Total No. of Questions : 8]

SEAT No. :

PD-4043

[Total No. of Pages : 4

[6402]-2
S.E. (Civil Engineering)
MECHANICS OF STRUCTURE
(2019 Pattern) (Semester - III) (201002)

Time : 2 ½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4. Q.5. or Q.6 Q.7 or Q.8.***
2) ***Figures to the right side indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume Suitable data if necessary.***
5) ***Use of scientific calculator is allowed.***
6) ***Assessment will be based on complete solution and not on final answer.***

Q1) a) Three wooden planks 200 mm × 20 mm each are connected to form a Symmetrical I section of a beam as shown in Figure 1. A moment of 7 kN.m is applied around the horizontal neutral axis. Find the bending stresses at both extreme fibers of cross section. **[8]**

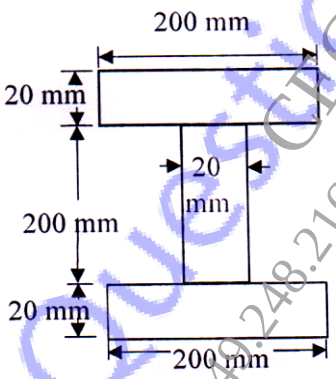

Figure-1

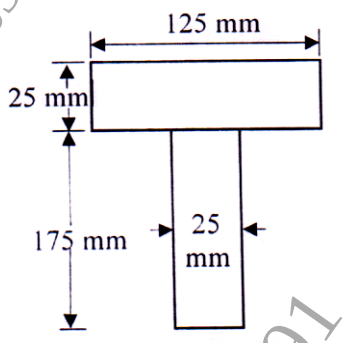

Figure -2

b) A simply supported beam caries a uniformly distributed load of 30 kN/m over the entire span of 2 m. The cross section of beam is aT section, with its top flange of 125 × 25 mm and web of 175 × 25 mm as shown in Figure 2. Obtain the maximum shear stress and plot a shear stress distribution. **[10]**

OR

P.T.O.

Q2) a) A simply supported beam caries a point load of 100 kN at mid span of the beam of span 2 m. The cross section of beam is a T section, with its top flange of 150 × 30mm and web of 30 × 200 mm as shown in figure 3. Obtain the maximum shear stress and plot a shear stress distribution. **[10]**

b) The cross section of simply supported beam of span 6 m long is shown in figure 4. If permissible stresses are 100 MPa in compression 40 MPa in tension, find safe udl the beam can carry. **[8]**

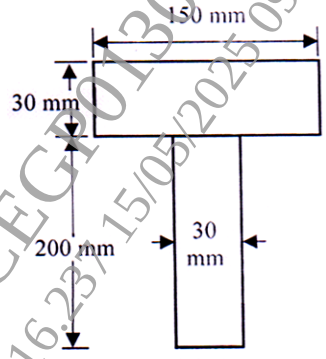

Figure -3

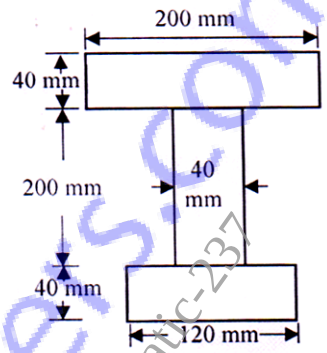

Figure - 4

Q3) a) Find maximum torque that can be safely applied to a shaft of 100 mm diameter. The permissible angle of twist is 2^0 in a length of 4 m and shear stress not to exceed 50 MPa. G = 80 × 10^3 N/mm^2. **[8]**

b) The plane element in a body is subjected to a tensile normal stresses of 25 N/mm^2 in X direction and shear stress of magnitude 100 N/mm^2. Calculate the normal, tangential and resultant stresses on a plane inclined at 30^0 with vertical direction anticlock wise. **[9]**

OR

Q4) a) A hollow shaft with ratio of internal diameter to external diameter 3/5 is required to transmit 400 kW at 60 rpm with a uniform twisting moment. The shearing stress in the shaft must not exceed 50N/mm^2 and the twist in a length of 3 m must not exceed 1^0. Taking G = 85 × 10^3 N/mm^2, determine the minimum external diameter of the shaft satisfying above two conditions. **[9]**

b) The principal tensile stresses at a point are 150 N/mm^2 and 100 N/mm^2. Find normal and tangential and resultant stress on a plane at 30^0 with major principal plane. What is angle of obliquity. **[8]**

Q5) a) State the assumptions made in Euler's theory. A4 m length of tube has buckling load 2 kN when used as a column hinged at both ends. Calculate buckling load for 4.5 m length of the same tube when used as column if,

(i) Both ends are fixed. (ii) One end fixed and another end is hinged. **[9]**

b) A short masonry pillar 600 mm × 600 mm in section. The pillar carries an eccentric load of 1200 kN. Acting at an eccentricity of 30 mm from the longitudinal axis as shown in figure 5. Find the maximum and minimum stresses on the section column. **[9]**

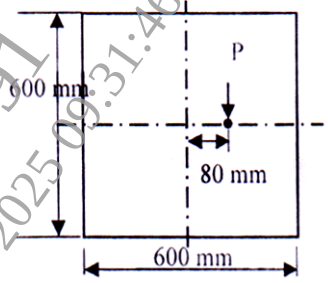

Figure -5

OR

Q6) a) A hollow C.I. column whose outer diameter is 300 mm has a thickness of 25 mm. It is 4 m long and fixed at both ends. Calculate the safe load by Rankine's formula using a factor of safety of 3. Calculate slenderness ratio and Rankine's critical load. Take $\sigma_c = 500$ N/mm^2, $\alpha = \frac{1}{7500}$ and take E = 2 × 10^5 N/mm^2. **[9]**

b) A column 1.2 m × 1.2 m is subjected to eccentric load 600 kN as shown in figure 6. Find The stresses at the corner A, B, C and D. Draw stress distribution diagram. **[9]**

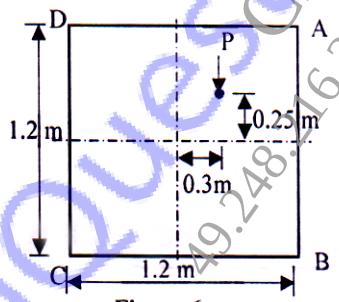

Figure-6

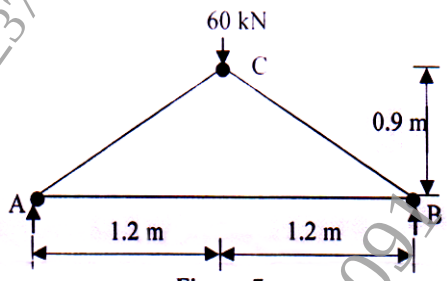

Figure-7

Q7) a) Calculate the slope and deflection of Simply supported beam of span *l* carrying a point load at mid span. **[8]**

b) Determine the horizontal displacement of the joint C of the pin jointed frame as shown in figure 7. The cross-sectional area of AB is 500 mm^2 and AC and BC is 750 mm^2. Assume E = 200k N/mm^2. **[9]**

OR

Q8) a) A simply supported beam having uniform section is 14 m long and is simply supported at its ends. It carries concentrated load of 12 kN and 8 kN at 3 m and 4.5 m from the two ends respectively as shown in figure 8. I for the beam is 16×10^4 m^2 and E = 2.1×10^4 kN/m^2. Calculate the deflection of the beam at points under the two loads by Macaulay's method. **[9]**

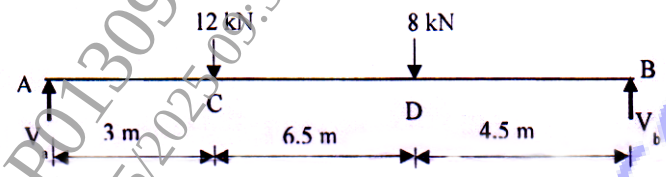

Figure - 8.

b) Determine the slope and deflection at free end of cantilever beam of span 'L' meter subjected udl 'w' on entire span. **[8]**