Code No: RT21013 **R13** SET - 1

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
STRENGTH OF MATERIALS - I
(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 about Elasticity (3M)
   b) Explain the Concept of shear force (4M)
   c) What is bending stress (4M)
   d) Draw Shear stress distribution for circular section (4M)
   e) Define Mohr's theorem (4M)
   f) What is Thin cylinder? (3M)

PART -B

2. A hollow cylinder 2 m long has an outside diameter of 50 mm and inside diameter of 30 mm. If the cylinder is carrying a load of 25 kN, find the stress in the cylinder. Also find the deformation of the cylinder, if the value of modulus of elasticity for the cylinder material is 100 GPa. (16M)

3. a) Define the following : (6M)
      i) Bending Moment.
      ii) Shear force.
      iii) Point of contraflexure.
   b) A cantilever beam of length 2m carries an uniformly distributed load of 3KN/m over a length of1.5m from its fixed end and a point load 5 KN at its free end. Draw the shear force and bending moment diagrams. (10M)

4. Obtain the shear stress distribution for a rectangular cross section 230X40mm subjected to a shear force of 40KN. Calculate the maximum and average shear stress. (16M)

5. a) What is moment area method? Explain the two Mohr's theorems, as applicable to the slope and deflection of a beam. (8M)
   b) A cantilever of uniform cross-section of length l carries two point loads, W at the free end and 2W at a distance a from the free end. Find the maximum deflection due to this loading. (8M)
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6. a) Derive an expression for the defection of a simply supported beam subjected to uniformly distributed load using integration method. (8M)
   b) A rectangular R.C simply supported beam of length 2m and cross section 100mmX200mm is carrying a uniformly distributed load of 10KN/m through its span. Find the maximum slope and deflection. Take $F = 2 \times 10^4 N/mm^2$ (8M)

7. A thin cylinder ***75*** mm internal diameter, ***250*** mm long with walls ***2.5*** mm thick is subjected to an internal pressure of ***7*** MN/m^2. Determine the change in internal diameter and the change in length. If, in addition to the internal pressure, the cylinder is subjected to a torque of ***200*** N m, find the magnitude and nature of the principal stresses set up in the cylinder. **E = *200*** GN/m2. ***v*** **= 0.3** (16M)

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Code No: RT21013 **R13** SET - 2

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
STRENGTH OF MATERIALS - I
(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 Resilience (3M)
   b) What is Point of contraflexure (4M)
   c) Write section modulus of circular sections (4M)
   d) Explain about shear centre. (4M)
   e) Write the formula of slope for cantilever beam subjected to UDL? (4M)
   f) Define Thick cylinder? (3M)

PART -B

2. An aluminum bar 60mm diameter when subjected to an axial tensile load 100KN elongates 0.20mm in a gauge length 300mm and the diameter is decreased by 0.012mm. Calculate the Modulus of elasticity and the poison's ratio of the material. (16M)

3. A simply supported beam 6 m long is carrying a uniformly distributed load of 5 kN/m over a length of 3 m from the right end. Draw shear force and bending moment diagrams for the beam and also calculate the maximum bending moment on the beam. (16M)

4. a) Prove that for a rectangular section the maximum shear stress is 1.5times the average stress. Sketch the variation of shear stress. (8M)
   b) A timber beam 120m wide and 185mm deep supports a u.d.l of intensity w KN/m length over a span of 2.7m. If the safe stresses are 29Mpa in bending and 3Mpa in shear, calculate the safe intensity of the load which can be supported by the beam. (8M)

5. a) What is moment area method? Explain the two Mohr's theorems, as applicable to the slope and deflection of a beam. (8M)
   b) A cantilever of uniform cross-section of length l carries two point loads, W at the free end and 2W at a distance a from the free end. Find the maximum deflection due to this loading. (8M)

6. Compare the values of maximum and minimum hoop stresses for a cast steel cylindrical shell of 600mm external diameter and 400mm internal diameter subjected to a pressure of 30N/mm2 applied internally and externally (16M)

7. Derive the formula for the thickness of the thin cylindrical shell and solve the following problem. A thin cylindrical shell of 1 m diameter is subjected to an internal pressure of 1 N/mm^2. Calculate the suitable thickness of the shell, if the tensile strength of the plate is 400 N/mm^2 and factor of safety is 4 (16M)

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Code No: RT21013 **R13** SET - 3

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
STRENGTH OF MATERIALS - I
(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 Hooke's law (3M)
   b) Explain the Concept of bending moment (3M)
   c) Write section modulus of circular sections (4M)
   d) Draw Shear stress distribution for rectangular section (4M)
   e) Define Volumetric strains (4M)
   f) Write the formula of slope for Simply supported beam subjected to UDL? (4M)

PART -B

2. a) Derive relation between three elastic moduli. (8M)
   b) Draw stress - strain diagram for mild steel. Indicate salient points and define them. (8M)

3. a) Device the relations among loading, shear force and bending moment in a beam. (8M)
   b) A cantilever beam AB span 6m is subjected to a uniformly varying load of 8 kN/m intensity at the fixed end A and zero at the free end B. draw SFD and BMD. (8M)

4. Two wooden planks 150mm x 50mm each are connected to form a T- section of a beam. If a moment of 3.4KN-m is applied around the horizontal neutral axis, inducing tension below the neutral axis, find the stresses at extreme fibres of the cross-section. Also calculate the total tensile force on the cross-section. (16M)

5. a) Prove that for a rectangular section the maximum shear stress is 1.5times the average stress. Sketch the variation of shear stress (8M)
   b) A rolled steel joist of I section has top flange 90 mm × 20 mm bottom flange 170 mm × 20 mm and web of size 220 mm × 20 mm. It is used as a simply supported beam over a span of 5m to carry a u.d.l. of 65kN/m over its entire span. Obtain the shear stress values at salient points and sketch the variation of shear stress. (8M)
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6. A simply supported beam of span 3 m is subjected to a central load of 10 kN. Find the maximum slope and deflection of the beam. Take $I = 12\ (10)^6\ mm^4$ and E = 200 GPa. (16M)

7. a) Derive the equations for the circumferential and longitudinal stresses in a thin cylindrical shell. (8M)

   b) A thin cylinder of 300mm internal diameter, 3 m long and made from 3 mm thick metal, has its ends blanked off. Working from first principles, except that you may use the equations derived above, find the change in capacity of this cylinder when an internal fluid pressure of 20 bar is applied. $E = 200 GN/m^2$; $\nu = 0.3$. (8M)

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Code No: RT21013 **R13** SET - 4

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
STRENGTH OF MATERIALS - I
(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 Factor of safety (3M)
   b) What are the different types of beams (3M)
   c) Write section modulus of rectangular sections (4M)
   d) Draw Shear stress distribution for Triangular section (4M)
   e) What is Hoop stress (4M)
   f) Write the formula of deflection for Simply supported beam subjected to UDL? (4M)

PART -B

2. a) An aluminium bar 60mm diameter when subjected to an axial tensile load 100KN elongates 0.20mm in a guage length 300mm and the diameter is decreased by 0.012mm. Calculate the modulus of elasticity and the poisson's ratio of the material. (8M)
   b) Explain about composite bars and Temperature stresses. (8M)

3. a) Circular beam of 120mm diameter is subjected to a shear force of 7KN. Calculate i) Average shear stress. ii) Maximum shear stress. Also sketch the variation of the shear stress along the depth of the beam. (8M)
   b) From first principles derive the expression for shear stress at any point in any cross-section of a beam which is subjected to a shear force F. (8M)

4. a) A cantilever of length 2.8 m fails when a load of 4.7 kN is applied at the free end. If the section of the beam is 65 × 105 mm find the stress at failure. (8M)
   b) A T-beam having flange 210× 20 mm and web 250 × 2o mm is simply supported over a span of 5 m. It carries a u.d.l of 8.8kN/m over its entire span. Calculate the maximum compressive and tensile stress occurring in the section. What is the magnitude of flexural stress at the junction of flange and web? Draw the variation of stress across the section. (8M)
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5. A beam of 6m length simply supported at ends A & B is loaded with two point loads of 60 KN and 50 KN at distance 1m and 3m respectively from end A. Determine the deflection under each load and the position and magnitude of maximum deflection in the beam. take $E = 2\times105N{=}mm^2$ and $I = 8500\times104cm^4$. (16M)

6. Derive a formula for the difference of radii for shrinkage of a compound thick cylindrical shell (16M)

7. a) Explain why `wire wound their cylinders' are more efficient than `ordinary thin cylinders'. (8M)

   b) A seamless pipe of 1m diameter is carrying a fluid under a pressure of 10 N/mm^2. Calculate the necessary thickness of the pipe, if the maximum allowable stress in the pipe material is $100N/mm^2$. (8M)

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Code No: RT21013 **R13** SET - 1

II B. Tech I Semester Regular Examinations, Dec - 2015
STRENGTH OF MATERIALS - I
(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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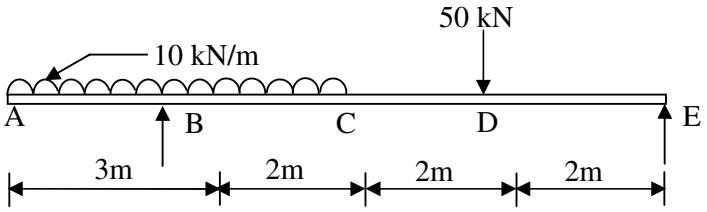
PART –A

1. a) Derive the relation between E, K and ν following usual notations.
   b) Define point of contra flexure, Shear force and bending moment
   c) State the assumptions of simple bending
   d) Define shear centre and demonstrate with an example
   e) State mohr's theorems and their significance
   f) Discuss the necessity and mechanics of compound cylinders (4M+4M+3M+4M+3M+4M)

PART –B

2. A central steel rod 18 mm diameter passes through a copper sleeve 24 mm inside and 39 mm outside diameter. It is provided with nut and washers at each end, and the nuts are tightened until a stress of 10 N/mm^2 is set up in the steel. The whole assembly is then placed in a lathe and a cut is taken along half the length of the tube , removing the copper to a depth of 1.5 mm (a) Calculate the stress now existing in the steel (b) If an additional end thrust of 5000 N is applied to the ends of the steel bar calculate the final stress in the steel. Take young's modulus for steel as twice that of copper. (16M)

3. Draw Shear Force Diagram and Bending Moment diagram for the beam shown below (16M)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4. a) State the assumptions made in deriving bending equation.
   b) An *I*-section has the following dimensions: flanges 150 × 10 mm and overall depth = 260 mm, thickness of web 10 mm. It is used as a cantilever beam over a span of 3 m to carry a load of 40 kN/m over its entire span. Find the maximum bending stresse induced.

(6M+10M)

5. The T section of a beam has the following size:
   Width of the flange 140 mm and depth of the flange 35 mm. Width of the web 30 mm and depth of the web is 130 mm. The beam is subjected to a vertical shear force of 60 kN. Calculate the shear stress at the junction of the web and the flange. (16M)

6. A cantilever beam of span 7 m carries a point load of 15 kN at a distance of 4 m from the right end. Compute (a) the slope (b) the deflection under the load (c) the maximum deflection and its location. Take E = 1.5 x 10^5 N/mm^2 and I = 5 x 10^8 mm^4. (16M)

7. A cylindrical drum 400 mm in diameter has a thickness of 8mm. If the drum is subjected to an internal pressure of 2 N/mm^2, determine the increase in the volume of the drum. Take young's modulus of elasticity, E=1.6x10^5N/mm^2 and poisson's ratio, υ=0.25. (16M)

Code No: RT21013 **R13** SET - 2

II B. Tech I Semester Regular Examinations, Dec - 2015
STRENGTH OF MATERIALS - I
(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) Derived the elongation in a tapered circular bar under an axial load of P
   b) Describe the different kinds of beams and their end reactions
   c) Derive the section modulus equation for rectangular and circular sections
   d) Determine the shear center for a T-section
   e) Explain moment area method with an example
   f) Derive change in volume of a thin cylindrical shell subjected to an internal pressure p

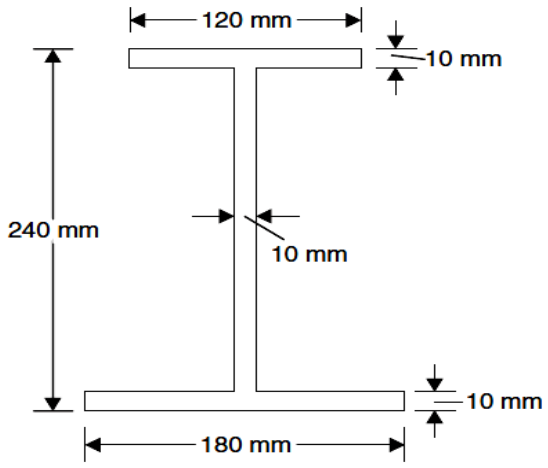
   (4M+3M+4M+4M+3M+4M)

PART –B

2. A steel tube 2.4 cm external diameter and 1.8 cm internal diameter encloses a copper rod 1.5 cm diameter to which it is rigidly joined at each end. If at a temperature of 10^0C there is no longitudinal stresses calculate the stresses in the rod and the tube when the temperature is raised to 200^0C. E_s=210 kN/mm^2 and E_c=1000 kN/mm^2. Coefficient of linear expansion for steel is $11(10^{-6})/^0$C and for copper $18(10^{-6})/^0$C (16M)

3. A 23 m long cantilever beam is 14 m long. The beam carries a load of
   10 KN at 5 m from the fixed end, and a distributed load the intensity of which varies linearly from zero at each end to 6 KN/m at free end. Draw the shear force and bending moment diagrams. Find the magnitude and position of maximum bending moment. (16M)
~~~~~~

4. Unsymmetrical *I*-section shown in below Figure is used as a simply supported beam of span 2.5 m to carry uniformly distributed load of 5 kN/m over entire span. Draw the variation of bending stress across the depth marking the values at salient point. (16M)



5. A beam of triangular section having base width 25 cm and height of 35 cm is subjected to a shear force of 5 kN. Sketch the shear stress distribution along the depth of the beam (16M)

6. A girder of uniform section and constant depth is freely supported over a span of 2.5 meters. Calculate the central deflection and slopes at the ends of the beam under a central load of 22 kN. Given: $I_{XX} = 8 \times 10^{-6} m^4$ and $E = 190\ GN/m^2$ (16M)

7. A thick spherical shell of 350 mm inside diameter is subjected to an internal pressure of $2N/mm^2$. Determine the necessary thickness of the shell, if the permissible stress in the shell material is $2.8\ N/mm^2$. (16M)

Code No: RT21013 **R13** SET - 3

II B. Tech I Semester Regular Examinations, Dec - 2015
STRENGTH OF MATERIALS - I
(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) Derive the volumetric strain and change in volume for a rectangular parallel-piped
   b) Derive the relation between SF, BM, and rate of loading at a section
   c) Derive and plot the variation of bending stress for a hollow rectangular section
   d) Find the shear centre for an rectangular section
   e) Apply moment area method to a cantilever beam carrying point load at the center and find the deflection at the tip
   f) Derive the relation for volumetric strain and volume change for a thick spherical shell

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

PART –B

2. A rod 1m long is 10 cm^2 in area for a portion of its length and 5 cm^2 in area for the remainder. The strain energy of the stepped bar is 40% that of a bar 10 cm^2 in area 1m long under the same maximum stress. What is the length of the portion of 10 cm^2 in area

3. Draw the SFD and BMD for the beam loaded as shown in the Figure1

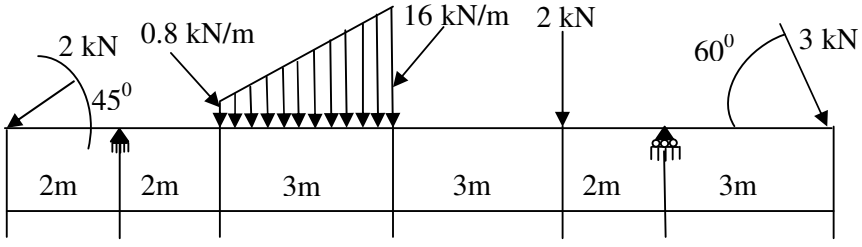

Figure1

4. a) State the assumptions involved in the theory of simple bending
   b) Derive the section modulus for a box section
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5. A beam of square cross section150 mm is placed in such away that its diagonal is the neutral axis. It is subjected to a sheer force of 6 kN. Sketch the variation of shear stress along the depth of the beam.

6. A horizontal steel girder having uniform cross-section is 14 m long and is simply supported at its ends. It carries two concentrated loads as shown in Figure 2. Calculate the deflections of the beam under the loads C and D. Take E = 250 GPa and I = $150x10^6 mm^4$.

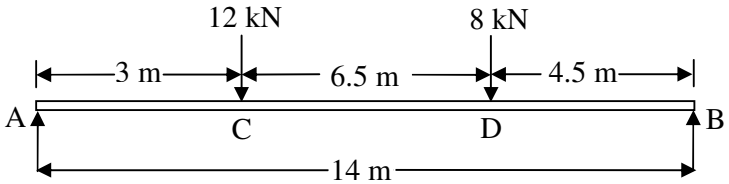

Figure 2

7. A compound cylinder formed by shrinking one tube to another is subjected to an internal pressure of 80 MN/m^2 . Before the fluid is admitted the internal and external diameters of the compound cylinder are 160 mm and 280 mm respectively and the diameter at the junction is 220 mm. If after shrinking on, the radial pressure at the common surface is 02 MN/m^2 determine the final stresses developed in the compound cylinder.

Code No: RT21013 **R13** SET - 4

II B. Tech I Semester Regular Examinations, Dec - 2015
STRENGTH OF MATERIALS - I
(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) Derive the expression for equivalent static load when a weight falls through a height h on the flange attached at the end of a circular bar.
   b) What is the convention for shear force and bending moment? Show with the help of diagrams
   c) Derive the variation of bending stress across a diamond section and plot the same
   d) What is shear center? Locate the shear center for a channel section
   e) Derive the expression for deflection under point load P situated at a distance a from one end of a simply supported beam.
   f) Prove that the net force on the longitudinal diametral section of a thin cylinder subjected to internal pressure p equals the projected area times the applied pressure

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

PART –B

2. Determine the percentage change in volume of a steel bar 7.6 cm square section1 m lond when subjected to an axial compressive load of 20 kN. What change in volume would a 10cm cube of steel suffer at a depth of 4.8 km in sea water? E = 205kN/mm^2 and G = 82 kN/mm^2

3. A 23 m long cantilever beam has a span of 16 m. The beam carries a load of 13 KN at 6 m from the fixed end, and a distributed load the intensity of which varies linearly from zero at fixed end to 6 KN/m at right free end. Draw the shear force and bending moment diagrams. Find the magnitude and position of maximum bending moment.
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4. An *I*-section has flanges of size 190 × 10 mm and its overall depth is 350 mm. Thickness of webis 10 mm. It is used as a cantilever beam over a span of 5 m to carry a load of 50 kN/m over its entire span. Find the bending stresses at the mid span.

5. An I-section with rectangular ends has the following dimensions.
   i) Flanges: 13 cm x 2.2 cm ii) Web : 33 cm x 1.3 cm
   Sketch the variation of shearing stress in the section for a shearing force of 10 kN

6. A overhang beam has two supports 4 a apart and has over hang portions of length a on either side of the supports. It is carrying a load of 4W at the center, and a load of W at its extremes. Determine the slope and deflection of the beam at the supports.

7. A pipe of 300 mm internal diameter and 60 mm thickness carries a fluid at a pressure of 15 MN/m^2. Calculate the maximum and minimum intensities of circumferential stresses across the section. Also sketch the radial stress distribution and circumferential stress distribution across the section.