[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2068)

18023(J)

B. Tech 3rd Semester Examination

Strength of Materials-I (CBS)

ME-301

Time : 3 Hours **Max. Marks : 60**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, selecting one question each from sections A, B, C & D of the paper and section E is compulsory.

SECTION - A

1. (a) A steel bar 300mm long, 50mm wide and 40mm thick is subjected to a pull of 300kN in the direction of its length. Determine the change in volume. Take E= 2×10^5N/mm^2 and Poission's ratio=0.25. (5)

   (b) Derive the relation for volumetric strain of a rectangular bar subjected to three forces which are mutually perpendicular. (5)

2. (a) Derive the value of normal stress and shear stress on an oblique plane at an angle θ to the vertical plane when a member is subjected to like direct stresses in two mutually perpendicular directions accompanied by a simple shear stress. (5)

   (b) Direct stresses of 120 N/mm^2 tensile and 90 N/mm^2 compression exist on two perpendicular planes at a certain point in a body. They are also accompanied by shear stress on the planes. The greatest principle stress at a point due to these is 150 N/mm^2.

   (i) What must be the value of shearing stress on the two planes?

   (ii) What will be the maximum shearing stress at the point? (5)

SECTION - B

3. (a) What is bending equation? Derive. (5)

   (b) A rectangular beam 300mm deep is simply supported over a span of 4 meters. Determine the uniformly distributed load per meter which the beam may carry if the stress should not exceed 120 N/mm^2. Take 1= 8×10^6mm^4. (5)

4. (a) What is theory of pure torsion? Write the assumption made while derivation of torsion equation. Find the value of section modulus for hollow circular shaft. (5)

   (b) A solid circular shaft transmits 75kW power at 200 rpm. Calculate the shaft diameter if the twist in the shaft is not to exceed 1° in 2m length of shaft, and shear stress is limited to 50MN/m^2. Take C= 100GN/m^2. (5)

SECTION - C

5. (a) Derive and plot shear stress distribution for rectangular and circular cross sections. (5)

   (b) A simply supported wooden beam of span 1.3m having a cross section 150mm wide by 250mm deep carries a point load W at the center. The permissible stress is 7N/mm^2 in bending and 1N/mm^2 in shearing. Calculate safe load W. (5)

6. (a) Derive the relation to find out the deflection of a simply supported beam carrying a uniformly distributed load on whole length of beam. (5)

[P.T.O.]

(b) A cantilever of length 2m carries a uniformly distributed load 2kN/m over a length of 1m from the free end, and a point load of 1kN at the free end. Find slope and deflection at free end if $E = 2.1 \times 10^5 N/mm^2$ And $I = 6.667 \times 10^7 mm^4$. (5)

SECTION - D

7. (a) What are theories of elastic failure? (5)

   (b) Explain Maximum shear stress theory and maximum strain energy theory. (5)

8. (a) Derive the expression for strain energy stored in the body when the load is applied with impact. (5)

   (b) A load of 100N falls through a height of 2cm a collar rigidly attached to a vertical bar 1.5m long and $1.5cm^2$ in section. The upper end of the bar is fixed. Determine

   (i) Maximum instantaneous stress induced in the bar.

   (ii) Maximum instantaneous elongation.

   (iii) Strain energy stored in the vertical rod.

   Take $E = 2 \times 10^5 N/mm^2$ (5)

SECTION - E

9. Answer all the following:-

   (a) What is hook's law and elastic limit?

   (b) What is concept of surface and volumetric strain?

   (c) What is bending equation?

   (d) What is Castiglano's Theorem?

   (e) Draw the shear stress distribution for I section.

(f) What are thermal stresses? How to calculate them?

(g) What is difference between hard and tough materials?

(h) Define principal stresses?

(i) Find the value of section modulus for circular section.

(j) What is volumetric strain? (10×2=20)