Total No. of Questions : 8]

SEAT No. :

P9082

[Total No. of Pages : 3

[6179]-207
S.E. (Civil)
MECHANICS OF STRUCTURE
(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) ***Figures in bold to the right, indicate full marks.***
3) ***If necessary, assume suitable data and indicate clearly.***
4) ***Use of electronic pocket calculator is allowed.***

Q1) a) A cast iron beam has an I-section with top flange 80 mm × 40 mm, web 120 mm × 20 mm and bottom flange 160 mm × 40 mm. If the tensile stress is not to exceed 30 N/mm^2 and compressive stress 90 N/mm^2, what is the maximum uniformly distributed load the beam can carry over a simply supported beam span 6 m, if the larger flange is in tension. **[9]**

b) The unsymmetrical I-section has top flange 80 mm × 20 mm, web 200 mm × 20 mm and bottom flange 160 mm × 40 mm is subjected to shear force of 40kN. Draw shear stress variation diagram across the depth. **[9]**

OR

Q2) a) A simply supported beam is having 3.5 m long span. Find the maximum udl it can carry. Its allowable compressive and tensile stress are 55 Mpa and 30 Mpa respectively. Draw a diagram showing the variation of stress over mid span section of the beam. **[9]**

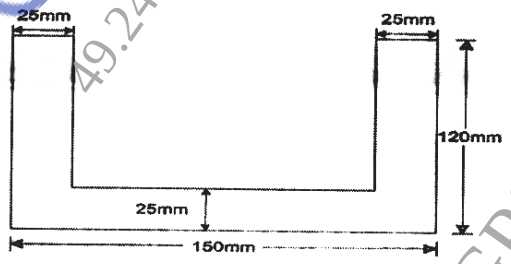

Figure 1

b) A steel beam of I section, 200 mm deep and 160 mm wide has 16 mm thick flange and 10 mm thick web. The beam is subjected to a shear force of 200 kN. Determine the stress distribution over the beam section if'the web of the beam is kept horizontal. **[9]**

P.T.O.

Q3) a) Calculate the maximum intensity of shear stress induced and the angle of twist produced in degrees in solid shaft of 100mm diameter, 10 m long, transmitting 112.5 kW at 150 rpm. Take G 82 kN/mm^2. **[9]**

b) The stresses at point in a component are 150 Mpa and 50 Mpa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55º with the axis of major tensile stress. Also find the magnitude of the maximum shear stress in the component.**[8]**

OR

Q4) a) A solid shaft is subjected to a torque of 1.6 kN-m. find the necessary diameter of the shaft, if the allowable shear stress is 60 Mpa. The allowable twist is 1º for every 20 diameter length of the shaft. Take C=80 Gpa.**[9]**

b) At a point in a strained material there is tensile stress of 80 N/mm^2 on a horizontal plane and compressive stress at 40 N/mm^2 on a vertical plane. There is also a shear stress of 48 N/mm^2 on each of these planes. Determine the planes of maximum shear stress at the point. Determine also the resultant stress on the planes of maximum shear stress. **[8]**

Q5) a) Determine the buckling load for a strut of tee section, the flange width being 100 mm. overall depth 80 mm and both flange and web 10 mm thick. The strut is 3 m long and is hinged at both ends. Take E = 200 GNm^2. **[8]**

b) A alloy hollow circular column of 200 mm external and 160 mm internal diameter is 5 m long and fixed at both ends. It is subjected to a load of 120 kN at an eccentricity of 20 mm from the axis. Determine the maximum stress induced in the column section. Take E = 120 Gpa. **[9]**

OR

Q6) a) Find the Euler's crippling load for a hallow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3m and hinged at its both ends. Take E = 205 Gpa. Also determine crippling load by Rankine's formula using yield stress 335 Mpa and constant 1/7500. **[8]**

b) A steel tube of external diameter 109 mm and internal diameter 100 mm is used as a column of length 5 m with both ends hinged. How much axial load can it carry with a factor of safety of 1.75? In case the same load acts with eccentricity of 12 mm, determine the maximum horizontal deflection and the stress in the column. Take E =2 × 10^5 N/mm^2. **[9]**

Q7) a) A simply supported beam of 6 m span is subjected to a concentrated load of 18 kN at 4 m from the left support. Calculate : **[9]**

i) the position and value

ii) slope at mid span

iii) deflection at the load point

Give E = 200 Gpa, I = 15×10^6 mm^4 use Macaulay's method

b) Determine the vertical deflection using strain energy method of point C in the frame shown in figure 2. Given E = 200 kN/mm^2 and I = 30×10^6 mm^4. **[9]**

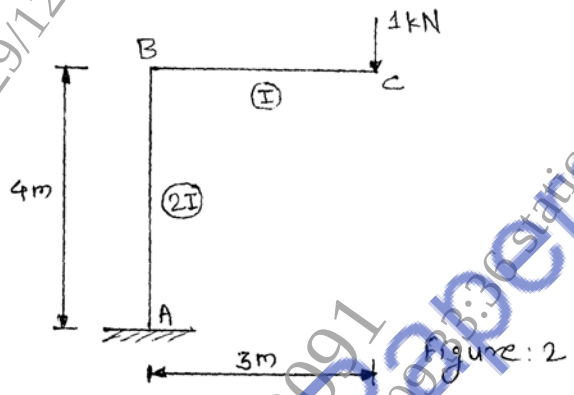

Figure : 2

OR

Q8) a) A cantilever of beam AB of length L and fixed at end A carries UDL of intensity l0kN/m over the entire span 6m and point load at free end 40 kN. Determine Slope at center and deflection at free end B of beam. Use Castingliano's theorem. **[9]**

b) Determine the horizontal displacement of the joint C of the pin jointed frame as shown in figure 3. The cross section are of AB is 500 mm^2 and AC and BC is 750 mm^2. Assume E = 200 kN/mm^2. **[9]**

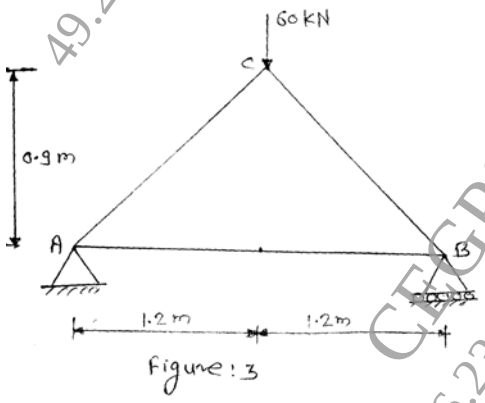

Figure : 3