Registration no: | | | | | | | | | | |

Total Number of Pages: 03 **B.TECH**
PCME4202

3rd Semester Regular / Back Examination 2015-16
MECHANICS OF SOLIDS
BRANCH: AUTO,CIVIL,MECH,MINERAL,MINING
Time: 3 Hours
Max Marks: 70
Q.CODE: T627

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) Draw the stress versus strain diagram of mild steel and show the salient points in it.

b) What do you understand by statically indeterminate problem? Illustrate with an example.

c) Write the expression showing the relation between the three modulus of elasticity.

d) What are the different types of supports provided for a beam, describe with neat sketches.

e) Draw the Shear Force and Bending Moment diagram of a simply supported beam with a uniformly distributed load in the entire span of the beam.

f) Write the expression for the central deflection of a simply supported beam of length l and subjected to a concentrated load W at the centre.

g) What do you understand by point of inflection? Explain with a neat sketch.

h) Draw the sketch showing the bending stress and shear stress distribution of a simply supported beam of rectangular cross section and subjected to a uniformly distributed load.

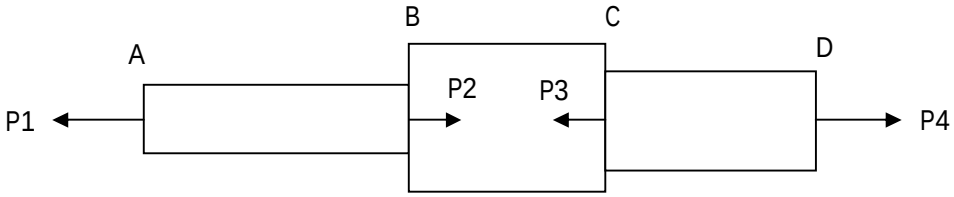
i) What do you understand by effective length of a coloumn? Write the expressions for the effective length of coloumns with different support conditions.

j) What do you understand by flexural rigidity and torsional rigidity?

Q2 **a)** A steel tube of 55mm outer diameter and 45mm inner diameter encloses a gunmetal rod of 30mm diameter and is rigidly joined at each end. If the temperature is increased by 200^0C, find the stresses developed in the tube and the rod. Given **(5)**
Coefficient of thermal expansion of steel = $11 \times 10^{-6}/^0$C
Coefficient of thermal expansion of gun metal = $18 \times 10^{-6}/^0$C
Young's modulus of steel = 2.05×10^5 N/mm^2
Young's modulus of gun metal = 1.05×10^5 N/mm^2

b) A member ABCD is subjected to point loads P1, P2, P3 and P4 as shown. Calculate the force P2 necessary for equilibrium if P1= 45 kN, **(5)**

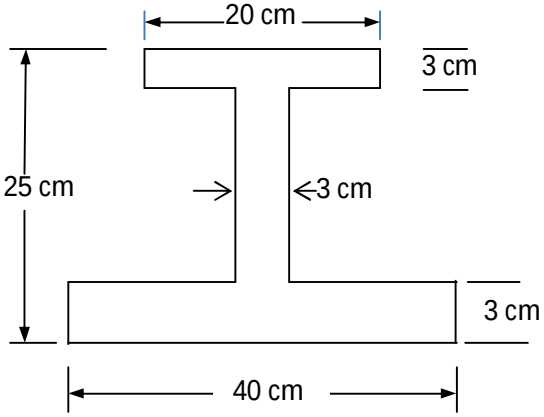
P3 = 420 kN, P4 = 120 kN. Determine the total elongation of the member assuming the modulus of elasticity to be 2.05 x 10^5 N/mm^2. The length and cross sectional area of AB, BC and CD are 1000mm, 500mm, 800mm and 500mm^2, 2000mm^2, 1200mm^2 respectively.



Q3 **a)** The stresses on two perpendicular planes through a point in a body are 100 MPa and 40MPa, both compressive along with a shear stress of 20 MPa. Determine the normal stress and shear stress on a plane inclined at 45^0 to the plane of 100 MPa stress. **(5)**

b) A simply supported beam of span 10m is subjected to two concentrated loads of 10 kN and 6 kN at distance of 2m and 9m from the left support and a uniformly distributed load of 5kN/m on the right half of the span. Calculate the shear force and bending moment at critical points and draw the shear force and bending moment diagram. **(5)**

Q4 The cross section of a cast iron beam is shown in figure below. The beam is simply supported at the ends and carries a uniformly distributed load of 30kN/m. If the span of the beam is 5m, determine the maximum tensile and compressive stress in the beam. Also show the stress distribution diagram. **(10)**

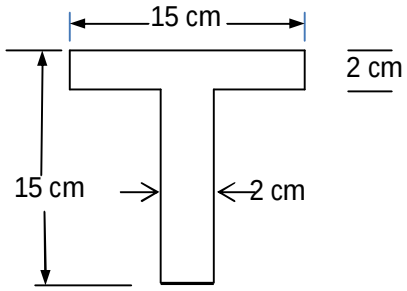


Q5 **a)** A simply supported beam of span 8m carries two loads of 80kN and 40kN at 2m and 4m respectively from the left end. Find the deflection at each load. Take E = 210 GPa and I = 150 x 10^6 mm^4. **(6)**

b) Derive the governing differential equation of the elastic curve of a beam subjected to load. **(4)**

Q6 **a)** Derive the Euler's buckling load for a coloumn with both ends hinged. **(4)**

b) Determine the Euler's buckling load of a coloumn with cross section as shown in the figure below. The coloumn is 2m long and both ends are pinned. Take G= 2.1 x 10^5 N/mm^2 **(6)**



Q7 **a)** A closed coil helical spring has a maximum load of 50 N and maximum shear stress induced is 100 MPa. The spring constant is 60 N/m in compression. If the solid length (coils touching) of the spring is 60mm, determine the wire diameter and the coil diameter. Take G = 32 GPa. **(5)**

b) Compare the resistance to torsion of a hollow circular shaft to that of solid shaft if the inside diameter of the hollow shaft is two third of the external diameter and the two shafts have the same material and weight and of equal length. **(5)**

Q8 Write short notes on any two: **(5 x 2)**

a) Use of Mohr's Circle of stress to determine the Principal stress

b) Analysis of composite beams

c) Area Moment method for determining slope and deflection of beam

d) Theory of simple bending with assumptions