

Roll No.

Total No. of Pages : 03

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B.Tech. (ME) Sem.- (4)
STRENGTH OF MATERIALS-II

Subject Code : BTME-401

M.Code : 59129

Date of Examination : 07-06-2023

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

1. Write briefly :

- a) Define proof resilience.
- b) Distinguish between energy of dilation and distortion.
- c) Why theories of failure play an important role in design of machine components?
- d) Give graphical representation of maximum principal strain theory.
- e) Why leaf spring is called spring of uniform strength?
- f) For what purpose compound cylinders are used?
- g) Name and define stresses developed in thick cylinders.
- h) What do you mean by discs of uniform strength?
- i) What is the importance of trapezoidal cross section of a crane hook, explain briefly.
- j) Explain the importance of shear centre.

SECTION-B

- A bar 110 cm in length is subjected to an axial pull, such that the maximum stress is equal to 150 MN/m^2 . Its area of cross-section is 2 cm^2 over a length of 100 cm and for the middle 10 cm length it is only 1 cm^2 . If $E = 210 \text{ GN/m}^2$, calculate the strain energy stored in the bar.
- A thin disc whose outer radius is 300 mm and inner radius is 150 mm rotates at 1509 rpm.

Compute :

- maximum radial stress and
 - maximum circumferential stress. Assume, Poisson's ratio = 0.3, and density = 7818 kg/m^3 of its material.
- A cylindrical tank open at top and having vertical axis, is of 2.5 m inside diameter and 22 m high. The tank is filled with water and is made of structural steel with a yield point of 220 MN/m^2 . Determine the thickness of the tank if :
 - longitudinal joint is 100% efficient.
 - longitudinal joint is 75% efficient. Assume factor of safety as 3.
 - A steel ring of 240 mm mean diameter has a rectangular cross-section of 60 mm x 40 mm, the larger section being in the radial direction. Determine the tensile force which the ring can carry safely if the permissible stresses are 140 MPa.
 - Derive the general formula for distribution of shear stress in beams.

SECTION-C

- A compound cylinder, formed by shrinking one tube to another is subjected to an internal pressure of 90 MN/m^2 . Before the fluid is admitted, the internal and external diameters of the compound cylinder are 180 mm and 300 mm respectively and the diameter at the junction is 240 mm. If after shrinking on, the radial pressure at the common surface is 12 MN/m^2 , determine the final stresses developed in the compound cylinder.
- A laminated steel spring 1 m long is to support central load of 6 kN. If the maximum deflection of spring is not to exceed 50 mm and maximum stress should not exceed 300 MN/m^2

Calculate :

- a) the thickness of the leaves,
 - b) their number if each plate is to be 80 mm wide. Take, $E = 200 \text{ GN/m}^2$.
9. A solid shaft transmits 970 kW at 290 rpm. Maximum torque is 2 times the mean. The shaft is subjected to a bending moment which is 1.5 times the mean torque. The shaft is made of a ductile material for which the permissible tensile and shear stresses are 110 MPa and 70 MPa respectively. Determine the shaft diameter using a suitable theory of failure. Give justification for the theory used.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.