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

II B. Tech II Semester Regular Examinations, May/June - 2015
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) If the principal stresses at a point in an elastic material are 2f tensile, 1.5f tensile and f compressive, calculate the value of 'f' at failure according to the maximum principal strain theory. The elastic limit in simple tension is 210 N/mm^2 and Poisson's ratio is 0.30.
   b) A 450 kW of power has to transmit at 100 r.p.m. Find the suitable diameter of hollow circular section, the inside diameter being 3/4 of the external diameter. Take allowable shear stress as 70 N/mm^2.
   c) Write and explain about the limitations of Euler's Formula.
   d) Find core diameter of a solid section, if diameter is 'd'.
   e) Explain the concept of unsymmetrical bending. What are the conditions that should be satisfied for a beam to bend without twisting?
   f) Explain the procedure for tension coefficient method in statically determinate frame.

(4M+4M+3M+4M+4M+3M)

PART-B

2. Direct stresses of 120 N/mm^2 (tensile) and 90 N/mm^2 (compressive) exist on two perpendicular planes at a certain point in a body. They are also accompanied by shear stress on the planes. The greatest principal stress at the point due to these is 150 N/mm^2.
   i) What must be the magnitude of the shearing stresses on the two planes?
   ii) What will be the maximum shearing stress at the point?

3. a) Derive the torsion equation from fundamentals $T/J = q/r = N\theta/L$ with usual notation.
   b) A solid steel shaft has to transmit 75 kW at 200 r.p.m., taking allowable shear stress as 70 N/mm^2. Find the diameter for the shaft, if maximum torque transmitted at each revolution exceeds the mean by 30%.
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4. A hollow rectangular column of external depth 1 m and external width 1 m is 10 cm thick. Calculate the maximum and minimum stress in the section of the column, if vertical load of 200 kN is acting with an eccentricity of 20 cm.

5. A beam carries a UDL of 50 kN/m over a span of 2 m long, with an axial compressive load of 50 kN. The beam section is rectangular, having depth equal to 240 mm and width equal to 120 mm. Compute (i) maximum fibre stress, (ii) fibre stress at a point 0.5 m from the left end of the beam and 80 mm below the N.A.

6. A beam of rectangular section, 80 mm wide and 10 mm deep is subjected a bending moment of 12 kN-m. The trace of the plane of loading is included at 45^{o} to the Y-Y axis of the section. Locate the neutral axis of the section and calculate the maximum bending stress induced in the section.

7. A cantilever truss is loaded as shown in Figure 1. Analyze the truss by method of sections.

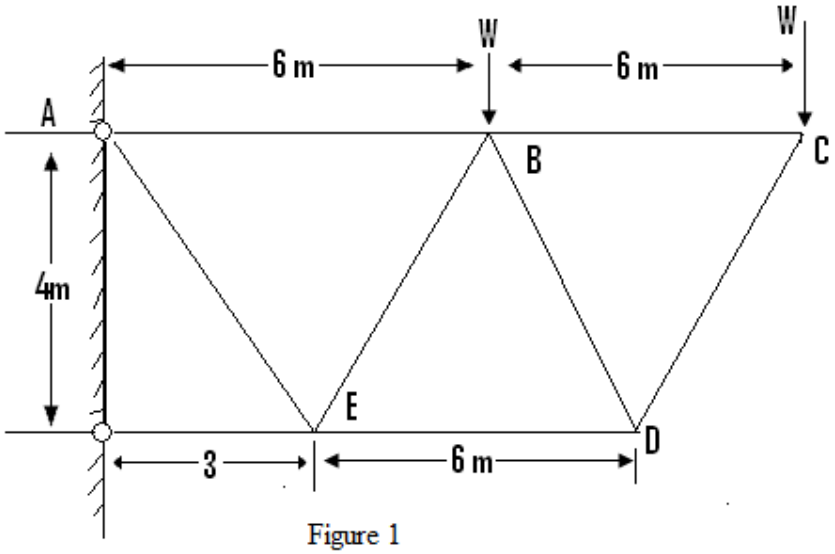

Figure 1

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

II B. Tech II Semester Regular Examinations, May/June - 2015
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) In a piece of material, a tensile stresses p1 and a shearing q act on a given plane. Show that principal stresses are always of opposite sign.
   b) Write the assumptions made in the theory of torsion.
   c) Calculate Euler's critical stress for the column having slenderness ratio 100,150 with both ends hinged. Take E = $2x10^5$ N/mm^2.
   d) Find core diameter of a hollow section, if external and internal diameter are 'D' and 'd'.
   f) State the assumptions made in analyzing a beam for unsymmetrical bending.
   g) Explain the procedure for method of sections in statically determinate frame.

(4M+3M+4M+4M+3M+4M)

PART-B

2. A circular shaft 100 mm diameter is subjected to combined bending and twisting of moments the B.M being 3 times the twisting moment. If the direct tensile yield point of the material is 350 N/mm^2, and the factor of safety is 4, calculate the allowable twisting moment according to the following theories of failures. (i). maximum principle stress theory, (ii) shear strain energy theory, if the simple shear is not to exceed 60 N/mm^2.

3. Derive the maximum shear stress induced, in the wire of a closed-coiled helical spring which carries an axial load W. Assume mean radius of spring coil is R and diameter of spring wire is d.

4. In an experimental determination of the buckling load for a rod 12 mm mild steel pin ended struts of various lengths, two of the values obtained were: (a) When the length is 50 cm load is 10 kN and (b) When the length is 20 cm load is 30 kN.
   Make necessary calculations and state whether either of the values of the loads, confirm with Euler's formula for the critical load. Take E= $2x10^5$ N/mm^2.
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5. A hollow rectangular column of external depth 1 m and external width 1 m is 10 cm thick. Calculate the maximum and minimum stress in the section of the column if vertical load of 200 kN is acting with an eccentricity of 20 cm.

6. Determine the principal moments of Inertia for an angle section 225x175x15 mm.

7. A cantilever truss is loaded as shown in Figure 1. Analyze the truss by method of joints.

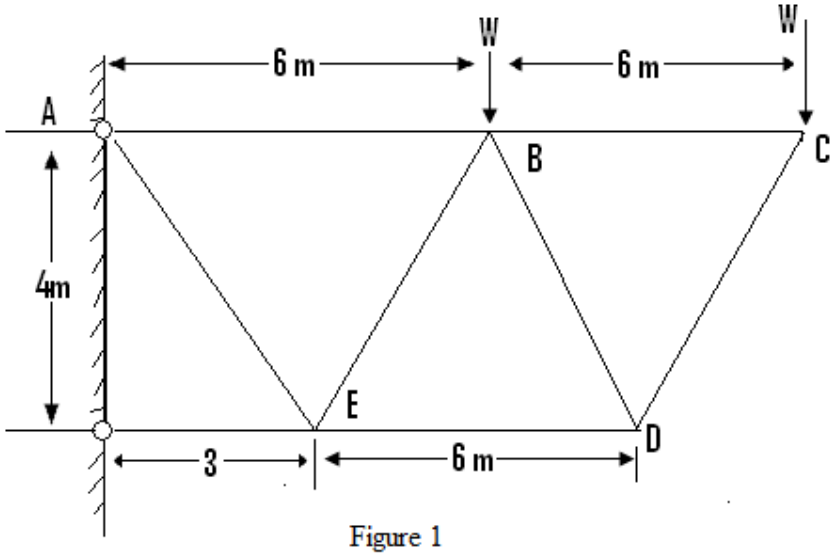

Figure 1

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

II B. Tech II Semester Regular Examinations, May/June - 2015
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) Show that the greatest shear strain is equal to greatest difference of principal strains.
   b) Find the maximum torque that can be safely applied to a shaft of 200 mm diameter, if the permissible shear stress is 45 N/mm^2.
   c) An I-section joist ISWB400 and 8 m long is used as a strut with both ends fixed, determine Euler's crippling load. Give for the section Ixx = 23426.7 cm^4, Iyy= 1388.0 cm^4 and E = 2x10^5 N/mm^2.
   d) Find maximum eccentricity of the rectangular section (width b and depth d) for no tension in the section.
   f) Explain the concept of unsymmetrical bending. What are the conditions that should be satisfied for a beam to bend without twisting?
   g) Determine the forces in the members of equilateral triangle truss of span 'L' loaded with a point load 'W'. (4M+3M+4M+4M+4M+3M)

PART-B

2. An element is subjected to tensile stresses of 60 N/mm^2 and 20 N/mm^2 acting on two perpendicular planes and is also accompanied by shear stress of 20 N/mm^2 on these planes. Draw the Mohr's circle of stresses and determine the magnitudes and directions of principal stresses and also the greatest shear stress.

3. A leaf spring carries a central load of 3000 N. The leaf spring has to be made of 10 steel plates 5 cm wide and 6 mm thick. If the bending stress is limited to 150 N/mm^2 determine: (i) length of the spring and (ii) deflection at the centre of the spring. Take E = 2x10^5 N/mm^2.
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4. a) Derive Euler's buckling load formula of a long column pinned at both ends.
   b) A solid round bar 3 m long and 5 cm in diameter is used as a strut with one end is fixed and other is hinged. Determine the crippling load. Take E = $2x10^5$ N/mm^2.

5. A short column of external diameter 40 cm and internal diameter 20 cm carries an eccentric load of 80 kN. Find the greatest eccentricity which the load can have without producing tension on the cross –section.

6. A rectangular section of dimensions 120 x 200 mm is used as a beam on a 3 m span, If the beam is loaded by a concentrated load (P) at the centre at 30^o to the vertical (Y-Y axis). Find the maximum value of the load 'P' in kN, if the maximum bending stress is not to exceed 12 MPa.

7. Determine the member forces of the truss shown in Figure 1, using method of joints.

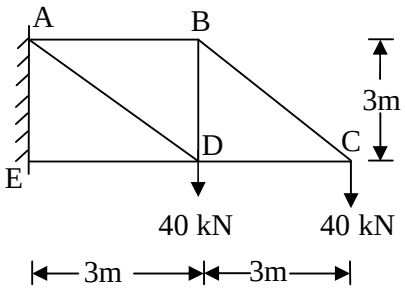

Figure 1

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

II B. Tech II Semester Regular Examinations, May/June - 2015
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 the maximum principal stress theory.
   b) A solid shaft is required to transmit 120 kW power at 200 r.p.m. Find the suitable diameter of the shaft if maximum torque transmitted in each revelation exceeds the mean by 20%. Take allowable shear stress as 70 N/mm^2.
   c) Calculate Euler's critical stress for the column having slenderness ratio 150, 200 with both ends fixed. Take E = $2x10^5$ N/mm^2.
   d) Explain about the term kernel and determine the size of kernel for a rectangular 200 mm x 300 mm.
   f) State the assumptions made in analyzing a beam for unsymmetrical bending.
   g) Explain the procedure for tension coefficient method in statically determinate frame.

(4M+4M+3M+4M+3M+4M)

PART-B

2. 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 shear stress

3. a) Derive the maximum shear stress induced, in the wire of a closed-coiled helical spring which carries an axial load W. Assume mean radius of spring coil is R and diameter of spring wire is d.
   b) A leaf spring carries a central load of 3000 N. The leaf spring has to be made of 10 steel plates 5 cm wide and 6 mm thick, if the bending stress is limited to 150 N/mm^2. Determine: (i) length of the spring and (ii) deflection at the centre of the spring. Take E = $2x10^5$ N/mm^2.
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4. A 1.5 m long column has a circular cross section of 5 cm diameter, one of the ends of the column is fixed in direction and position, and the other end is free. Taking factory of safety as 3, calculate the safe load using: (i) Rankin's formula, take yield stress is 560 N/mm^2 and a= 1/1600 for pinned ends, (ii) Euler's formula, Young's Modulus for the material is $1.2x10^5$ N/mm^2.

5. A square chimney, 30 m high, has a flue opening of size 1.5 m x 1.5 m. Find the minimum width required at the base for no tension if the masonry weights 20 kN/m^3 and the wind pressure is 1.5 kN/m^2. The permissible stress in the masonry is $1kN/m^2$.

6. A T-Section of dimensions 150 wide x 200 mm deep, with 10 mm thickness of flange and web, is used as simply supported a beam on a span of 6 m. Find the maximum value of 'w' in kN/m, the permissible stress in the material is 120 MPa. The plane of loading is inclined at an angle of 40^o to the vertical plane.

7. Determine the member forces of the truss shown in Figure 1, using method of sections.

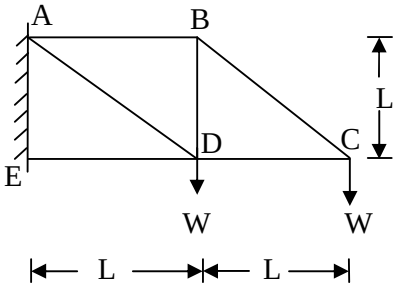

Figure 1

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

II B. Tech II Semester Supplementary Examinations, November - 2020
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) What are different failures? (4M)
   b) Write about axial couple. (3M)
   c) Write the expression for buckling load (or) Crippling load when both ends of the Columns are fixed? Explain each term. (4M)
   d) Write the conditions for stability. (4M)
   e) What are the types of beams? (3M)
   f) Write the conditions of equilibrium. (4M)

PART -B

2. In a material the principal stresses are 60 MN/m^2, 48 MN/m^2 and - 36 MN/m^2. Calculate (16M)
   (i) Total strain energy
   (ii) Volumetric strain energyP
   (iii) Shear strain energy
   (iv) Factor of safety on the total strain energy criteria if the material yields at 120 MN/m^2.
   Take E = 200 GN/m^2 and 1/m = 0.3

3. A shaft is required for transmitting a power of 60 kW running at a speed of 750 rpm. if the available shaft material has permissible shear strength of 36 N/mm^2 and rigidity modulus of 96kN.mm design a hollow shaft such that the inner diameter is 0.6 times the outer diameter. (16M)

4. A mild steel tube 4m long, 3cm internal diameter and 4mm thick is used as a strut with both ends hinged. Find the collapsing load, what will be the crippling load if (16M)
   (i) Both ends are built-in.
   (ii) One end is built-in and one end is free

5. (a) Determine stresses in case of chimney with suitable example (8+8M)
   (b) What is the core of a section. Calculate core for the rectangular section
~~~~~~

6. (a) What do you mean by unsymmetrical bending? (8+8M)
   (b) A beam of rectangular section 80mm wide and 120mm deep is subjected to a bending moment of 12kN.m The trace of the plane of loading is inclined at 45^0 to the y-y axis of the section. Locate the neutral axis of the section and calculate the maximum bending stress induced is the section

7. Explain method of tension coefficients, and explain why it is preferred to analyze the trusses. (16M)

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

II B. Tech II Semester Supplementary Examinations, November - 2019
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) Define Normal stress and Tangential stress. (4M)
   b) What are the different Types of springs? (3M)
   c) What are the assumptions of Euler's theorem for long columns? (4M)
   d) What are the different types of beam? (3M)
   e) What is unsymmetrical bending? (4M)
   f) Define indeterminacy with suitable example. (4M)

PART -B

2. In a material the principal stresses are 50 N/mm^2, 40 N/mm^2 and -30 N/mm^2, calculate: (16M)
   (i) Total strain energy
   (ii) Volumetric strain energy
   (iii) Shear strain energy and
   (iv) Factor of safety on the total strain energy criterion if the material yield at 100 N/mm^2.
   Take E = 200 x 10^3 N/mm^2 and poission ratio = 0 .28

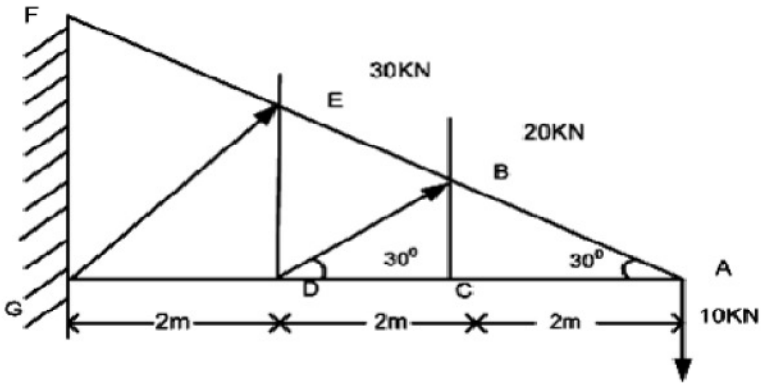
3. A carriage spring consists of 6 plates of steel, the cross section of each plate being 60mm wide and 6 mm thick. The length of the longest plate is 1040mm. the central load required to straighten the spring is 4KN. Modulus of elasticity of the material of the spring=2x10N/mm. Calculate the deflection in the spring. (16M)

4. (a) A steel column is of length 8 m and diameter 600 mm with both ends hinged. Determine the crippling load by Euler's formula. Take E =2.1 x 105 N/mm2 (8+8M)
   (b) Derive the expression for crippling load when column with one end fixed and other end hinged.

5. A hollow rectangular masonry pier is 1.2m x 0.8m wide and 150mm thick. A vertical load of 2 MN is transmitted in the vertical plane bisecting 1.2 m side and at an eccentricity of 100mm from the geometric axis of the section. Calculate the maximum and minimum stress intensities in the section. (16M)
~~~~~~

6. A beam of rectangular cross section is subjected to pure bending with a moment of 20kN.m. The trace of the plane of loading is inclined at 45^0 to the YY axis of the section. Identify the N.A of the section and calculate the bending stress induced at each corner of the beam section (16M)

7. (16M)



Find the forces in all the members of the cantilever type plane pin jointed truss loaded as shown in above fig. Use method of sections.

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

II B. Tech II Semester Supplementary Examinations, April-2018
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) What is Mohr's circle of stresses? (4M)
   b) Draw springs in series and springs in parallel (4M)
   c) What are the different types of columns? (3M)
   d) Define bending stress &Direct stress (4M)
   e) What are the stresses in beam subjects to unsymmetrical bending? (4M)
   f) Define degree of freedom (3M)

PART -B

2. Derive expressions for principal stresses, principal planes and max shear stress if there are like direct stresses accompanied by a state of simple shear (16M)

3. A shaft transmits 300kW power at 120rpm. Determine the necessary diameter of solid circular shaft and the necessary diameter of hollow circular section, the inside diameter being 2/3 of the external diameter. The allowable shear stress is $70N/mm^2$. Taking the density at material as $77N/m^3$, calculate the %saving in the shaft if hollow shaft is used. (16M)

4. A column having a T section with a flange 120 mm x 16 mm and web 150 mm x 16mm is 3m long. Assuming the column to be hinged at both ends, find the crippling load by using Euler's formula. $E = 2 \times 10^6$ Kg/cm^2 (16M)

5. A beam of rectangular cross section is subjected to pure bending with a moment of 20kNm. The trace of the plane of loading is inclined at 45^0 to the YY axis of the section. Identify the N.A of the section and calculate the bending stress induced at each corner of the beam section (16M)
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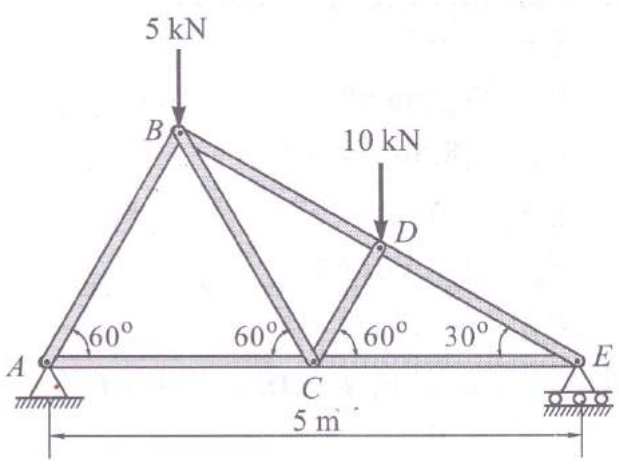
6. a) Explain in brief how stresses in beams due to unsymmetric bending is considered. (8+8M)
   b) Explain in brief the method of locating shear centre

7. Determine the forces in all the members of the frame by method of joints. (16M)



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

II B. Tech II Semester Supplementary Examinations, Dec/Jan-2015-16
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) Define the term obliquity.
   b) What are the springs in series and in parallel?
   c) Write the crippling load by Rankine's formula. Mention the each term in the formula.
   d) What is the difference between dam and a retaining wall?
   e) Define unsymmetrical bending and shear centre.
   f) What is a frame? State the difference between perfect frame and imperfect frame?

PART -B

2. a) Derive the normal stress, tangential stress and resultant stress of two mutually perpendicular principal stresses of unequal intensities by Mohr's method.
   b) Define and explain maximum strain energy theory.

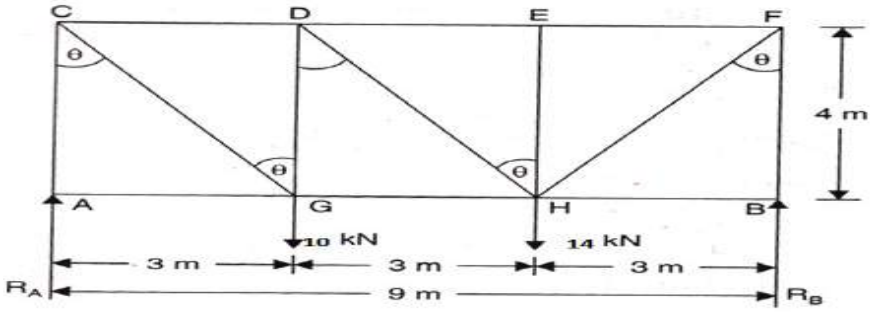
3. Derive the Torsion equation $T/J = \tau/R = C\theta/L$

4. a) Derive the equation for the Euler's crippling load for a column when both ends fixed.
   b) What is a slenderness ratio?

5. A column is rectangular in cross section 300 x 400 mm .The column carries an eccentric loading of 360kN on one diagonal at a distance of quarter diagonal length from a corner. Calculate the stresses at all four corners. Also draw stress distribution diagram for any side.

6. Determine the stresses and deflection for the mid section of the I beam by unsymmetrical method. Also identify the position of the neutral axis

7. Find the reactions in the members by method of joints.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