MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Estd. 2000

Department of Civil Engineering
Question Bank - Academic Year (2020-21)

Course Code & Course Name : 19CED02 & Mechanics Of Solids

Year/Sem/Sec : II/III/-

Unit-I : Stress And Strain

Part-A (2 Marks)

1. Define: Stress
2. Define: Strain
3. Define: Elastic limit
4. State: Hooke's law.
5. Define: Young's modulus (NOV/DEC 2008)
6. Define: Longitudinal strain
7. Define: Lateral strain (NOV/DEC 2008)
8. Define: shear stress and shear strain.
9. Define: volumetric strain
10. Define: Poisson's ratio

Part-B (16 Marks)

1. A body is subjected to direct stresses in two mutually perpendicular directions accompanied by a simple shear stress. Draw the Mohr's circle of stresses and explain how you will obtain the principal stresses and principal planes (16)

2. The normal stresses acting on two perpendicular planes at a point in a strained material are 100 MN/ m^2 tensile, 45 MN/ m^2 compressive. In addition, shear stress of 50 N/mm^2 act on these planes. Calculate the following: (16)

   (i).The magnitude of the principle Stresses (ii).The direction of the principal planes (iii).The magnitude of the maximum shear stress.

3. A M.S bar of 50mm square in size and 150mm long is subjected to an axial thrust of 200kN. Half the lateral strain is prevented by the application of uniform external pressure of certain intensity. If E = 200 GPa and Poisson's ratio 0.3. Calculate the change in the length of the bar. (16)

   An element in a stressed material has tensile stress of 500 N/mm^2 and compressive (16)

4. stress of 350 N/mm^2 acting on two mutually perpendicular planes and equal shear stresses of 100 N/mm^2 on these planes. Find the principal stresses and its planes. Find the plane of maximum shear stress and its plane.

Unit-II : Shear And Bending In Beams

Part-A (2 Marks)

1. Define: Beam
2. What is mean by transverse loading on beam?
3. What is Cantilever beam?
4. What is simply supported beam?
5. What is mean by over hanging beam?
6. What is mean by concentrated loads?
7. What is uniformly distributed load (udl).
8. Define point of contra flexure? In which beam it occurs?
9. What is mean by positive or sagging BM?
10. What is mean by negative or hogging BM?

Part-B (16 Marks)

1. A rolled steel joist of section has the following dimension. (16)

   Flange width = 250 mm; Flange thickness = 25 mm

   Overall depth = 800 mm; Web thickness = 12 mm

   Calculate the safe 'UDL' per meter length of beam, if the beam, if the effective span is 8m and the maximum stress in steel is 100 N/mm$^{2.}$

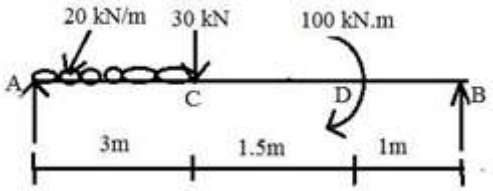
2. A flitched beam consists of two timber joist 100mm wide and 240mm deep with a steel plate 180mm deep and 10mm thick placed symmetrically between the timber joists and well clamped. Determine (16)

   i) The maximum fibre stress when the maximum fibre stress in wood is 80 kg/cm^2.

   ii) The combined moment of resistance if the modular ratio is 18.

3. 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 the bending moment of 200 Nm is acting one of the section (16)

4. Draw shear force and bending moment diagram for the beam shown in Fig. (16)



5. A beam 6m long and simply supported at each end has a uniformly distributed load of 800 N/m extending from the left end to a point 2 m away. There is also a clockwise couple of 1500 Nm. applied at the centre of the beam AB. Draw the shear force and bending moment diagrams for the beam and find the maximum bending moment. (16)

Unit-III : Deflection

Part-A (2 Marks)

1. What are the methods for finding out the slope and deflection at a section?
2. Why moment area method is more useful, when compared with double integration?
3. What is the ratio of maximum shear stress to the average shear stress in the case of solid circular section?
4. Explain the Theorem for conjugate beam method?
5. Define method of Singularity functions?
6. What are the points to be worth for conjugate beam method?
7. What is the formula to find a shear stress at a fiber in a section of a beam?
8. What is the shear stress distribution rectangular section?
9. State the main assumptions while deriving the general formula for shear stresses
10. Define: Shear stress distribution

Part-B (16 Marks)

1. A simple beam of span 10m carries a udl of 3kN/m. The section of the beam is a T having a flange of 125x125mm and web 25x175mm. For the critical section obtain the shear stress at the neutral axis and at the junction of flange and the web. Also draw the shear stress distribution across the section (16)
2. A beam of channel section 120x60mm has a uniform thickness of 15mm. Draw the shear stress distribution for a vertical section where the shear force is 50kN. Find the ratio between the maximum and mean shear stress (16)
3. A beam AB of span 10m is simply supported at end A and B and is located as shown in figure. Take E = $200x10^6$ kN/m^2 and I = $8.5x10^8$ mm^4. Find the position and magnitude deflection using (16)
   Macaulay's method.

4. A cantilever of length 2.5m is loaded with an udl of 10 kN/m over a length 1.5m from the fixed end. Determine the slope and deflection at the free end. Determine the slope and deflection at the free end of the cantilever L = 9500cm^4, E = 210 GN / m^2 using Moment area method. (16)

5. A steel cantilever of 2.5m effective length carries a load of 25kN at its free end. If the deflection at the free end is not exceed 40mm. What must be the I value of the section of the cantilever. Take E = 210 GN/m^2 using moment area method. (16)

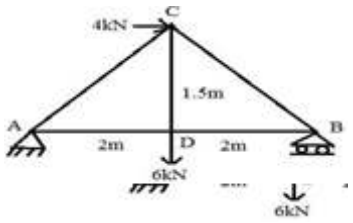
Unit-IV : Principal Stress And Strain & Analysis Of Plane Truss

Part-A (2 Marks)

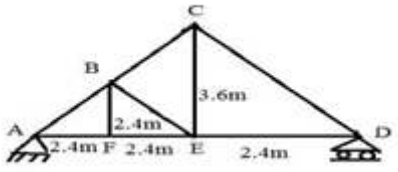
1. What are the different types of frames?
2. What is mean by perfect frame?
3. What is mean by Imperfect frame?
4. What is mean by deficient frame?
5. What is mean by redundant frame?
6. What are the assumptions made in finding out the forces in a frame?
7. How will you Analysis of a frame?
8. What are the methods for Analysis the frame?
9. How method of joints applied to Trusses carrying Horizontal loads.
10. How method of joints applied to Trusses carrying inclined loads.

Part-B (16 Marks)

1. Find the forces in the members of the truss shown in Fig (16)



2. Find the forces in the member of the truss shown in fig. by method of sections (16)



3. A thin cylindrical shell 1000 mm long, 200 mm in external diameter, thickness of metal 10 mm is filled with a fluid at atmosphere pressure. If an additional 25 cm^3 of the fluids at atmospheric find the pressure exerted by the fluid on the wall. Take E = 2 x 10^5 N/mm^2 and Poisson's ratio = 0.3. Find also the hoop stress induced (16)

4. A cylindrical shell 3m long which is closed the ends has an internal diameter of 1m a wall thickness of 15mm. Calculate the Circumferential and longitudinal stresses induced and also changes in the dimensions of the shell, if it is subjected to an internal pressure of 1.5 N/mm^2. Take E = 2 x 10^5 N/mm^2 and 1/m = 0.3. (16)

5. A cast iron thin cylindrical pipe of internal diameter 200 mm and 15mm thick is closely wounded by single layer steel wire of 2mm diameter under a tension of 50 N/mm^2. Find the stresses set up in the pipe when the pipe is empty. Also find the stresses set up in the pipe and steel wire (16)

Unit-V : Torsion Of Shafts And Spring

Part-A (2 Marks)

1. Write down the expression for power transmitted by a shaft
2. Write down the expression for torque transmitted by hollow shaft
3. Write down the equation for maximum shear stress of a solid circular section in diameter 'D' when subjected to torque 'T' in a solid shaft.
4. What is solid length?
5. Define torsional rigidity
6. What is composite shaft?
7. What is a spring?
8. State any two functions of springs.
9. What are the various types of springs?
10. Classify the helical springs.

Part-B (16 Marks)

1. i) Derive the torsion equation for a circular shaft of diameter'd' subjected to torque 'T'. Find the torque that can be transmitted by a thin tube 6 cm mean diameter and wall thickness 1 mm. the permissible shear stress is 6000 N/cm^2 **.** (16)

2. A close coiled helical spring is made of a round wire having 'n' turns and the mean coil radius R is 5 times the wire diameter. Show that the stiffness of the spring = 2.05 R/n. If the above spring is to support a load of 1.2kN with 120mm compression. Calculate mean radius of the coil and number of turns assuming G = 8200 N/mm^2 and permissible shear stress, $\lambda_{allowable}$ = 250 N/mm^2. (16)

3. A steel shaft ABCD having a total length of 2400mm is contributed by three different sections as follows. The portion AB is hollow having outside and inside diameters 80mm and 50mm respectively, BC is solid and 80mm diameter. CD is also solid and 70mm in diameter. If the angle of twist is same for each section, determine the length (16)

of each portion and the total angle of twist. Maximum permissible shear stress is 50 MPa and shear modulus 0.82×10^5 MPa.

4. A shaft has to transmit 110 kW at 160rpm. If the shear stress is not to exceed $65 N/mm^2$ and the twist in a length of 3.5m must not exceed 1^o, find a suitable diameter. Take $C = 8 \times 10^4 N/mm^4$. (16)

5. A close coiled helical spring has a stiffness of 5N/mm. its length when fully compressed with adjacent coils touching each other is 40 cm. the modulus of rigidity of the material of the spring is $0.8 \times 10 N/mm^2$. Determine the wire diameter and mean coil diameter if their ratio is 1/10. What is the corresponding maximum shear stress in the spring? (16)

Course Faculty **HoD**