

Total No. of Questions : 8]

SEAT No. :

PA-1180

[Total No. of Pages : 3

[5925]-202

S.E. (Civil Engineering)

MECHANICS OF STRUCTURES (MOS)

(2019 Pattern) (Semester - III) (201002)

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) *Use of non-programable calculator is allowed.*
- 3) *Assume any data, if required.*

Q1) a) A symmetric I section is having two flanges, each of 300 mm × 20 mm and vertical web of 20 mm thickness and 160 mm depth. The beam is subjected to shear force 200 kN. Draw Shear Force Distribution diagram. [9]

b) A rectangular simply supported beam of 5m span is subjected to a central point load of 100 kN. The given beam is 300 mm wide and 500 mm deep. Determine maximum bending stress induced in the section. Draw Bending Stress Distribution diagram. [9]

OR

Q2) a) A 'T' beam, subjected to shear force of 200 kN. The flange is 200 mm × 30 mm and the web is 30 mm thick and 180 mm deep. Draw shear stress distribution diagram. [9]

b) A symmetric I section of flanges 120 mm × 20 mm and web of thickness 20 mm and 100 mm depth, carrying uniformly distributed load of magnitude 80 kN/m over 4 m span. Calculate the maximum bending compressive stress. [9]

P.T.O.

- Q3)** a) A solid circular shaft of diameter 90 mm rotates at 130 rpm. The twist is observed as 3° over 6 m span. [9]

Determine power transmitted.

Take $G = 80$ GPa.

- b) Determine normal, tangential and resultant stresses on a plane at 25° with major principal plane. The principal stresses of 120 MPa tensile on major principal plane and 50 MPa compressive on minor principal plane are acting at a point on the member. [8]

OR

- Q4)** a) A solid circular shaft transmits 220 kW at 160 rpm. The maximum allowable shear stress is 60 MPa and angle of twist permitted is 2° in 3m length. Design suitable shaft. Take $G = 78$ GPa. [9]

- b) A circular bar of diameter 80 mm diameter is subjected to axial compression force of 200 kN. Determine shear stress on a plane, on which the normal stress is 100 MPa. [8]

- Q5)** a) Compare the crippling loads given by Euler's and Rankine's formulae for a steel strut 2.5 m long having outer & inner diameter as 40 mm and 30 mm respectively loaded through pin jointed at the ends. Take yield stress as 320 N/mm^2 the Rankine's constant $\frac{1}{7500}$, $E = 2 \times 10^5$ MPa. [9]

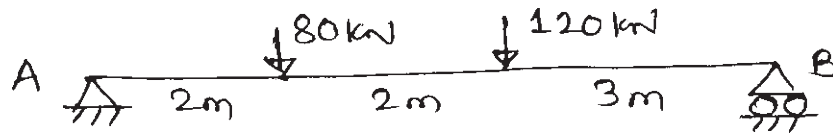
- b) Explain 'Core of the Section' and obtain a core section for a hollow circular column of external and internal diameter 'D' and 'd' respectively. [9]

OR

- Q6)** a) A steel rod 6m long and 30 mm diameter is used as a column. One end is fixed and other is free. Determine the crippling load by Euler's formula. Take $E = 200$ GPa. [9]

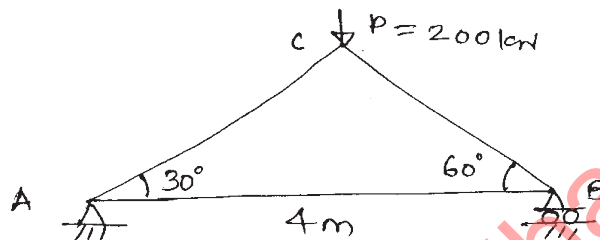
- b) A rectangular column of $240 \text{ mm} \times 150 \text{ mm}$ is subjected to a vertical load of 110 kN, acting at an eccentricity of 60 mm in a plane bisecting 150 mm side. Determine the maximum and minimum stresses. [9]

- Q7) a) The beam is supported and loaded as shown in figure. Determine the position and value of Maximum deflection $EI = 1.4 \times 10^{11} \text{ kN-mm}^2$. Use Macaulay's method. [9]



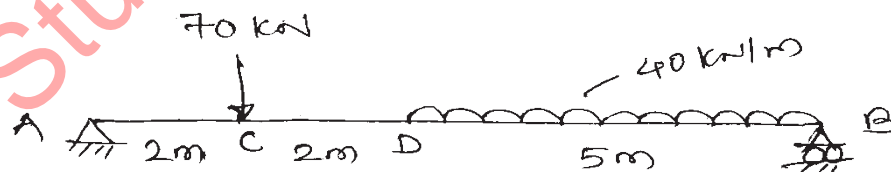
- b) Determine the vertical and horizontal deflection at point 'C' for the truss shown below. [8]

$E = 200 \text{ GPa}$ $A = 2 \times 10^{-4} \text{ m}^2$ for all members.



OR

- Q8) a) Find slope at supports and at point 'C', deflection at 'C' and 'D' for the given beam using Macaulay's method. [9]



- b) Determine the deflection and slope at the free end of cantilever beam of span ' l ' m, loaded with central point load ' w ' kN. [8]

$E I$ is constant.

