Code No: R09220102 **R09** **Set No. 2**

II B.Tech II Semester Examinations,April/May 2012
STRENGTH OF MATERIALS - II
Civil Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. A steel column of hollow circular section, 50 mm external diameter and 6 mm thick, is 6.3 m long with both ends being hinged. Determine the critical load and also find the safe load if the factor of safety is 2.5. [15]

2. Draw the shear force and bending moment diagrams of a fixed beam loaded as shown in the Figure 1. [15]

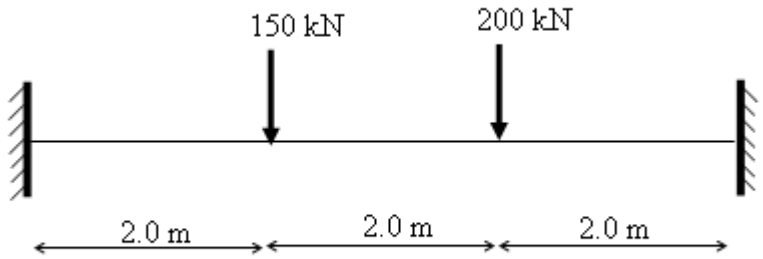

Figure 1:

3. A 3.3 m long steel horizontal strut member consists of 150 mm external diameter and wall thickness 12.5 mm. The member is subjected to a load of 75 kN. Determine the maximum stress in the strut. Take the self weight of the strut in to account. [15]

4. A hollow steel shaft, 150 mm external diameter and 75 mm internal diameter, is subjected to a torque of 50 kNm, a bending moment of 30 kNm and an end thrust of 200 kN . Determine the location and the magnitude of principal stresses and maximum shear stress induced. [15]

5. A 300 mm deep I-beam with the flanges 150 mm wide and thickness of the section 12 mm, is subjected to a bending moment in a plane inclined at 30^0 with respect to major principal axis. Find the position of the neutral axis and the magnitude of the bending moment if the allowable stress is limited to 80 N/mm^2. [15]

6. A uniform cross-section circular beam of radius 4 m is simply supported by equally spaced three columns. The circular beam is subjected to three concentrated loads of magnitude 50 kN each and acting at the mid span section of the segment of the beam joining the two supports. Determine the support reactions. [15]

7. A masonry dam of trapezoidal section is 8 m high, 1 m wide at top and 4 m wide at base with its water-face vertical. It is found that some tension is induced in the base if water is stored up to the top of the dam. Calculate the height to which water may be stored so that no tension is induced at the base. Assume the unit weight of masonry is 18 kN/m^3. [15]

8. A continuous beam supported and loaded as shown in figure 2. Draw the shear force and bending moment diagrams if the middle support sinks by 2.5 mm per kN load. [15]

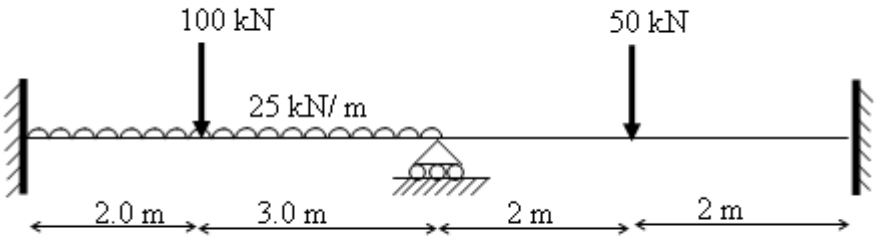

Figure 2:

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Code No: R09220102 **R09** **Set No. 4**

II B.Tech II Semester Examinations,April/May 2012
STRENGTH OF MATERIALS - II
Civil Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. A tie rod of uniform section is required to resist a force of 450 kN at an eccentricity of 25 mm from the axis of the rod. Determine the size of the tie rod if the permissible stress is limited to 125 N/mm^2. [15]

2. A steel hinged square tubular strut of size, 60 mm × 60 mm × 4 mm is 2 m long. It is required to carry an axial load of 80 kN in addition to a lateral load of 12 kN at its mid-height. Determine the maximum stress. [15]

3. (a) Describe the different modes of failures of columns.
   (b) Explain the assumptions made in the Euler's column theory. [7+8]

4. A continuous beam supported and loaded as shown in figure 3. Draw the shear force and bending moment diagrams. [15]

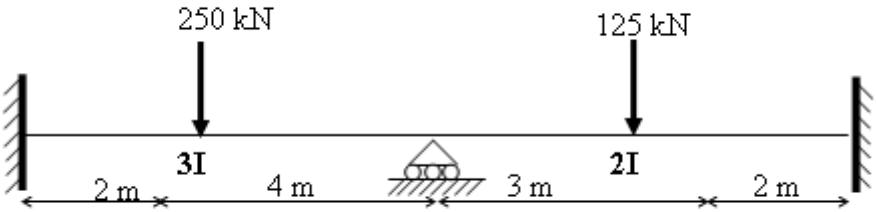

Figure 3:

5. A circular beam of radius 6 m and uniform cross-section is supported on six symmetrically placed columns. The beam is subjected to a uniformly distributed load of intensity 30 kN/m. Draw the twisting moment diagram and indicate the salient features [15]

6. Find the position and magnitude of the maximum deflection of a steel fixed beam loaded as shown in the Figure 4. Assume the second moment of inertia of the cross-section of the beam is $400\times10^6 mm^4$. [15]

7. A steel leaf spring has 1.2 m span and required to carry a load of 12 kN. The maximum bending stress for the spring material and the maximum central deflection are not to exceed 200 N/mm2 and 45 mm respectively. Determine the suitable

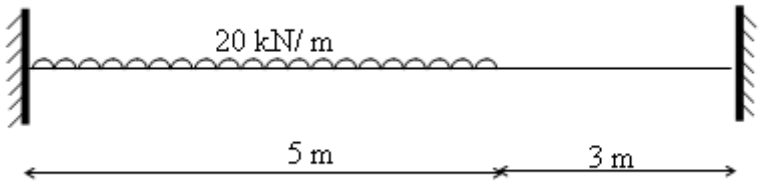

Figure 4:

width, thickness and the number of plates required for the spring if the plates are available in multiples if 1 mm thick and 4 mm width. Also find the radius to which the plates should be formed. [15]

8. A simply supported steel beam of span 3.6 m has I-section, 150 mm × 250 mm × 12 mm. The beam is subjected to a uniformly distributed load of 72 kN (total). The applied load acts in plane making an angle 35^0 with respect to vertical and passing through the centroid of the section. Calculate the maximum bending stress at mid-span and the maximum deflection. [15]

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Code No: R09220102 **R09** **Set No. 1**

II B.Tech II Semester Examinations,April/May 2012
STRENGTH OF MATERIALS - II
Civil Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. A hollow steel shaft, 12 m long, is required to transmit 1000 kw when running at a speed of 300 rpm. If the maximum permissible shear stress in the shaft is 80 N/mm^2 and the ratio of inner diameter to the outer diameter is $\frac{3}{4}$, find the dimensions of the shaft and also the angle of twist of one end of the shaft relative to the other. The modulus of rigidity is 0.85 $\times 10^5 N/mm^2$. [15]

2. A hollow short column of external diameter 500 mm and internal diameter 230 mm is subjected to an eccentric load of 150 kN. Determine the maximum eccentricity of the load without producing tension on the section. Also draw the core of the section. [15]

3. A simply supported beam of span 4.5 m has I-section 125 mm × 250 mm × 10 mm. The beam is subjected to a concentrate load of 75 kN at the mid-span in a plane making an angle 20^0 with respect to vertical and passing through the centroid of the section. Determine the maximum stresses developed at the section. [15]

4. A continuous beam is supported and loaded as shown in figure 5. Draw the shear force and bending moment diagrams with salient features. [15]

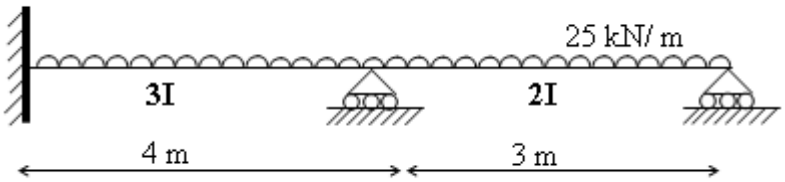

Figure 5:

5. A hollow cylindrical steel strut has to be designed for the following conditions: Length 3.0 m, axial load 125 kN, ratio of internal diameter to the external diameter is 0.75, factor of safety is 4.0 and the ends of the strut are fixed. Use Rankines formula. The Rankine's constants are 320 MPa and $\frac{1}{7500}$. [15]

6. A semi-circular beam of radius 4 m is simply supported on three equally spaced simple supports. The beam is subjected to a uniformly distributed load of intensity 20 kN/m over the entire length. Determine the angle θ between the supports so that the bending moment is equal. [15]

7. Draw the shear force and bending moment diagrams of the propped cantilever beam loaded as shown in the Figure 6. [15]

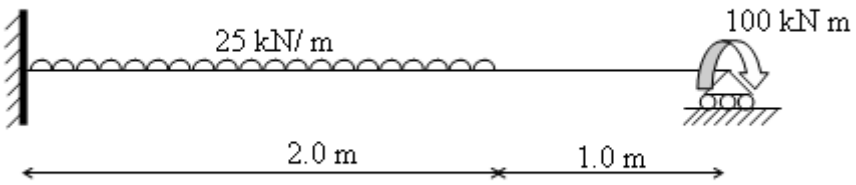

Figure 6:

8. A steel hinged square tubular beam column of size, 60 mm × 60 mm × 4.8 mm is 2.5 m long. It is required to carry an axial load of 75 kN in addition to a transverse uniformly distributed load 2 kN/m length over its entire span. Determine the maximum stress. [15]

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Code No: R09220102 **R09** **Set No. 3**

II B.Tech II Semester Examinations,April/May 2012
STRENGTH OF MATERIALS - II
Civil Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. A solid aluminium shaft 1m long and 50 mm diameter is to be replaced by a tubular steel shaft of the same length and same outside diameter such that each of the two shafts could have the same angle of twist per unit torsional moment over the total length. What must be the inner diameter of the tubular shaft? Modulus of rigidity of steel is three times that of aluminium. [15]

2. (a) Explain the following
   i. Middle third rule
   ii. Middle quarter rule
   (b) A rectangular strut of width 125 mm and breadth 100 mm carries an eccentric load at an eccentricity of 25 mm on minor axis. Determine the maximum and minimum stresses. [8+7]

3. A circular beam of radius 3.5 m and uniform cross-section is supported on four symmetrically placed columns. The beam is subjected to a uniformly distributed load of intensity 12 kN/m. Draw the twisting moment diagram and indicate the salient features. [15]

4. A continuous beam is supported and loaded as shown in figure 7. Draw the shear force and bending moment diagrams. [15]

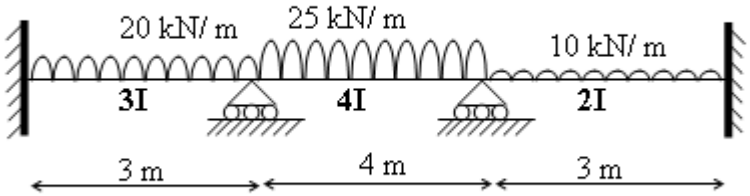

Figure 7:

5. Determine the Euler's critical load for a steel strut of T-section shown in Figure 8. The lengthof the strut is 5.2 m and both ends hinged. [15]

6. Draw the shear force and bending moment diagrams of the propped cantilever beam loaded as shown in the Figure 9. [15]

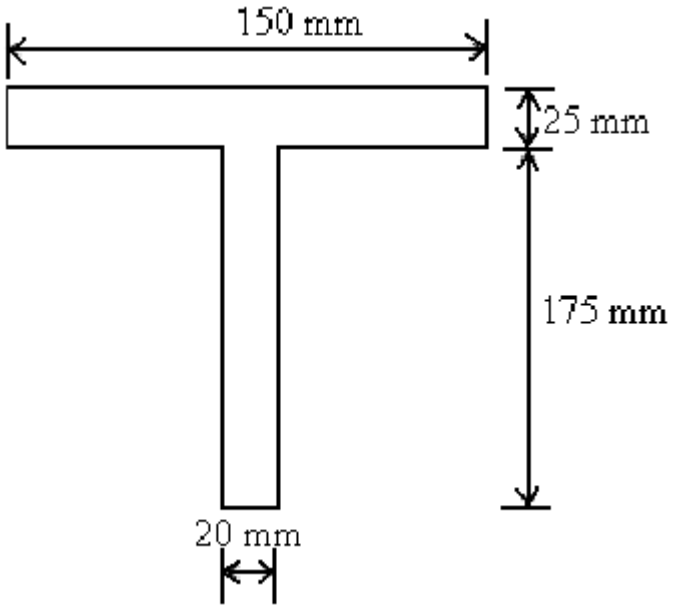

Figure 8:

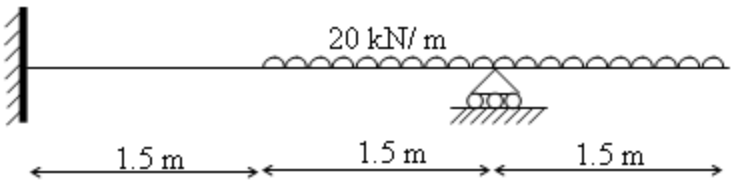

Figure 9:

7. A 300 mm deep I-beam with the flanges 150 mm wide and thickness of the section 12 mm is subjected to a bending moment in a plane inclined at 60^0 with respect to minor principal axis. Find the magnitude of the bending moment if the allowable stress is limited to 80 N/mm^2 and also locate the neutral axis. [15]

8. A steel square tubular strut of size 72 mm $\times$ 72 mm $\times$ 4.8 mm, is 2.75 m long. It is required to carry an axial load of 125 kN in addition to a lateral load of 15 kN at the top. Determine the maximum bending moment if the bottom end of the column is fixed and the top end of the column is rigidly fixed against rotation but not against sway. [15]

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