Code No : **19MET301**

R19

II B. Tech I Semester Regular Examinations, March - 2021

MECHANICS OF SOLIDS

(MECHANICAL ENGINEERING)

Time : 3 Hours **Max. Marks : 60**

Note : Answer **ONE** question from each unit **(5 × 12 = 60 Marks)**

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UNIT-I

1. a) Derive the relation between Young's modulus and shear modulus. [6M]

   b) Draw stress strain diagram for structural steel and locate various important salient points on that. [6M]

(OR)

2. a) Define the following a) Poisson's ratio b) shear modulus c) Volumetric strain d) factor of safety [4M]

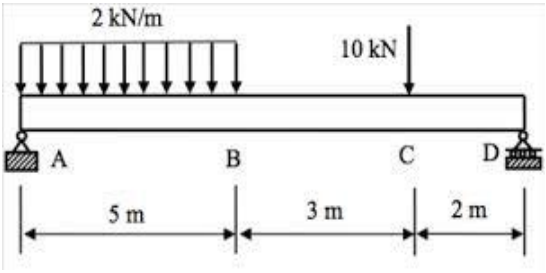
   b) A specimen of steel 25mm diameter with a gauge length of 200mm is tested to destruction. It has an extension of 0.16mm under a load of 80KN and load at the elastic limit is 160KN. The maximum load is 180KN. The total extension at fracture is 56mm and diameter at neck is 18mm. [8M]

   Find a) stress at elastic limit b) Young's modulus c) percentage elongation d) percentage reduction area e) ultimate tensile stress.

UNIT-II

3. a) Define point of contra flexure. [2M]

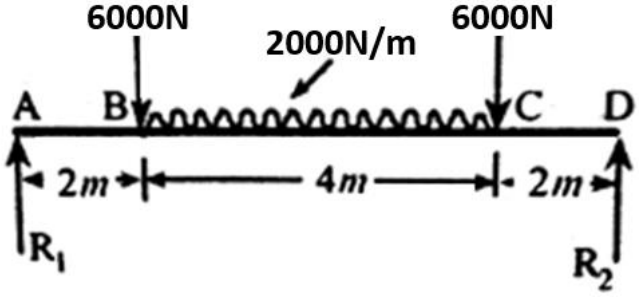
   b) Draw the Shear force and bending moment diagram for the loaded beam as shown in figure. [10M]



(OR)

4. a) Derive the relation between load, shear force and bending moment. [4M]

   b) Draw SFD and BMD for the beam loaded as shown in below figure [8M]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UNIT-III

5. a) Derive Torsion equation. [6M]

   b) A rectangular beam 200mm deep and 300mm wide is simply supported over a span of 8m. What uniformly distributed load per meter the beam may carry, if the bending stress is not to exceed 120 N/mm^2. [6M]

(OR)

6. a) Derive flexure equation. [6M]

   b) A hollow steel shaft transmits 600kW at 500 rpm. The maximum shear stress is 62.4MPa. Find the outside and inside diameter of the shaft, if the outer diameter is twice of inside diameter, assuming that the maximum torque is 20% greater than the mean torque. [6M]

UNIT-IV

7. a) Differentiate between thin and thick cylinders. [4M]

   b) Draw the Mohr's circle for the following state of stress. [8M]

   $\sigma_x = 40MPa,\quad \sigma_y = 10MPa,$ and $\tau_{xy} = 25MPa$

   Calculate i) Principal stresses ii) Maximum shear stress

   iii) Planes on which principal stresses are acting

   iv) Planes on which shear stress is acting

(OR)

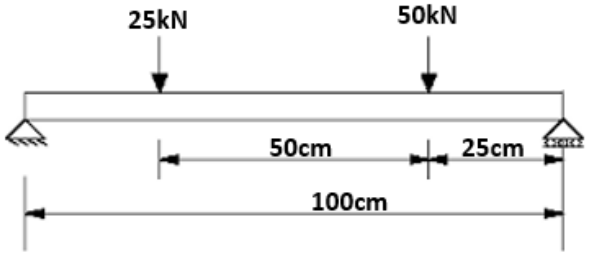
8. a) Derive Lames equations. [4M]

   b) A thin cylindrical shell of 120cm diameter, 1.5cm thick and 6m long is subjected to internal fluid pressure of 2.5 N/mm^2. If the value of E = 2 x 10^5 N/mm^2 and Poisson's ratio=0.3, calculate change in diameter, length and volume. [8M]

UNIT-V

9. a) Define Mohr's theorems. [4M]

   b) Using Macaulay's method calculate slopes and deflections under the loads and also maximum deflection as the beam loaded as shown in figure. [8M]



(OR)

10. a) Write effective length for different end conditions of columns and explain limitations of the Eulers formula. [6M]

    b) Calculate the crippling load for a 5m long hinged -hinged column of 150mm x 200mm section. Young's modulus for timber is 17GPa. [6M]

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