Code No: T0122 **R07** SET - 1

II B. Tech II Semester Supplementary Examinations Dec – 2012
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 80

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

1. a) Discuss briefly about maximum strain energy theory.
   b) A bolt is subjected to an axial pull of 12 kN together with a transverse shear of 6 kN. Determine the diameter of the bolt by according to i) Maximum principal stress theory ii) maximum shear stress theory iii) maximum strain energy theory iv) maximum distortion energy theory. Take E = 2 X 10^5 N/mm^2, failure stress in tension test to be 300 N/mm^2, factor of safety 3 and $\mu = 0.3$.

2. a) Derive an expression relating the applied twisting moment acting on a shaft of circular cross section and the shearing stress at any point in the shaft.
   b) Determine the maximum shearing stress and elongation in a helical steel spring composed of 20 turns of 20-mm-diameter wire on a mean radius of 90 mm when the spring is supporting a load of 1.5 kN. Use G = 83 GPa.

3. A 4m long steel tie bar with a diameter of 32 mm is supported horizontally through pin joints. Determine the maximum tensile stress in the bar if it sustains an axial pull of 15 kN. Density of steel is 7600 kg/cm^3 and E is 205 GPa.

4. a) Derive the equation for Euler buckling load, when one end of the column is fixed and other end is free.
   b) Compare the crippling loads given by Euler's and Rankine's formulae for a tubular steel strut 2.5 m long having outer and inner diameters 4.0 cm and 3.50 cm respectively. Assume pin joints at both ends. Take E = 2.1 x 10^5 N/mm^2, yield stress = 320 N/mm^2 and Rankine's constant is 1/5000.
~~~~~~~~~~~~~~~~~~~~~~

Code No: T0122 **R07** SET - 1

5. The Aluminum column in Fig. 1 fixed at A and hinged at B. Use the concept of effective length to replace the fixed condition by a simple support. It is made of an I – Section with dimensions as marked. Calculate maximum stress and displacement for load eccentricities marked in Figure1

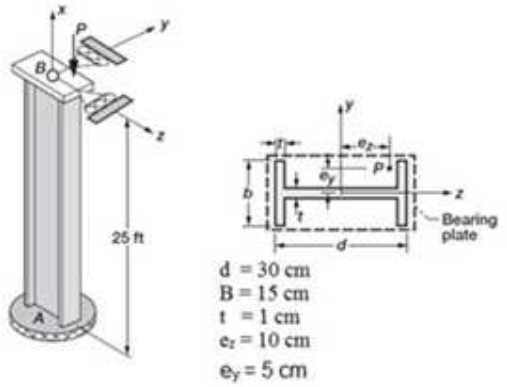

Figure1

6. A beam of rectangular section as shown in Figure 2 is 15 cm wide and 20 cm deep. It is used as a simple supported beam of span of 6 m. Two loads of 10 kN each are applied to the beam, each load being 2 m from the support. The plane of the loads make an angle of 30^0 with the vertical plane of symmetry. Find the direction of neutral axis and the bending stresses at the point.

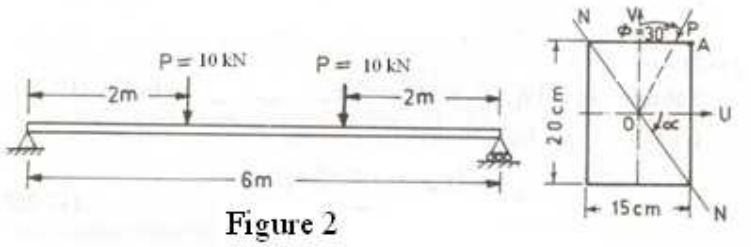

Figure 2

7. For a simple supported Curved beam, derive the relation to find Shear force, BM and Tensional moments at a point P, at an angle of φ from one support.

8. Calculate the magnitude and nature of the forces in the member of the truss as shown in Figure 3 by method of joints.

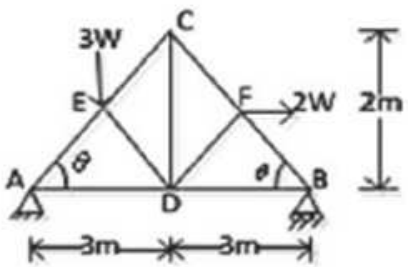

Figure 3

Code No: T0122 **R07** SET - 2

II B. Tech II Semester Supplementary Examinations Dec – 2012
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 80

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

1. a) Define Principal Stresses, Principal planes and Principal strains.
   b) If an element is subjected to the state of stress as shown in figure 1, find the principal stresses. Also compute the stress components on a plane at 30° counter clockwise from the x-face.

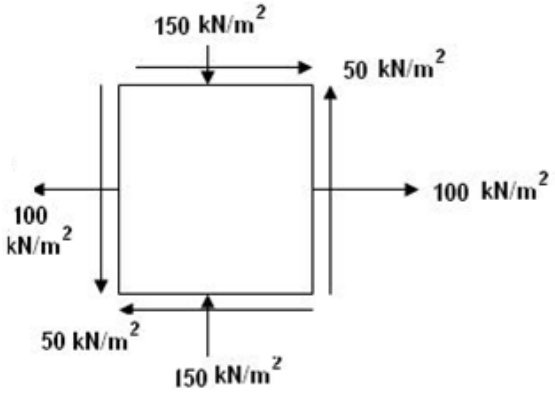

Figure 1

2. Determine the maximum shearing stress and elongation in a helical steel spring composed of 20 turns of 20-mm-diameter wire on a mean radius of 90 mm when the spring is supporting a load of 1.5 kN. G = 83 GPa.

3. A coupling rod of ***I*** **-** section is 2.5 m length and is 125 mm deep overall. The two flanges are 60 mm width and 5 mm thick where as web is 2.5 mm thick. The axial load on the rod is 180 kN and the lateral load 3.75 kN uniformly distributed. Find the maximum value of the stress developed. E = 200 GPa.

4. A straight bar of steel 100 cm long and 20 x 7.5 mm in section is mounted in a testing machine and loaded axially in compression till it buckles. Assuming the Euler's formula for pinned ends to apply, estimate the maximum central deflection before material attains its yield stress of 320 N/mm^2. E = 2.1 x 10^5 N/mm^2.

5. A compressive load of P = 80 kN is applied through Z –axis with an eccentricities of 40 mm and 60 mm along the X – and Y – axis respectively from the centriod of a column. The column dimensions are along x – axis 200 mm and along Y –axis 400 mm. Compute the stress at each corner and the location of neutral axis. Illustrate your answers with a sketch. What additional load applied at the cetriod is necessary so that no tensile stress exists anywhere on the cross section.
~~~~~~~~~~~~~~~~~~~~~~

Code No: T0122 **R07** SET - 2

6. a) What is unsymmetrical bending? Explain.
   b) A rectangular beam 50 mm x 80 mm is arranged as a cantilever beam 1.3 m long and loaded at its free end with a load of 5 kN inclined at an angle of 30^0 to the vertical axis and passing through the centriod of the section. Determine the position and magnitude of the greatest tensile stress in the section. E = 2.1 x 10^5 N/mm^2.

7. For a semicircular beam simply supported on three supports equally spaced. Compute the maximum Twisting moment and location at which this maximum twisting moment occurs for a uniformly distributed load of intensity ***w***, acting on the entire beam.

8. Find the forces in members of truss shown in Figure2 and tabulate the values.

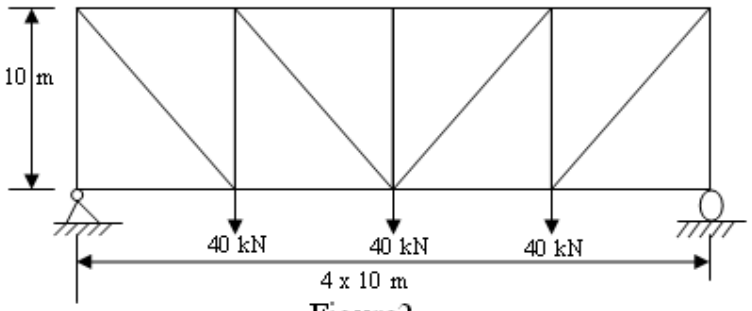

Figure2

Code No: T0122 **R07** SET - 3

II B. Tech II Semester Supplementary Examinations Dec – 2012
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 80

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

1. a) Discuss briefly about maximum shear stress energy theory
b) Two of the principal stresses at a point are 130 N/mm^2 and 90 N/mm^2. Determine the safe range of the third principal stress at the point by i) Maximum principal stress theory ii) maximum shear stress theory iii) maximum strain energy theory iv) maximum distortion energy theory. Take E = 2 X 10^5 N/mm^2, failure stress in tension test to be 210 N/mm^2 and μ = 0.25. Assume failure stress in tension and compression is same.

2. a) Derive an expression for the angle of twist of a circular shaft as a function of the applied twisting moment. Assume that the entire shaft is acting within the elastic range of action of the material.
b) A solid circular shaft is required to transmit 200 kW while turning at 1.5 rev/s. The allowable shearing stress is 42 MPa. Find the diameter of shaft required.

3. A 2.7 m long column of rectangular section measuring 150 mm x 50 mm carries an axial load of 60 kN and a lateral distributed load of 2.7 kN. Find the minimum stress induced if both ends of the column are hinged. Also calculate the percentage error in the minimum stresses if axial load effects on bending are neglected. E = 80 GPa.

4. a) Derive the expression for Euler's crippling load for long column with both ends hinged.
b) A hallow cylindrical steel strut has to be designed for the flowing conditions. Length 2m, axial load 100 kn, ration of internal to external diameter 0.8, and factor of safety 3. Determine the necessary external diameter of the strut and the thickness of the metal, if the ends of the strut are hinged. Use Rankine's formula. Take E = 2.1 x 10^5 N/mm^2, yield stress = 320 N/mm^2 and Rankine's constant is 1/7500.

5. A compressive load of P = 100 kN is applied through Z –axis with an eccentricities of 70 mm and 30 mm along the X – and Y – axis respectively from the centriod of a column. The column dimensions are along x – axis 300 mm and along Y –axis 150 mm. Compute the stress at each corner and the location of neutral axis. Illustrate your answers with a sketch. What additional load applied at the centriod is necessary so that no tensile stress exists anywhere on the cross section.
~~~~~~~~~~~~~~~~~~~~~~

Code No: T0122 **R07** SET - 3

6. A cantilever beam of I – section is used to support the loads inclined to the V – axis as shown in Figure1. Calculate the stresses at the corners A, B, C and D. Also locate the neutral axis.

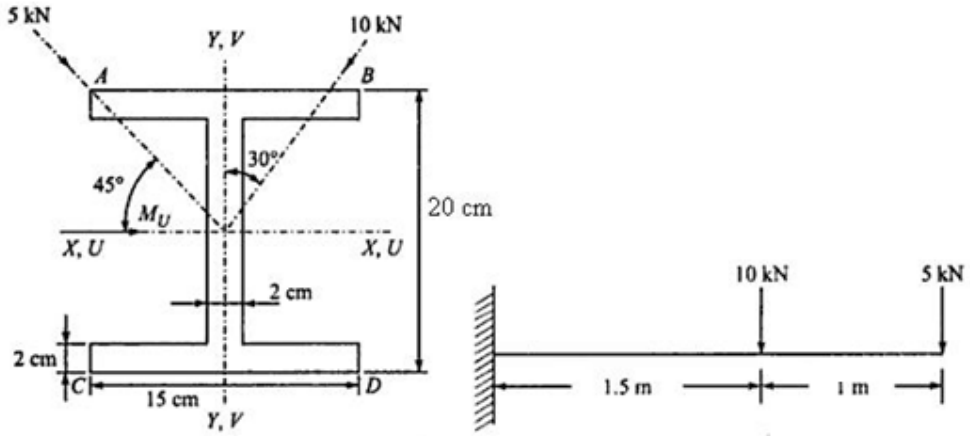

Figure 1

7. For a semicircular beam simply supported on three supports equally spaced. Compute the maximum bending moment and location at which this maximum bending moment occurs for a uniformly distributed load of intensity ***w***, acting on the entire beam

8. Determine the forces in the members of a pin jointed steel structure in the given figure 2 by method of slices.

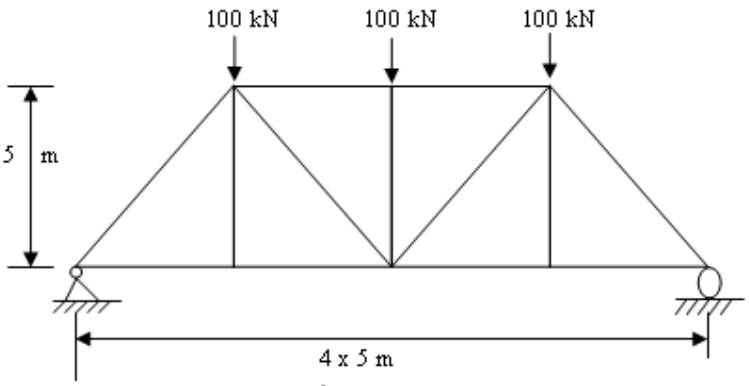

Figure 2

Code No: T0122 **R07** SET - 4

II B. Tech II Semester Supplementary Examinations Dec – 2012
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 80

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

1. Derive an expression for the major and minor principal stresses on an oblique plane, when the body is subjected to direct stresses in two mutually perpendicular directions accompanied by a sear stress.

2. a) Derive an expression for the angle of twist of a circular shaft as a function of the applied twisting moment. Assume that the entire shaft is acting within the elastic range of action of the material,
b) Compute the maximum shearing stress developed in a phosphor bronze spring having mean diameter of 200 mm and consisting of 24 turns of 200-mm-diameter wire when the spring is stretched 100 mm. Use G = 42 GPa.

3. A strut of 40 mm diameter and 3.2 m length carries a compressive load of 36 kN along with a transverse wind load of 800 N/m. Find the maximum stress developed in the strut. E = 200 GPa.

4. a) Develop secant formula and discuss with its importance.
b) Compare the crippiling loads given by Euler's and Rankine's formulas for the tubular steel strut 2.5 m long having outer and inner diameters of 4 cm and 3.5 cm respectively. Assume the pin joints at both ends. Permissible stress, σ_s = 320 N/mm^2.

5. a) What do you mean by eccentricity of loading? What are its effects on a column section?
b) A hollow rectangular column is 120cm deep, 80cm wide and 15cm thick. An eccentric load of 200kN acts on the centroidal axis bisecting 120cm long side, the eccentricity being 10cm. Determine the maximum and minimum stress in the column.
~~~~~~~~~~~~~~~~~~~~~~

Code No: T0122 **R07** SET - 4

6. A beam of T – section (flange: 100 X 20 mm, Web 150 X 10 mm) is 3 m in length and is simply supported at the ends as shown in Figure 1. It carries a load of 5 kN inclined at 20^0 to the vertical and passing through the centriod of the section. If E = 210 GPa, calculate:
   i) Maximum tensile stress ii) maximum compressive stress iii) Deflection due to the load iv) position of the neutral axis.

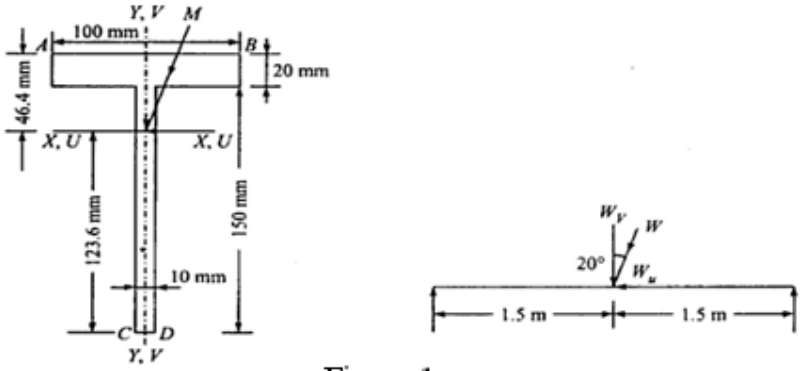

Figure 1

7. For a semicircular beam simply supported on three supports equally spaced. Compute the maximum Twisting moment and location at which this maximum twisting moment occurs for a uniformly distributed load of intensity ***w***, acting on the entire beam.

8. Determine the forces in the members FH, HG and GI in the truss shown in Figure 2. Each load is 10 kN and all triangles are equilateral with sides 4 m.

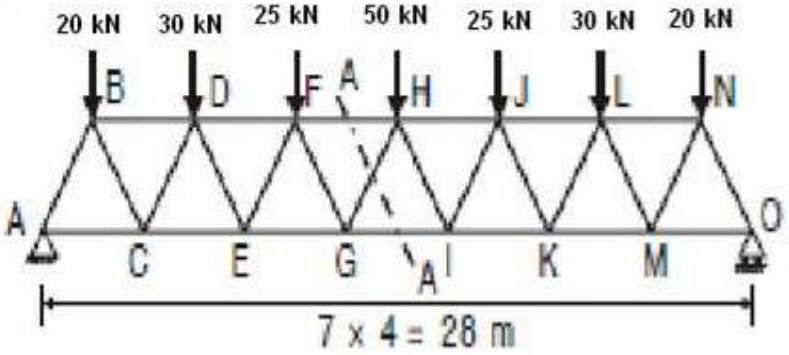

Figure2