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

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

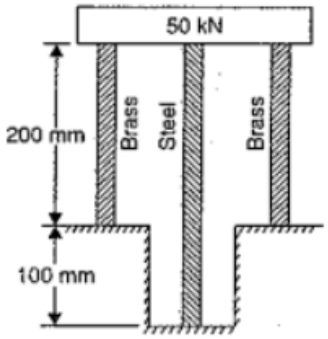
1st Semester Back Examination 2017-18
MECHANICS OF SOLIDS
BRANCH(S) : AUTO, CIVIL, MECH, MINERAL, MINING
Time: 3 Hour
Max Marks: 70
Q Code : B1194

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 a stress strain diagram for mild steel ?
b) State the significance of Mohr's circle?
c) What are principal planes?
d) Sketch the shear stress and bending stress variation for symmetrical I section?
e) Define the term thin cylinder?
f) When a Macaulay's method is preferred?
g) Differentiate between simple bending and pure bending?
h) What are the assumptions made in the theory of torsion?
i) What do you mean by crippling load ?
j) What is leaf spring?

Q2 **a)** **(5)**



A steel rod of cross section area of 1500mm^{2}and two brass rod each of 1000mm^2 cross section area to gether support a load of 5KN as shown in the figure. Find the stress in the rods Take the value of E for brass = 1.3×10^5

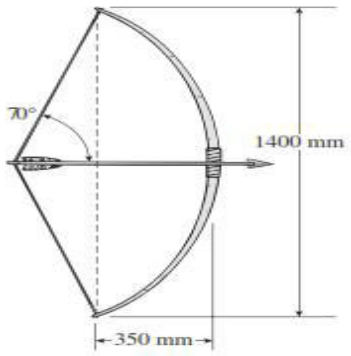
N/mm^2, for steel = 2×10^5N/mm^2 .

b) A steel tube is 2.4 cm external diameter and 0.8cm internal diameter encloses a copper rod 1.5cm diameter to which it is rigidly joined at each ends. If at a temperature of 10^0C there is no longitudinal stress calculate the stresses in the rods and tube when temperature is raised to 200^0C. E_S= 21000N/mm^2 E_{CU}=100000 N/mm2. Coefficient of linear expansion of steel is $\alpha_{steel} = 11x10^{-6}/^0C$ and copper is $\alpha_{copper} = 18x10^{-6}/^0C$ **(5)**

Q3 **a)** Derive relation between bulk modulus and young's modulus in terms of Poission's ratio. **(5)**

b) A flat brass plate was stretched by tensile forces acting in directions x and y at right angles. Strain gauges showed that the strain in x direction was 0.0072 and in y direction is 0.00016. Find (i) the stresses acting in x and y directions. (ii) the normal and shear stresses on a plane inclined at 300 to the x direction. E=80,000 N/mm2. Poissons's ratio= 0.3. **(5)**

Q4 **a)** At full draw, an archer applies a pull of 130 N to the bowstring of the bow shown in the figure below. Determine the bending moment at the midpoint of the bow. **(5)**

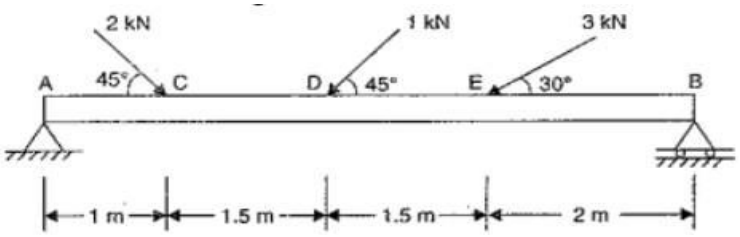


b) A simply supported beam of span 4m carries a uniformly distributed load of 6kN/m over the entire span. If the maximum allowable stress due to bending is restricted to 150 N/mm^2, determine the crosssectional dimensions if the section is; **(5)**
(i)Rectangular with depth twice the breadth
(ii)Solid circular section
(iii)Hollow circular section having a diameter ratio of 0.6

Q5 **a)** A shaft has to transmit 15Kw at 200 rpm. If the shear stress is not to exceed $60N/mm^2$and the twist in a length of 3.5m must not exceed 0.75^0, find a suitable diameter of shaft Take G= $8.5x10^4N/mm^2$ **(5)**

b) A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made up of steel plate 3 mm thick. The length and internal diameter of the vessel are 50 cm and 25 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell dueto an internal fluid pressure of 3 N/mm^2. Also calculate the increase in length, diameter and volume of vessel. Take E = $2\times10^5N/mm^2$ and μ =0.3. **(5)**

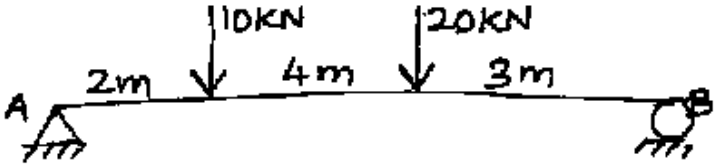
Q6 **a)** A beam is loaded as shown in the figure below , find the reactions at point A and B. Also find the shear force and bending moment diagram. E = $2\times10^5N/mm^2$ **(5)**



b) A close coiled helical spring is made of a round wire having 'n' turns and the mean coil radius R is 5 times the wire diameter. Show that the stiffness of the spring = 2.05 (R/n). If the above spring is to support a load of 1.2kN with 120mm compression. Calculate mean radius of the coil and number of turns assuming G = 8200 N/mm^2 and permissible shear stress = 250 N/mm^2 **(5)**

Q7 **a)** At the critical section of I section bean the value of vertical shear load is 45KNand the section dimensions are: Flange width =250mm^2, Flange thickness 35mm and web thickness 42mm and the total depth is 350mm. Draw the shear stress distribution across the depth of section. **(5)**

b) Determine the maximum deflection of the following beam. **(5)**



Q8 **Answer any Two** **(5x2)**

a) Mohr circle

b) Euler's theory for columns

c) Macaulay's method

d) Pure torsion equation for circular shaft