Code No.: ME301PC | R20 | H.T.No. | | | 8 | R | | | | | | |

CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
II–B.TECH–I–Semester End Examinations (Supply) – August - 2023
MECHANICS OF SOLIDS
(MECH)

[Time: 3 Hours] **[Max. Marks: 70]**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART-A **(20 Marks)**

1. a) Define Factor of safety and Poisson's ratio. [2M]
   b) Define [2M]
      i. Strain Energy.
      ii. Resilience.
   c) Define point of contraflexure with neat sketch. [2M]
   d) Draw the shear force and bending moment diagram for cantilever beam subjected to point load at free end. [2M]
   e) State the assumptions made in the theory of simple bending. [2M]
   f) Draw the shear stress distribution diagram for 'T' section. [2M]
   g) Define Principal plane with neat sketch. [2M]
   h) What do you understand by the term theories of failure? Name the important theories of failure. [2M]
   i) State the assumptions made in torsion equation in case of pure torsion. [2M]
   j) Define hoop and longitudinal stress. [2M]

PART-B **(50 Marks)**

2. A copper rod of 40 mm diameter is surrounded tightly by a cast iron tube of 80 mm external diameter, the ends being firmly fastened together. Calculate the sharing of load when subject to a compressive load of 30 kN. Also calculate the decrease in length of the composite system if it is 2 m long. Take E_{CU} = 75 GPa and E_{CI} = 175 GPa. [10M]

OR

3.a) The modulus of rigidity for a material is $0.5*10^5$ N/mm^2. A 12 mm diameter rod of the material was subjected to an axial pull of 14 kN and change in diameter was observed to be $3.6*10^{-3}$mm. Calculate Poisson's ratio and modulus of elasticity. [5M]
   b) Explain the main aspects of stress strain diagram for mild steel. [5M]

4. A cantilever 2 m long is loaded with a uniformly distributed load of 2 kN/m run over a length of 1 m from the free end. It also carries a point load of 4 kN at a distance of 0.5 m from the free end. Draw the S.F and B.M. diagrams. [10M]

OR

5. A simply supported beam of length 5 m carries a uniformly increasing load of 800 N/m run at one end to 1600 N/m run at the other end. Draw the shear force and bending moment diagram for the beam. Also locate the point of contra flexure. [10M]

6. State the assumptions made in theory of simple bending. Derive the equation of bending moment. (Bending equation: M/I=f/y=E/R). [10M]

OR

7.a) Derive an expression for shear stress distribution across a rectangular section. [5M]

b) A simply supported beam of span 3 m and cross section 150 x 250 mm carries a UDL of 5 kN/m over entire span. Find maximum intensity of shear stress in beam at a section at 0.75 m from any of the support. [5M]

8. At a certain point in a strained material the principal stresses are 100 N/mm^2 and 40 N/mm^2 both are tensile. Find the normal, tangential and resultant stresses across a plane through the point at 48^0 to the major principal plane, using Mohr's circle of stress. [10M]

OR

9. A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 N-m and a torque (T). If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to: [10M]

   i. The maximum principal stress.
   ii. The maximum Shear Strain Energy theory of yielding.

10. Determine the diameter of a solid shaft which will transmit 300 kW at 250 r.p.m. The maximum shear stress should not exceed 30 N/mm^2 and twist should not be more than 1^0 in a shaft length of 2m. Take modulus of rigidity = $1*10^5$ N/mm^2. [10M]

OR

11. A cylindrical shell 3 m long which is closed at the ends has an internal diameter of 1m and a wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and also change in the dimensions of the shell if it is subjected to an internal pressure of 1.5MN/m^2. Take: E = 200 GN/m^2, and Poisson's ratio 0.3. [10M]

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