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309302

Dec., 2018

B.Tech. (ME) IIIrd Semester

STRENGTH OF MATERIALS

(PCC-ME-203)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Assume suitable value for the missing data.*

PART–A

1. (a) Define the term factor of safety and its importance. (1.5)

(b) What are the main types of supports? Distinguish between rolled and hinged. (1.5)

(c) Distinguish between thin and thick pressure vessels. (1.5)

(d) What do you mean by equivalent torque? (1.5)

(e) What do you mean by 'neutral axes' and 'neutral surface'? (1.5)

(f) Define the term 'moment of resistance'? (1.5)

(g) What is the maximum slope of a cantilever having a uniformly distributed load? (1.5)

(h) What is the relationship between shear force and loading function of a beam? (1.5)

(i) What are principal plan and stresses? (1.5)

(j) What is point of contra-flexure? (1.5)

PART–B

2. (a) Derive a relationship between Young's Modulus, Modulus of rigidity and the Poisson's ratio. (5)

(b) Draw the Mohr's circle for a bi-axial stress system having two direct stresses of 30 MPa (tensile) and 20 MPa (compressive). Determine the magnitude and the direction of the resultant stresses on plane which make angle; (i) 250, and (ii) 700 with the 30 MPa stress. (10)

3. (a) Derive the relationship between bending moment and shear force for a UDL beam. (5)

(b) A simple supported beam of 10 m length carries a uniformly distributed load throughout its length. The supports of the beam are to be 6 m apart. Determine the position of the supports with respect to the ends so that the bending moment on the beam is the least possible. (10)

4. A bar of T-section symmetrical about the vertical center line has the flange 160 mm wide and 20mm thick and the web 120 mm deep and 20 mm thick as shown in Figure 1. The member is acted upon by a longitudinal pull P which acts on the section at a point on the vertical central line and is 50 mm from the bottom edge of web. Determine the magnitude of the maximum stresses on the section when the pull P is transmitted. (15)

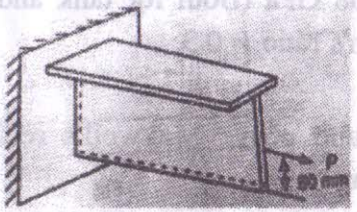

Figure 1

5. (a) Obtain the expression for maximum principle stress and maximum shear stress for a shaft under the combined bending and torsion. (5)

(b) A solid shaft transmits 200 W of power at 80 rpm. Determine the diameter of the shaft if the shear stress is not to exceed 75 MPa. If this shaft is replaced by a hollow shaft whose internal diameter is 0.6 of the external diameter while the length, material and the maximum shear stress are the same, find the percentage saving in weight. (10)

6. (a) What do you mean by compound tubes used as pressure vessels? Explain. (5)

(b) A cylindrical tank is 3 m in length, 2.4 m in diameter and 15 mm in thickness. Its flat ends are joined by 12 equally spaced tie bars, each tie bar being 50 mm in diameter. Initially, when the tank is filled with water, the tie bars are stressed to 48 MPa. Determine the increase in the capacity of the tank and resultant stress in the tie bars when the pressure is raised to 1.5 MPa. E = 208 GPa (Both for tank and the tie bars) and poisson's ratio = 0.3. (10)

7. (a) State and prove Maxwell's reciprocal deflection theorem. (7)

(b) What is Macaulay's method? Derive an expression for deflection at any section of a simply supported beam with eccentric point load, using Macaulay's method. (8)