Code No: RT22013 **R13** SET - 1

II B. Tech II Semester Regular/ Supplementary Examinations, April/May-2017
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Discuss in brief various prominent theories of failure.
   b) Compare the weights of equal lengths of hollow and solid shafts to transmit a given torque for the same maximum shear stress if the inside diameter is 2/3 of the outside.
   c) Why is it necessary to use the minimum radius of gyration of section to calculate the crippling load? Explain briefly.
   d) Explain the conditions for stability of dam.
   e) Discuss briefly the stresses in beams subjected to unsymmetrical bending.
   f) What are the different methods of analyzing for finding out the forces of a perfect frame? Which one is used where and why?

PART -B

2. a) Derive expressions for principal stresses and maximum shear stress when a body is subjected to a simple stresses in two mutually perpendicular directions.
   b) At a point in a material, the stresses on two mutually perpendicular planes are $50 N/mm^2$ (tensile) and $30 N/mm^2$ (tensile). The shear stress across these planes is $12 N/mm^2$. Using Mohr circle, find magnitude and direction of the resultant stress on a plane making an angle of 35^0 with the plane of the first stress. Find also, the normal and tangential stresses on this plane.

3. a) A 50 kW has to be transmitted at 150 R.P.M. Find the necessary diameter of solid circular shaft. Find necessary hollow shaft with internal diameter equal to 3/4 of external diameter. What will be the % savings in the weight of the shaft? Allowable shear stress is $90 N/mm^2$ and density of the material is $7 g/cm^3$.
   b) Calculate the angle of twist for a shaft having diameter of 60 mm at one end and 70mm at the other end in a length of 2 m. Also, find the % error committed in calculating, if it is calculated on the basis if an average diameter of 65 mm.

4. A cast iron hollow column of 200 mm external diameter and 160 mm internal diameter is 4 m long. It is fixed at its both ends and subjected to an eccentric load of 150 kN. Determine the maximum eccentricity, in order that there is no tension any where in the section. Take $E = 0.94 \times 10^5 N/mm^2$.

5. Masonry dam 9m high, 1.5m wide at top and 6m wide at the base retains water to a depth of7.5m, the water face of the dam being vertical. Find maximum and minimum stress intensities at the base. The weight of water is $9.81 kN/m^3$ and weight of masonry is $24 kN/m^3$
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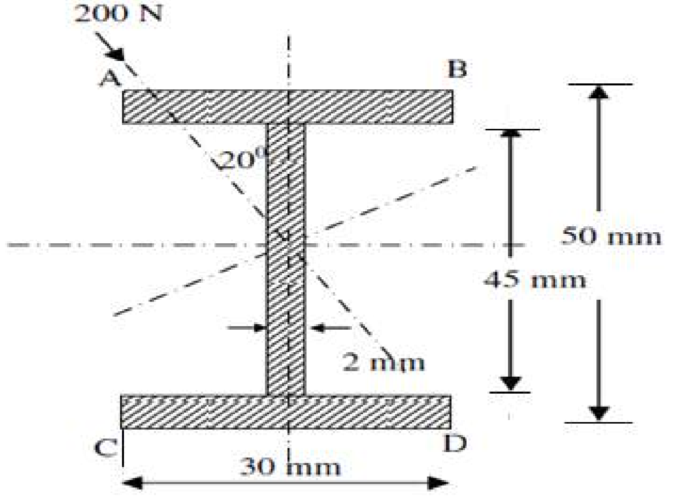
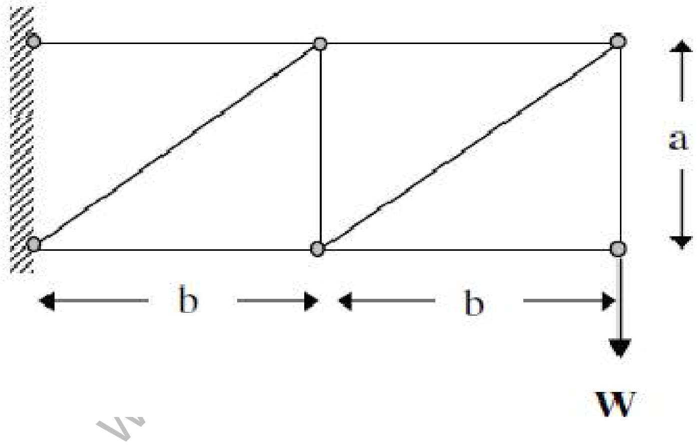
R13

SET - 1

6. A cantilever, of I – section, 2.4 meters long is subjected to a load of 200 N at the free end as shown in figure. Determine the resulting bending stresses at corners A and B, on the fixed section of the cantilever.



7. Determine the forces in the members of pin jointed steel structure shown in figure by the method of section.



Code No: RT22013 **R13** SET - 2

II B. Tech II Semester Regular/ Supplementary Examinations, April/May-2017
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Write a note on significance of theories of failure.
   b) Derive the fundamental torsion equation.
   c) Compare the ratio of the strength of a solid steel column to that of a hollow of the same cross-sectional area. The internal diameter of the hollow column is ¾ of the external diameter. Both the columns have the same length and are pinned at the ends.
   d) Explain the conditions for stability for retaining wall.
   e) Discuss briefly about deflection of beams under unsymmetrical bending.
   f) What is the advantage of method of section over method of joints?

PART -B

2. a) Maximum shear stress theory and Maximum strain energy theories of failure that govern the design of a stressed system.
   b) A piece of material is subjected to tensile stresses of P1 and P2 at right angles to each other (p1>p2). Find the plane across which the resultant stress is most inclined to the normal. Find the value of this inclination and the resultant stress when p1 = 60 N/mm^{2}and p2 = 40 N/mm^2 (both tensile).

3. An open coiled helical spring is made of 12mm diameter wire has 16 coils and 75mm mean diameter with each coil makes an angle of 15^0 with the plane perpendicular to the axis of the spring. Calculate for an axial load of 300N i) Axial deflection, ii) Twist about horizontal axis of the free end and iii) Maximum intensities of direct and shear stresses induced in the section of the wire.
   $E = 2.0 \times 10^5$ N/mm^2, $G = 0.82 \times 10^5$ N/mm^2

4. A 350 mm × 165 mm R. S. joist is used as a strut, 6 metres long, one end fixed, the other hinged. Calculate the crippling load by Rankines formula. Compare this with the load obtained by the Euler formula, taking E = 2×105N/mm^2. For what length of this strut will the two formulae give the same crippling load? For the joist, area of section = 630mm^{2}Ixx = 13158.3 ×10^{4}mm^4; Iyy = 631.9 × 10^{4}mm^4.
   Take fc = 315N/mm^2

5. A Retaining wall 3m wide at top and 8m wide at bottom and 12m high is subjected to earth pressure on the back. If the weight of masonry is 25kN/m^3, and weight of earth retained is16kN/m^2 and angle of repose is 30^0 is horizontal and level with the top of the wall, Find maximum and minimum stress intensities at the base. Examine the stability of the wall if μ=0.62.
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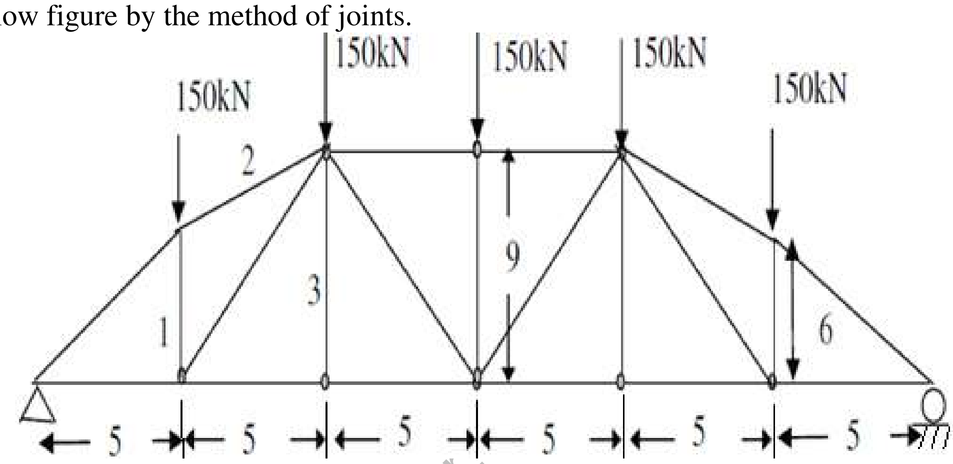
6. A 240 mm × 120 mm steel beam of I-section is simply supported over a span of 6m and carries two equal concentrated loads at points 2 m from each end. The properties of the section are $I_{xx} = 6012.32 \times 10^4 mm^4$, $I_{yy} = 452.48 \times 10^4$ mm^4.
a) Determine the magnitude of the loads when the plane of the loads is vertical through YY. The permissible stress is 150 N/mm^2 in compression and tension.
b) Determine the degree of inclination of the plane of these loads to the vertical principal plane YY that will result in 20 percent greater bending stress than permitted under (A).

7. Determine the forces in the members' 1, 2, 3 of a pin jointed steel structure in below figure by the method of joints.



Code No: RT22013 **R13** SET - 3

II B. Tech II Semester Regular/ Supplementary Examinations, April/May-2017
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Explain briefly the maximum shear strain energy theory
   b) Derive expression for deflection in an open coiled helical spring subjected to axial load?
   c) Enumerate the assumptions of Euler's theorem for long columns.
   d) Explain briefly determination of stresses in the case of chimneys.
   e) Explain graphical method for locating principal axes.
   f) How will you use method of section in finding forces in the members of a truss? Explain briefly.

PART -B

2. A bending moment of M applied to a solid round shaft causes a maximum direct stress f at elastic failure. Determine the numerical relation between Bending moment M and twisting moment T which acting alone on the shaft, will produce elastic failure according to each of the following theories of failure i) Maximum Principal stress, ii) Maximum Principal Strain Theory, iii) Maximum Shear Stress Theory iv) Maximum strain energy theories. Poisson's ratio =0.3

3. A closely coiled helical spring is made out of 10mm dia. steel rod, the coil having12 complete turns. The mean dia. of spring is 10mm. Calculate the shear stress induced in the section of the rod due to an axial load of 250N. Find also the deflection under the load, energy stored in the spring and the stiffness of spring. Take N = 8 x10^4 N/mm^2.

4. A column of circular cross section made of cast iron 300mm in diameter and 25mm thick is used as a column 5m long. Both the ends of the column are fixed. The column carries a load of 300kN at an eccentricity of 25mm from the axis of the column. Find the extreme stress on the column section. Determine the maximum eccentricity in order there may be no tension anywhere on the section.

5. A cylindrical chimney shaft of a hollow circular section, 2.50 meters external diameter, 1 meter internal diameter, is 30 meters high. If the horizontal intensity of wind pressure varies as X2/3 where X is the vertical height above the ground, calculate the over turning moment at the base due to the force of wind pressure, taking the coefficient of wind-resistance as 0.6. Given that the horizontal intensity of wind pressure at a height of 20 meters is 1KN/m^2. If the weight of masonry is 22.5KN/m^3, calculate the extreme intensities of stress at the base
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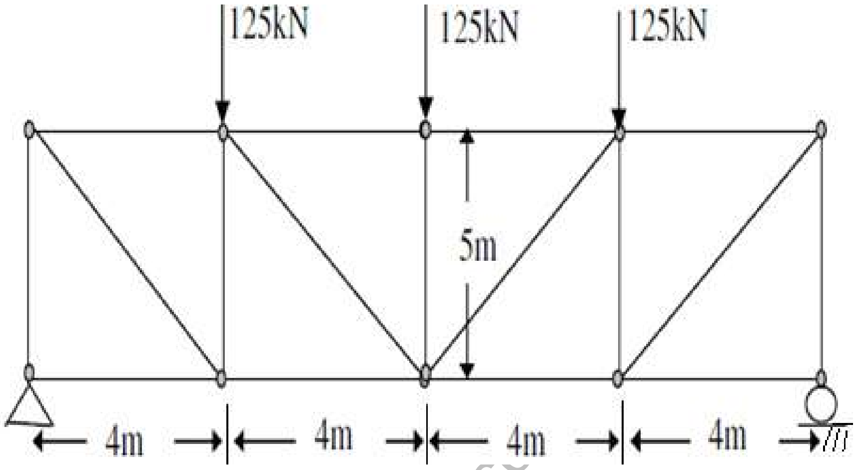
6. A beam having an I section 5m in length carrying a uniformly distributed load of 15 kN/m and having the section properties listed below. Calculate maximum bending stresses induced in the member when the trace of load plane is inclined at 18^0 to the principal axis YY. Calculate the maximum deflection in the beam.
$I_{XX} = 13158\ cm^4$, $I_{YY} = 631.9\ cm^4$, $Z_{XX} = 751.9\ cm^3$ $Z_{YY} = 76.6\ cm^3$, h = 350mm, b = 165mm

7. Determine the forces in the members of a pin jointed steel structure in figure by method of sections.



Code No: RT22013 **R13** SET - 4

II B. Tech II Semester Regular/ Supplementary Examinations, April/May-2017
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Discuss briefly about maximum shear stress theory.
b) Derive general equation governing the torsion in a circular shaft.
c) What is meant by Euler's critical stress and write limitations of Euler's theory.
d) Where do you use beams curved in plan?
e) Explain phenomenon of "Unsymmetrical bending" in structural elements.
f) Explain briefly tension coefficient method.

PART –B

2. At a point is an elastic material there are normal stresses of 35MPa (tensile) and 25MPa (compressive) on two mutually perpendicular planes, accompanied by shearing stresses of 10MPa on the same planes. The loading on the material is increased so that the stresses reach values of K times those given. If the max. direct stress is not to exceed 80MPa and the max shear stress is not to exceed 50 MPa, find them ax value of K.

3. a) Find the percentage saving in material if a hollow shaft of the same material is to replace a solid shaft transmitting the same torque the internal dia = 3/4 of externaldia.
b) A propeller shaft 200 mm dia. transmits 3000 H.P. at 240 R.P.M. The propeller weighing 50 kN is carried by the shaft overhanging the support by 40 cm. The propeller thrust is 150 kN. Calculate the max. direct and shear stress induced in the cross-section of the shaft. Find also the planes on which they act.

4. A hollow C.I. column with fixed ends supports an axial load of 1000 kN. If the column is 5m long and has an external diameter of 250mm, find the thickness of metal required. Use the Rankine's formula, taking a constant 1/6400 and assume a working stresses of 80N/mm^2.

5. A Masonry dam 8m high, 1.5m wide at top and 5m wide at the base retains water to a depth of7.2m, the water face of the dam being vertical. Find maximum and minimum stress intensities at the base. The weight of water is 9.81kN/m^3 and weight of masonry is 22kN/m^3.
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Code No: RT22013 **R13** SET - 3

6. A 500 x 500 mm timber is strengthened by the addition of 500mm x 8mm steel plates secured to its top and bottom surfaces. The composite beam is simply supported at it sends and carries a uniformly distributed load of 100kN/m run over an effective span of 6m. Find the maximum bending stresses in steel and timber at the mid span. Take ES =2x 10^5 N/mm^2 and E_T = 0.1 x 10^5 N/mm^2.

7. Determine the forces in the members of a pin jointed steel structure in figure by method of sections.