Total No. of Questions : 8]

SEAT No. :

PD4132

[Total No. of Pages : 3

[6402]-93

S.E. (Production/Production S.W/Robotics & Automation)

STRENGTH OF MATERIALS

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

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data if necessary***

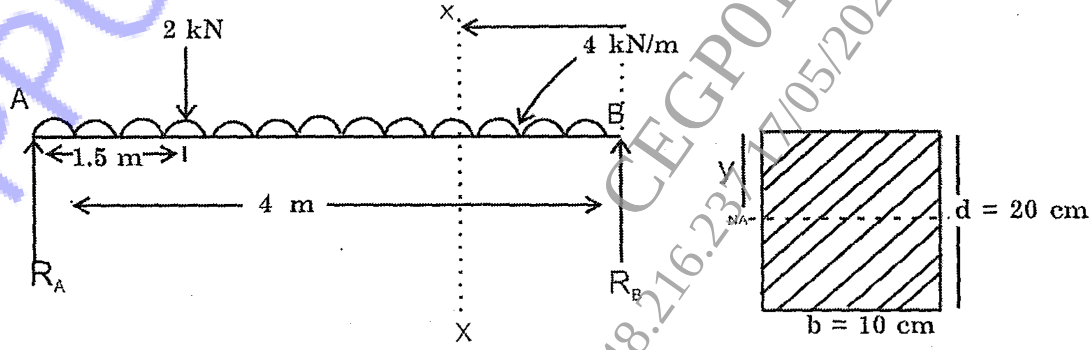
Q1) a) Derive relation between Maximum shear stress and average shear stress for circular cross-sectional Beam **[8]**

b) Write assumption made in Pure bending theory. **[9]**

OR

Q2) a) Derive relation between Maximum shear stress and average shear stress for Square cross-sectional Beam. **[8]**

b) A Simply supported beam AB of span length 4 m supports a uniformly distributed load of intensity q = 4 kN/m spread over the entire span and a concentrated load P = 2 kN placed at a distance of 1.5 m from left end A. The beam is constructed of a rectangular cross-section with width b=10 cm and depth d=20 cm. Determine the maximum tensile and compressive stresses developed in the beam to bending. **[9]**



P.T.O.

Q3) a) A steel rod of 40 mm diameter ,is 2.5 M long .Find maximum instantaneous stress induced when a pull of 80 kN ia applied- **[6]**

i) gradually

ii) Suddenly

b) Discuss Analytical methods for determining the stresses in a member subjected to direct stresses in two mutually perpendicular directions accompanied by a simple shear stress. **[6]**

c) An element in a strained body is subjected to a tensile stress od 150 Mpa and Shear stress 50 Mpa tending to rotate an element in anticlockwise direction find magnitude of shear and normal stresses on a section inclined at 45 degree with the tensile stress. **[6]**

OR

Q4) a) Define- **[6]**

i) Strain energy

ii) Proof Resilience

iii) Modulus of Resilience

b) Direct stress of 120 Mpa (Tensile) and 90 Mpa (compressive) exist on two perpendicular plane at acertain point in abody.They are also accompanied by shear stress on the planes the greaterprinciple stress at a point due to these is 150Mpa.Find the shear stress on these planes,Find also the maximum stress at the point **[6]**

c) Derive strain energy stored in a body when the load is suddenly applied. **[6]**

Q5) a) Design the diameter of circular shaft to transmit 50KW power rotating at 100 rpm .Maximurn torque is likely to exceed mean torque by 25%. Maximum permissible shear stress s 60 Mpa. Also calculate angle of twist for a length of 2M.Take G=80 Gpa. **[6]**

b) Derive a equation for circular shaft subjected to torsion. **[6]**

$$\frac{\tau}{R} = \frac{T}{J} = \frac{G\theta}{L}$$

Where J = Polar moment of inertia τ = Shear stress induced due to torsion T. G = Modulus of rigidity θ = Angular deflection of shaft R, L = Shaft radius & length respectively.

c) Discuss the stresses in a thin cylinder vessel subjected to internal pressure. **[6]**

OR

Q6) a) A hollow shaft 1M in length is required to transmit a torque of 10kN-M. The total angle of twist in this length is not to exceed 1° and the allowable shearing stress is 100 Mpa. Determine the inside and outside diameter of the shaft if G=l00GPa. **[6]**

b) Discuss the stresses in a thin spherical shell subjected to internal pressure. **[6]**

c) Define-Hoop or Circumferential Stress, Longitudinal Stress, Radial pressure. **[6]**

Q7) a) Derive a relation for slope and deflection for a simply supported beam with central point load. **[10]**

b) A hollow mild steel tube 6 M long and 4 cm in internal diameter and 6mm thick is used as a strut with both ends hinged. Find the crippling load and safe load taking factor of safety as 3.$E=2\times10^5$ N/mm^2. **[7]**

OR

Q8) a) Derive relation for buckling load for column when both end are hinged. **[7]**

b) A cast iron beam 40 mm wide and 80 mm deep is simply supported on a span 1, 2 M. The beam carries a point load of 15kN at the centre. Find the deflection at the centre, E=108000 N/mm^2. **[5]**

c) Explain procedure for finding deflection in cantilever beam by Macaulay's method. **[5]**

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