Roll No. | | | | | | | | | | |

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (ME) (Sem.–3)

STRENGTH OF MATERIALS – I

Subject Code : BTME-301

M.Code : 59111

Date of Examination : 08-12-2023

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. Answer briefly :

a) Define Poisson's Ratio.

b) Explain how complementary shear stresses are developed in the body?

c) What do you mean by principal planes and principal stresses?

d) What is the relation between F and W (rate if loading) if F is shear force?

e) Define torsional rigidity of shaft.

f) What is plane of bending? Why a section should be symmetrical about the plane of bending?

g) What are the drawbacks of Euler's theory of buckling?

h) What do you mean by pure bending?

i) What is a conjugate beam? How reactions at the ends give the slope at the ends of the beam?

j) Define slenderness ratio.

SECTION-B

2. A simply supported beam of length L carries a uniformly distributed load of w per unit length over the whole span. Using double integration method, find slope and deflection at mid and end points.

3. Derive an expression for the Euler's crippling load for a long column with both ends are hinged.

4. How can Mohr's Circle can be used to determine the stresses acting on a plane at a given orientation in a loaded material? Provide a step-by-step solution.

5. A simply supported beam is carrying a uniformly distributed loads of 2 kN/m over a length of 3 m from the right end. The length of beam is 6 m. Draw the S.F. and B.M. diagrams for the beam and determine the maximum bending moment on the section.

6. Find the young's Modulus of a brass rod of diameter 25 mm and of length 250 mm which is subjected to a tensile load of 50 kN when the extension of the rod is equal to 0.3 mm.

SECTION-C

7. **Write a short note on any two of the following :**

   a) Thermal stresses

   b) Johnsons parabolic formula for failure of columns.

   c) Stress strain curve for ductile materials and label various points on it.

8. A solid cylindrical shaft is to transmit 300 kW power at 100 r.p.m.

   a) If the shear stress is not to exceed 80 N/mm^2, find its diameter.

   b) What percent saving in weight would be obtained if this shaft is replaced by hollow one whose internal diameter equals to 0.6 of the external diameter, the length, the material and the maximum shear stress being the same.

9. Two rectangular plates, one of steel and the other of brass each 40 mm wide and 10 mm deep are placed together to form a beam 40 mm wide and 20 mm deep, on two supports 1m apart, the brass plate being on the top of the steel plate. Determine the maximum load, which can be applied at the centre of the beam, if the plates are:

   a) Separate and can bend independently

   b) Firmly secured throughout their lengths.

   Maximum allowable stress in steel = 112.5 N/mm^2 and in brass = 75 N/mm^2. Take E_{steel} = 2×10^6 N/mm^2 and $E_{brass} = 8 \times 104$ N/mm^2.

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.