) A beam of length 8m is simply supported at the ends and carries a uniformly distributed load of 1.5KN/m run and three concentrated loads of 1.5kN, 2.5KN, 3KN acting at a distance of 1.5m, 3m, 4.5m respectively from left end. Draw the S.F and B.M diagrams and determine the maximum bending moment.

3. a) What do you understand by neutral axis and moment of resistance?
   b) A cast iron pipe has 300mm bore and 12mm metal thickness, and is supported at two points 8m apart. Find the maximum stress in the metal when it is running full. Take unit eight of cast iron as $80kN/m^3$ and that of water as $9.81kN/m^3$.

4. a) Prove the shear stress distribution in a rectangular section of a beam which is subjected to a shear force F is given by
   $$q = F/2I\,[(d^2/4)-y^2]$$
   b) An I- section has flanges of width b and overall depth is 2b. The flanges and web are of uniform thickness t. Find the ratio of the maximum shear stress to the average shear stress.
~~~~~~~~~~~~~~~~~~~~~~

5. A truss of span 7.5m is loaded as shown in the Figure. 1 below. Find the reactions and forces in the members of the truss.

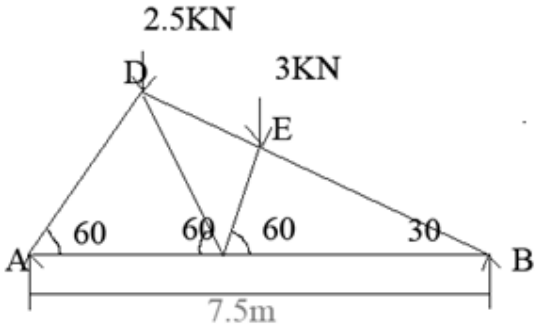


Figure 1

6. a) Prove the relation that

$$M = EI\,(dx^2/dy^2)$$

Where M = Bending moment.

E = Young's modulus.

I = M.O.I

b) A beam of uniform rectangular section 120mm wide and 240mm deep is simply supported at its ends. It carries a uniformly distributed load of 10kN/m run over the entire span of 4m. Find the deflection at the centre if $E=1.1x10^4$ N/mm^2.

7. a) While designing a cylindrical vessel, which stress should be used for calculating the thickness of the cylindrical vessel?

b) A cylindrical thickness 2 cm has to with stand maximum internal pressure of 2N/mm^2. If the ultimate tensile stress in the material of the cylinder is 300 N/mm^2, factor of safety 4 and the joint efficiency 80% determine the diameter of the cylinder.

8. Find the ratio of thickness to internal diameter for a tube subjected to internal pressure when the ratio of internal pressure to maximum circumferential stress is 0.5. Find the alteration of thickness of metal in such a tube 80mm internal diameter when the pressure is 60 N/mm^2. E=200,000 N/mm^2, μ=0.304.

Code No: R22031 **R10** SET - 4

II B. Tech II Semester Supplementary Examinations January - 2014
MECHANICS OF SOLIDS
(Com. to ME, AME, MM)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
~~~~~~~~~~~~~~~~~~~~~~

1. a) A rod whose ends are fixed to rigid supports is heated so that rise in temperature is T^0C. Prove that the thermal strain and thermal stresses set up in the rod are given by,
   Thermal strain= αT, and
   Thermal stress= αTE
   Where α = Co-efficient of thermal expansion.
   b) A member ABCD is subjected point loads P_1, P_2, P_3, and P_4 as shown in the figure below. Calculate the force P_3 necessary for equilibrium if P_1=150KN, P_2=250KN, P_4=200kN. Determine the net charge in the length of the member. Take E=200GN/m^2, (Figure1).

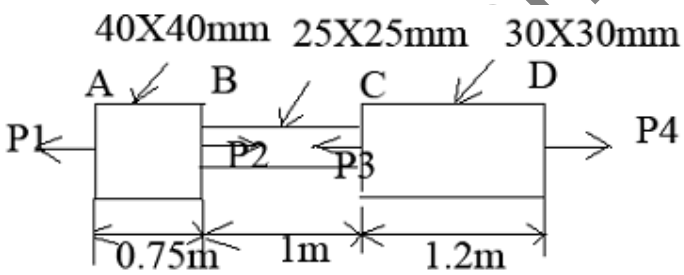


Figure1

2. a) Draw the S.F and B.M diagrams for a simply supported beam of length L carrying a point load W at its middle point.
   b) A beam of length 6m is simply supported at its ends. It is loaded with a gradually varying load of 750N/m from left hand support to 1500N/m to the right hand support. Construct the S.F and B.M diagrams and find the amount and position of the maximum bending moment over the beam.

3. a) What is the meaning of the strength of the section?
   b) A 100mmX200mm rolled steel joist of I-section has flange 12mm thick and web 10mm thick. Find the safe uniformly distributed load that this section can carry over a span of 6m if the permissible skin stress is limited to 160N/mm^2.
~~~~~~~~~~~~~~~~~~~~~~

4. a) 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.
   b) A beam of I-section is having overall depth as 500mm and over all width as 190mm. The thickness of flanges is 25mm where as the thickness of the web is 15mm. the moment of inertia about N.A is given as $6.4x10^8$ mm^4. If the section carries a shear force of 40KN, calculate the maximum shear stress. Also sketch the shear stress distribution across the section.

5. Determine the forces in the truss shown in Figure 2 below which carries a horizontal load of 16KN and a vertical load of 24KN.

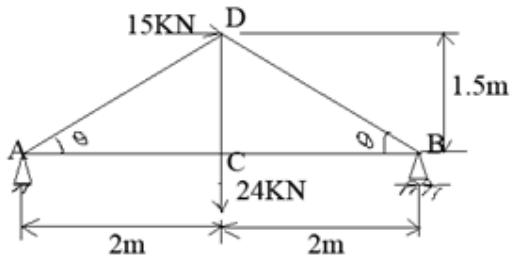


Figure 2

6. a) Derive the expression for the slope and deflection of a beam subjected to uniform bending moment.
   b) A beam of length 15m is simply supported at its ends and carries two point loads of 100KN and 60KN at a distance of 2m and 5m respectively from the left support. Calculate the deflections under the load. Find also the maximum deflections
   Take $I=18x10^8 mm^4$ and $E=2x10^5$ N/mm^2

7. a) Show that in thin cylinder shells subjected to the internal fluid pressure, the circumferential stress is twice the longitudinal stress.
   b) A water main 90cm diameter contains water at a pressure head of 110m. If the weight density of water is $9810N/mm^3$, fine the thickness of the metal required for the water main. Given the permissible stress as 25 N/mm^2.

8. The maximum stress permitted in a thick cylinder, radii 100mm and 150mm is $25N/mm^2$. The external pressure is 10 N/mm^2. What internal pressure can be applied plot curves showing the variation of hoop and radial stresses through the material.