Roll No. | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(AE) (2011 Onwards) (Sem.–3)

MECHANICS OF MATERIALS

Subject Code : BTAE-301

Paper ID : [A1112]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q**1) Write briefly :**

a) What is modulus of rupture?

b) What do you mean by hoop stress in a thin cylinder?

c) What do you mean by ‘simple bending’ or ‘pure bending’?

d) What are different types of beams?

e) What is principal stress and principal plane?

f) What do you mean by moment of resistance?

g) What do you mean by Section Modulus?

h) What are different types of loads?

i) Define total strain energy theory.

j) What are limitations of Euler’s formula for columns and struts?

SECTION-B

Q2) Prove that the bending stresses in any fibre is proportional to the distance of that fibre from neutral layer in a beam.

Q3) A steel rod of 20 mm diameter passes centrally through a copper tube of 50 mm external diameter and 40 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly home on the projecting parts of the rod. If the temperature of the assembly is raised by 50° C, calculate the stresses developed in copper and steel. Take E for steel and copper as 200 GN/m^2 and 100 GN/m^2 and α-for steel and copper as 12×10^{-6} per °C and 18×10^{-6} per °C.

Q4) Derive an expression for the slope and deflection of a cantilever of length L, carrying a point load W at the free end by double integration method.

Q5) A hallow shaft of diameter ratio 3/8 (internal dia. to outer dia) is to transmit 375 kW power at 100 *r.p.m.* The maximum torque being 20% greater than the mean. The shear stress is not to exceed 60 N/mm^2 and twist in a length of 4 m not to exceed 2° .Calculates its external and internal diameters which would satisfy both the above conditions. Assume modulus of rigidity = 0.85×10^5N/mm^2.

Q6) How will you draw the shear stress distribution diagram for composite section?

SECTION-C

Q7) A cylindrical shell 3 meters long which is closed as the ends has an internal diameter of 1 m and a wall thickness of 15 m. Calculate the circumferential and longitudinal stresses induced and also changes in the dimensions of the shell, if it is subjected to an internal pressure of 1.5 N/mm^2. Take E = 2×10^5 N/mm^2 and l/m=0.3.

Q8) Calculate the safe compressive load on a hollow cast iron column (one end rigidly fixed and other hinged) of 15 cm external diameter, 10 cm internal diameter and 10 cm in length. Use Euler's formula with a factor of safety of 5 and E=95 kN/mm^2 .

Q9) A beam of square section is used as a beam with one diagonal horizontal. The beam is subjected to a shear force F, at a section. Find the maximum shear in the cross-section of the beam and draw the shear distributions diagram for the section.