Code No: RR220102 **Set No. 1**

II B.Tech II Semester Supplementary Examinations,
November/December 2005
STRENGTH OF MATERIALS-II
(Civil Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. At a point is an elastic material, direct stresses of magnitude 60 MPa (tensile) and 40 MPa (compressive) are applied on planes at right angles to each other. If the max principal stress is not to exceed 65 MPa, find out the shear stress which can be applied on the planes. Find the magnitude and nature of minor principal stress. Find also the magnitude of max. shear stress and the planes on which it acts.[16]

2. At a point in a steel member, the major principal stress is 20 MPa (tensile) and the minor principal is compressive. If the Poisson's ratio is 0.25 and the yield stress in steel is 30 MPa in simple tension, find the magnitude of minor principal stress at which yielding will commence according to the following criteria of failure:

   (a) Max. shear stress

   (b) Max. total strain energy. [8+8]

3. A solid shaft, 80mm in dia. transmits 120 H.P. running at 180 R.P.M. Calculate the max. intensity of shear stress induced and the angle of twist for a length of 6m. Take $N = 8X10^4 N/mm^2$. [16]

4. Determine the deflection, bending stress and shear stress induced in an open coiled helical spring due to axial load of 700N. The no. of coils are 20, and angle of helix 12^0. Take $E = 200GN/m^2$ and $N = 80GN/m^2$. [16]

5. An R.S.Tee-section, 150mm wide × 75mm deep, thickness of flange 9mm, thickness of web 8.4mm, is used as a strut, 3 metre 4 long, ends hinged.Calculate the safe axial load by Rankines formula, using a factor of safety of 3. Rankines constants, $fc = 315N/mm^2$; a = 1/ 7500. [16]

6. (a) What do you understand by "Beam-columns"?

   (b) A horizontal strut of length L, having hinged ends, carries an axial compressive load P, and central vertical load W. Derive expression for max values of deflection, B.M. and stress. [4+12]

7. A compound steel cylinder has a bore of 80 mm and an outside; diameter of 160 mm, the diameter at the common surface being 120 mm. Find the radial pressure at the common surface which must be provided by shrinkage if the resultant maximum hoop tension in the inner cylinder under a superimposed internal pressure of $60N/mm^2$ is to be half the value of the maximum hoop tension which would be produced in the inner cylinder if that cylinder alone were subjected to an internal

pressure of $60N/mm^2$. Determine the final hoop tensions at the inner and outer surfaces of both cylinder under the internal pressure of $60N/mm^2$ and sketch a graph to show the hoop tension varies across the cylinder wall. [16]

8. Derive the general expressions and explain the procedure of finding deflections in a beam subjected to unsymmetrical bending. [16]

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Code No: RR220102 **Set No. 2**

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STRENGTH OF MATERIALS-II
(Civil Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Show that the difference of principal strains = max shear strain.
   (b) Derive expressions for principal stresses in terms of principal strains, Poissons ratio modulus of elasticity. [6+10]

2. (a) Explain Haigh's max. strain energy theory originally put forward by Beltrami.
   (b) Obtain the yield criterion and design criterion in the case of 3-D and 2-D stress systems. [8+8]

3. Calculate the dia. of shaft which will transmit 50 H.P. at 150 R.P.M; if the shearing stress is limited to $50N/mm^2$ and the angle of twist should not exceed 1^0 in 2.5m length. $N = 8X10^4N/mm^2$. [16]

4. Two co-axial springs, one placed inside the other and made of steel wires of the same dia. support an axial compressive load P on a rigid plate on the top of the springs. The number of coils in the two springs are 10 and 12 while the mean radii of the coils are 40mm and 60mm. Both the springs are of equal length before loading. Calculate P, if the wire dia. is 8mm and the shear stress in the wire is not to exceed $800N/mm^2$. [16]

5. An R.S.Tee-section, 150mm wide × 75mm deep, thickness of flange 9mm, thickness of web 8.4mm, is used as a strut, 3 metre 4 long, ends hinged.Calculate the safe axial load by Rankines formula, using a factor of safety of 3. Rankines constants, $fc = 315N/mm^2$; a = 1/ 7500. [16]

6. (a) What do you understand by "Beam-columns"?
   (b) A horizontal strut of length L, having hinged ends, carries an axial compressive load P, and central vertical load W. Derive expression for max values of deflection, B.M. and stress. [4+12]

7. Compare the values of max. and minimum hoop stresses for a cast steel cylindrical shell of 600 mm external dia. And 400 mm internal dia. Subjected to a pressure of $30N/mm^2$ applied
   (a) Internally and
   (b) Externally. [8+8]

8. A cantilever of span 600mm carries a load P at the free end. The section of the beam is rectangular $100 \times 150mm$. The load line is inclined at 45^0 to the vertical and passes through the c.g. of section. Find P if the max. Tensile stress is limited to $15N/mm^2$. [16]

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STRENGTH OF MATERIALS-II
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Answer any FIVE Questions
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1. At a point is an elastic material, direct stresses of magnitude 60 MPa (tensile) and 40 MPa (compressive) are applied on planes at right angles to each other. If the max principal stress is not to exceed 65 MPa, find out the shear stress which can be applied on the planes. Find the magnitude and nature of minor principal stress. Find also the magnitude of max. shear stress and the planes on which it acts.[16]

2. (a) Explain Haigh's max. strain energy theory originally put forward by Beltrami.
   (b) Obtain the yield criterion and design criterion in the case of 3-D and 2-D stress systems. [8+8]

3. A solid shaft, 80mm in dia. transmits 120 H.P. running at 180 R.P.M. Calculate the max. intensity of shear stress induced and the angle of twist for a length of 6m. Take $N = 8X10^4 N/mm^2$. [16]

4. A close coiled helical spring is made of 10mm dia. wire coiled to a mean dia. of 120mm the number of turns being 10. It is fixed at one end and a twist of 15 N m is applied at the other end. Taking $E = 200GN/m^2$, find
   (a) the max. bending stress induced
   (b) angle of twist of spring and
   (c) number of turns after application of torque. [6+6+4]

5. An R.S.Tee-section, 150mm wide × 75mm deep, thickness of flange 9mm, thickness of web 8.4mm, is used as a strut, 3 metre 4 long, ends hinged.Calculate the safe axial load by Rankines formula, using a factor of safety of 3. Rankines constants, $fc = 315N/mm^2$; a = 1/ 7500. [16]

6. (a) What do you understand by "Beam-columns"?
   (b) A horizontal strut of length L, having hinged ends, carries an axial compressive load P, and central vertical load W. Derive expression for max values of deflection, B.M. and stress. [4+12]

7. Compare the values of max. and minimum hoop stresses for a cast steel cylindrical shell of 600 mm external dia. And 400 mm internal dia. Subjected to a pressure of $30N/mm^2$ applied
   (a) Internally and
   (b) Externally. [8+8]

8. An angle section $200 \times 200 \times 20mm$ is used as a simply-supported beam of 3m span with one of its legs horizontal. It carries two point loads of 25KN each at third point. The load line is vertical passing through the c.g. of the section. Find the bending stresses at the 3 extreme corner of the section. [16]

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Code No: RR220102 **Set No. 4**

II B.Tech II Semester Supplementary Examinations,
November/December 2005
STRENGTH OF MATERIALS-II
(Civil Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Draw the Mohr's circle of stress if a piece of material is subjected to tensile stresses of 80 MPa and 35 MPa on mutually perpendicular planes. Find the plane across which the resultant stress is most inclined to the normal. Find also the magnitude of the resultant stress on this plane. [16]

2. Applying max. strain energy theory find the dia of a steel bar subjected to an axial pull of 10 kN along with a transverse S.F of 5 kN. Take the elastic limit in tension as 240 MPa and F.O.S. = 3. [16]

3. A solid shaft, 80mm in dia. transmits 120 H.P. running at 180 R.P.M. Calculate the max. intensity of shear stress induced and the angle of twist for a length of 6m. Take $N = 8X10^4 N/mm^2$. [16]

4. A steel carriage spring of 60cm span carries a central load of 5 kN. If the plates are 60mm wide and 5mm thick, find the number of plates required. The bending stress is limited to $300N/mm^2$. Find the central deflection and the radius to which the plates should be bent. Take $E = 200GN/m^2$. [16]

5. An R.S.Tee-section, 150mm wide × 75mm deep, thickness of flange 9mm, thickness of web 8.4mm, is used as a strut, 3 metre 4 long, ends hinged.Calculate the safe axial load by Rankines formula, using a factor of safety of 3. Rankines constants, $fc = 315N/mm^2$; a = 1/ 7500. [16]

6. A horizontal strut 3m long is of-hollow circular section 16cm external dia. And internal dia. 14cm. It carries an end thrust of 300kN along with a u.d.l of 5kN/m. Assuming the ends as hinged and taking the self weight also into account, calculate the max. stress induced in the section ($Density = 78.5kN/m^3$). [16]

7. Compare the values of max. and minimum hoop stresses for a cast steel cylindrical shell of 600 mm external dia. And 400 mm internal dia. Subjected to a pressure of $30N/mm^2$ applied

   (a) Internally and

   (b) Externally. [8+8]

8. Determine the principal moments of inertia for an unequal angle section $200 \times 150 \times 10mm$ analytically or graphically. [16]

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