SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL NO: | | | | | | | | | | | | | **Total number of pages:[2]**

B. Tech. - Chemical/ 3rd Semester

Strength of Materials

Subject Code: BTCH-304

Paper ID:

Time allowed: 3 Hrs **Max Marks: 60**

Important Instructions:

- **All questions are compulsory**
- **Assume any missing data**

PART A (2×10)

Q. 1. Answer in brief:

(a) What do you mean by Hardness?

(b) What do you understand by Principal axes?

(c) What do you mean by bending moment and shear force in beams?

(d) State assumption made in deriving the Torsion formula?

(e) What do you understand by point of contraflexure? Show with neat diagram.

(f) A close coiled helical spring absorbs 90 *Nmm* of energy while extending by 5*mm*. Calculate the stiffness of the spring.

(g) Differentiate columns from struts by giving examples of each.

(h) Write down the boundary conditions for simply supported beam used to obtain constants in double integration method.

(i) What do you mean by engineering failure?

(j) Calculate the ratio of hoop stresses in a thin spherical pressure vessel and a thin cylindrical pressure vessel of same mean radius, wall thickness and same internal pressure.

PART B (5×8)

Q. 2. Briefly explain the Stress-Strain diagram for ductile materials and show all important points on it. How it is different from Stress-Strain diagram for brittle material?

OR

Derive an expression of change in internal volume for thin cylinder subjected to internal pressure.

CO1

Q. 3. A hollow circular shaft is required to transmit 400 *kW* of power at 150 *rpm*. Calculate the

diameters of shaft if the inside diameter is 0.75 times the outside diameter. Take maximum allowable shear stress of the shaft material as 80 *MPa*.

OR

Derive the Bending equation for a straight beam subjected to pure bending *i.e.* $\frac{\sigma_{max}}{y_{max}} = \frac{M}{I} = \frac{E}{R}$.

State the assumptions made in the deriving this bending equation.

CO2

Q. 4. Draw shear force diagram and bending moment diagram for a cantilever carrying uniformly distributed load of intensity 'w' *N/m* on its entire span.

OR

A beam AB of 6*m* span is simply supported at the ends carries point load of 70*kN* at a point 2*m* from left end support. Determine the maximum deflection in the beam using Macaulay's Method. Take E = 200 × 10^6 *kN/m*^{2} and I = 20 × 10^{-6} *m*^{4}.

CO3

Q. 5. A hollow circular shaft has an outer diameter of 100 *mm* and inner diameter 90 *mm*. What bending moment can it carry in addition to a torque of 15 *kNm* before failure, according to

(a) Tresca Theory (b) von-Mises Theory.

Take yield point strength of the shaft material as 250 *MPa* with a factor of safety 2.5.

OR

A solid circular shaft is required to carry a torque of 40 *kNm* and a bending moment of 30 *kNm*. If yield stress in a simple tensile test on the material of the shaft was found to be 250 *N/mm*^{2}, find the minimum required diameter of the shaft according to (a) Rankine's theory (b) Tresca Theory. Take a factor of safety = 2.5.

Q. 6. Derive an expression for the buckling load for a pin end column according to Euler's theory. Also state the limitation of Euler's formula. CO4

OR

Two long columns are of equal length and made of same material. Both are pin jointed at the ends. One of the columns is of circular section, while the other is of square section. The cross sectional area of the two are also equal. Compare the buckling strengths of the two.

CO5

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