Total No. of Questions : 8]

SEAT No. :

PA-1308

[Total No. of Pages : 3

[5925]-341

S.E. (Robotics and Automation)

STRENGTH OF MATERIALS

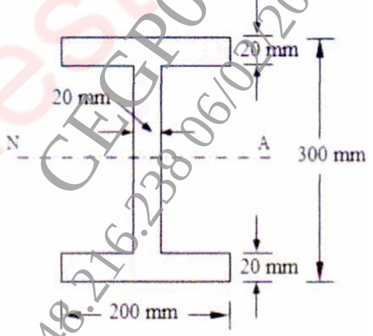
(2019 Pattern) (Semester - III) (211082)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right side indicate full marks.***
3) ***Use of calculator is allowed.***
4) ***Assume suitable data, if necessary.***

Q1) a) A beam of an I-section shown in Fig. is simply supported over a span of 4 m. Find the uniformly distributed load the beam can carry if the bending stress is not to exceed 100 N/mm^2. **[8]**



b) Derive an expression for section modulus of hollow rectangular section. **[4]**

c) A rectangular beam of size 60 mm × 100 mm has a central rectangular hole of size 15 mm × 20 mm. The beam is subjected to bending and the maximum bending stress is limited to 100 N/mm^2. Find the moment of resistance of the hollow beam section. **[5]**

OR

Q2) a) A rectangular beam of width 200 mm and depth 300 mm is simply supported over a span of 5 m. Find the safe uniformly distributed load that the beam can carry per meter length if the allowable bending stress in the beam is 100 N/mm^2. **[9]**

P.T.O.

b) An I section beam 350 × 200 mm has a web thickness of 12.5 mm and a flange thickness of 25 mm. It carries a shearing force of 200 kN at a section. Sketch the stress distribution across the section. **[8]**

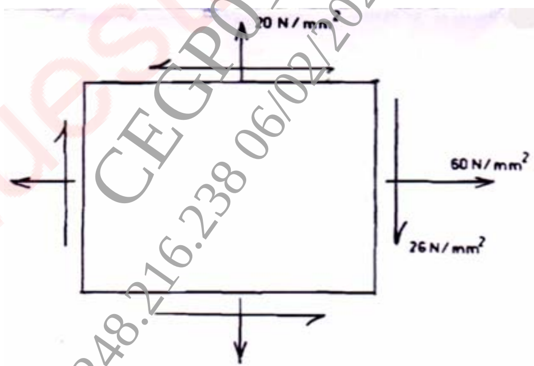
Q3) a) Derive an expression for Principal Stresses in a general two-dimensional state of stress. **[8]**

b) A steel bar 4 mm in length and 40 mm × 40 mm in section is subjected to a axial pull of 150 KN. Calculate the strain energy stored in the bar and also find extension of the bar. Assume modulus of elasticity as 200 GPa. **[9]**

OR

Q4) a) Derive an expression for the maximum shear stress in a general two-dimensional state of stress and also an expression for the aspect angle of the corresponding plane. **[7]**

b) Evaluate the principal stresses and principal planes for the state of stress shown in Figure. **[10]**



Q5) a) What must be the length of a 5mm diameter aluminium wire so that it can be twisted through 1 complete revolution without exceeding a shear of $42 N/mm^2$. Take, G = 27 GPa. **[8]**

b) A cylindrical shell 1 m long, 150 mm internal diameter having metal thickness as 7 mm is filled with fluid of atmospheric pressure. If an additional 25 cc of fluid is pumped into the cylinder, find the pressure exerted by the fluid on the cylindrical shell and the resulting hoop stress. Assume modulus of elasticity = 2×10^5 MPa and Poisson ratio of 0.27. **[10]**

OR

Q6) a) A thin cylindrical vessel of 2 m diameter and 4 m length contains a particular gas at a pressure of 1.65 N/mm^2. If the permissible tensile stress of the material of the shell is 150 N/mm^2, find the minimum thickness required. **[9]**

b) A cylindrical boiler is 2 m in diameter and 15 mm in thickness carries steam at a pressure of 0.8 N/mm^2: Find the stresses in the shell. **[9]**

Q7) a) Explain Macaulay's method to determine the slope and deflection of beam. **[9]**

b) A beam 6 m long, simply supported at its ends, is carrying a point load of 50 KN at its center. The moment of inertia of the beam is 78×10^6 mm^4. If modulus of elasticity for the material of the beam = 2.1×10^5 N/mm^2, calculate deflection at the center of the beam and slope at the supports. **[9]**

OR

Q8) a) Derive Euler's formula for buckling load for column with hinged ends. **[9]**

b) A cantilever of length 4 m carries a uniformly distributed load over the entire length. If the deflection at the free end is 50 mm, find the slope at the free end. **[9]**

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