Total No. of printed pages = 4

19/3rd Sem/DCE303

2021

STRENGTH OF MATERIALS

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *four* questions from the rest.

1. (a) Describe the theory of simple bending with respect to neutral layer. 5

   (b) Derive a relationship for section modulus of rectangular and circular section. 5

   (c) In case of simple bending, derive $M/I = \sigma/Y = E/R$. 5

   (d) Fill in the blanks : 5

   (i) At the point of contraflexure, the value of bending moment is _____.

   (ii) SI units of Bending moment is _____.

[Turn over

(iii) Torque is _____ moment.

(iv) The SI units for torsion is _____.

(v) The shear stress is _____ at the axis of the shaft.

2. (a) A cylindrical bar is 20 mm diameter and 1000 mm long. During a tensile test it is found that the longitudinal strain is 4 times the lateral strain. Calculate the modulus of rigidity and bulk modulus.

Given $E=1\times10^5$ N/mm^2. 10

(b) A bar ABCD 950mm long is made up of three parts AB, BC and CD of lengths 250mm, 450mm and 250mm respectively. AB and CD are cylindrical having diameters 25mm and 15mm respectively. The rod BC is square section 30 mm × 30 mm, the rod is subjected to a pull of 26000N. Find, stresses in the three parts of the rod, extension of the rod. Given $E=2\times10^5$N/mm^2.

10

3. (a) What are the assumptions made in pure torsion ? 4

(b) A circular shaft of 60mm diameter is running at 150 rpm. If the shear stress is not to exceed 50 MPa, find the power which can be transmitted by the shaft. 6

(c) A steel shaft transmits 105 kW at 160 rpm. If the shaft is 100 mm in diameter, find the torque on the shaft and the maximum shearing stress induced. Also find the twist of the shaft in a length of 6 m. Take C= 8×10^4 N/mm^2. 10

4. (a) The principal tensile stresses at a point across two perpendicular planes are 80 N/mm^2 and 40 N/mm^2. Find,

(i) The normal stress

(ii) The tangential stress

(iii) The resultant stress and

(iv) Obliquity

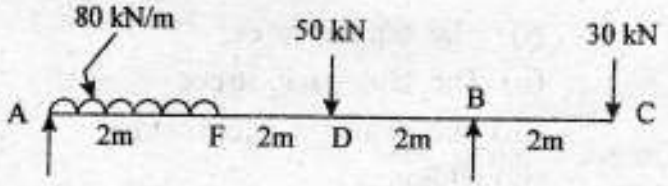
On a plane at 20^0 with the major principal plane. 8

(b) At a point in a bracket the normal stresses on two mutually perpendicular planes are 120 N/mm^2 tensile and 60 N/mm^2 tensile. The shear stresses across the plane is 30 N/mm^2. Using Mohr's circle find principal stresses and maximum shear stress at the point. 12

5. (a) A steel plate of width 120 mm and of thickness 20mm is bent into a circular arc of radius 10m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. Take E = 2×10^5 N/mm^2. 8

(b) A cast iron beam 20 mm × 20 mm in section and 1m long and supported at the ends fails when a central load of 640 N is applied. What UDL will break a cantilever of the same material 50mm wide, 100mm deep and 2m long ? 12

6. Calculate the shear force and bending moment for the beam. Also draw the SF and BMD diagrams. 20



7. Draw the shear force and bending moment diagram for the given beam as below. Also indicate the location and magnitude of maximum bending moment. 20