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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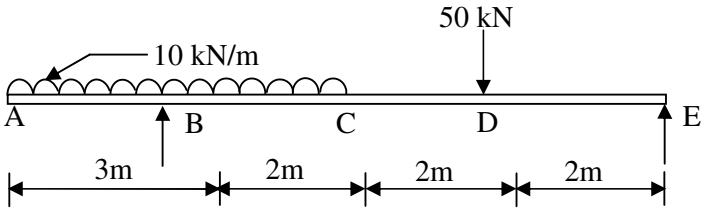
PART –A

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

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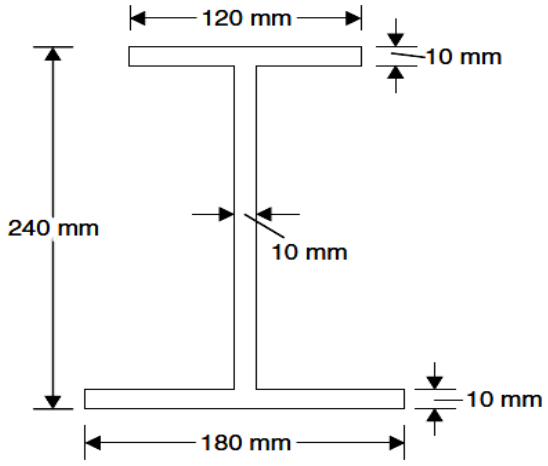
4. Unsymmetrical *I*-section shown in below Figure is used as a simply supported beam of span 2.5 m to carry uniformly distributed load of 5 kN/m over entire span. Draw the variation of bending stress across the depth marking the values at salient point. (16M)



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

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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

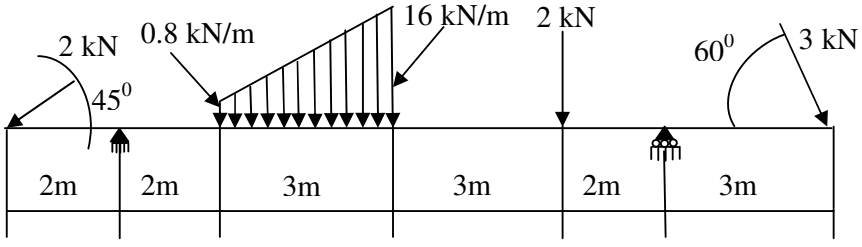

Figure1

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 = $150x10^6 mm^4$.

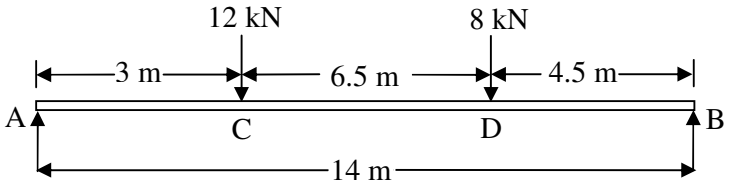

Figure 2

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

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(Civil Engineering)

Time: 3 hours Max. Marks: 70

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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.