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B095314(095)

B. Tech. (Third Semester) Examination, Nov.-Dec. 2020

(AICTE Scheme)

STRENGTH OF MATERIALS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Attempt all questions. Part (a) of each question is compulsory are carries equal 4 marks. Attempt any* ***two*** *parts from (b), (c) and (d) are carries equal 8 marks.*

Unit - I

1. (a) Explain simple shear and pure shear.

(b) A steel tube 4.5 cm external diameter and 3 mm thick encloses centrally a solid copper bar of

3 cm dimater. The bar and tube are rigidly connected together at the ends at a temperature of 30°C. Find the stresses in each metal when heated to 180°C. Also find the increase in length if the original length of the assembly is 30 cm. Coefficients of expansion for steel and copper are 1.08×10^{-5} and 1.7×10^{-5} respectively per degree Celsius. E = 210 GN/m^2 for steel and 110 GN/m^2 for copper.

(c) A steel bar of cross sectional area 300 mm^2 held firmly by the end supports and loaded by an axial force of 30 kN as shown in figure (c).

Determine :

(i) Reaction at L and M

(ii) Extension of the left portion LN.

Take, E = 210 GN/m^2.

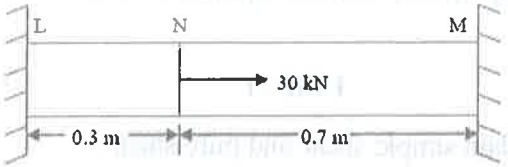

Figure (c). Steel bar subjected to an axial load of 30 kN.

(d) Derive the relationship between elastic constants.

Unit - II

2. (a) Draw Mohr's circle for a two dimensional stress field subjected to (i) pure shear, (ii) pure biaxial tension, (iii) pure uniaxial tension and (iv) pure uniaxial compression.

(b) What do you understand by NDT? Explain any one process with suitable diagram.

(c) At a certain point in a strained material, the intensities of tensile stresses on two planes right angles to each other are 20 N/mm^2 and 10 N/mm^2. They are accompanied by a shear stress of magnitude 10 N/mm^2. Find graphically the location of the principal planes and evaluate the principal stresses.

(d) Explain mechanical properties of metals in detail.

Unit - III

3. (a) Define point of contra-flexure.

(b) A 250 mm (depth) × 150 mm (width) rectangular beam is subjected to maximum bending moment of 750 kNm.

Determine :

(i) The maximum stress in the beam

(ii) If the value of E for the beam material is 200 GN/m^2, find out the radius of curvature for that portion of the beam where the bending is maximum.

(iii) The value of the longitudinal stress at a distance of 65 mm from the top surface of the beam.

(c) A hollow shaft of diameter ratio 3/5 is required to transmit 800 kW at 110 r.p.m., the maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and the twist in a length of 3 m is not to exceed 1.4 degrees. Calculate the minimum external diameter of the shaft.

(d) What is pure bending? Also derive equation for pure bending condition and write the assumptions used.

Unit - IV

4. (a) What are the methods of increasing the shock aborbing capacity of bolt?

(b) A gas tank consists of a cylindrical shell of 2.5 m inner diameter. It is enclosed by hemispherical shells by means of butt welded joint as shown in figure (b). The thickness of the cylindrical shell as well as the hemispherical cover is 12 mm. Determine the allowable internal pressure to which the tank may be subjected, if the permissible tensile stress in the weld is 85 N/mm^2. Assume efficiency of welded joint as 0.85.

Figure (b).

(c) How is a rivet joint of uniform strength designed?

(d) Discuss the basic types of screw fastening methods.

Unit - V

5. (a) Show that in thin cylinder shells subjected to

internal fluid pressure, the circumferential stress is twice the longitudinal stress.

(b) A thin spherical shell 50 cm in diameter, with a thickness 3 mm, is full of water at atmospheric pressure (0.1 MPa). Find the intensity of radial pressure exerted on the wall of the shell if 30 c.c. of water at atmospheric pressure is pumped into the shell. Calculate the resulting hoop stress and the change in the volume of sphere if modulus of elasticity of shell is $E = 210$ GPa, Poisson's ratio $\nu = 0.33$, and bulk modulus of water is 2.361 GPa.

(c) A boiler is subjected to an in steam pressure of 2 N/mm^2. The thickness of boiler plate is 2 cm and permissible tensile stress is 120 N/mm^2. Find out the maximum diameter, when efficiency of longitudinal joint is 90% and that of circumferential joint is 40%.

(d) A thick cylinder of 250 mm internal diameter and 350 mm outer diameter contains a fluid at a pressure of 12 N/mm^2. Determine the hoop stresses and radial stresses and draw a neat sketch showing the stress distribution across wall thickness.