Total No. of Questions : 8]

SEAT No. :

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[6179]-326

S.E. (Automobile & Mechanical/ Mechanical Sandwich and Automation & Robotics)

SOLID MECHANICS

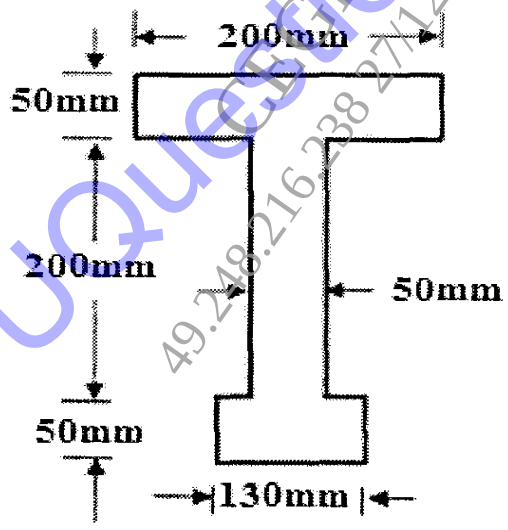
(2019 Pattern) (Semester-III) (202041)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8.*
2) *Figures to the right indicate full marks.*
3) *Use of electronic pocket calculator is allowed.*
4) *Assume suitable data, if necessary.*

Q1) a) The shear force of 50kN acts on I section beam as shown in fig. 1 have unequal flanges. Moment of inertia about neutral axis is 2.849×10^8 mm^4. Calculate magnitude of shear stress at important points and draw shear stress distribution diagram. **[9]**



Q1 (a) Fig.1

b) A beam of length 6 m is simply supported at its end and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from left Support. Find **[9]**

P.T.O.

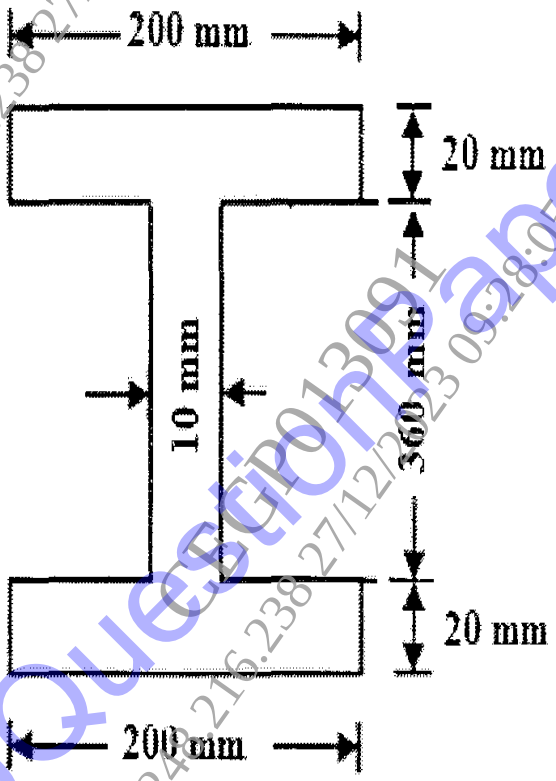
i) Deflection under each load,

ii) Maximum deflection and

iii) Point at which maximum deflection occurs. Take I = 85×10^6 mm^4 and E = 2×10^5 N/mm^2.

OR

Q2) a) A simply supported beam is 10 m long carries udl of 40 kN/m over entire span. The cross section of beam is I as shown in fig.2. Calculate the maximum stress produced due to bending. Also draw bending stress distribution diagram across depth : **[9]**



Q.2(a) Fig.2

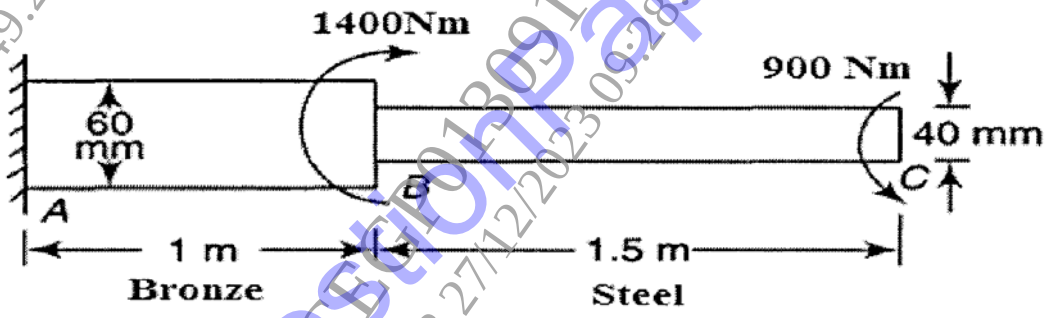
b) The T shaped cross section of beam has 200 mm wide × 50 mm thick flange and overall depth of section is 250 mm. The web is 50 mm thick. Section is subjected to vertical shear force of 100 kN. Calculate the shear stress at the neutral axis and at the junction of flange and the web. Take I about NA = 1.134×10^8 mm^4. Also draw the shear stress distribution diagram. **[9]**

Q3) a) A shaft of hollow circular section has outer diameter 120mm, inner diameter 100mm. Permissible shear stress is 95MPa. Angle of twist is not to exceed 3.6 degree in a length of 3m. Maximum torque is 30% excess of mean torque. Speed of shaft is 2 Hz. Determine maximum power transmitted by shaft. Take G = 80 GPa. **[9]**

b) A cylindrical tube having internal diameter 70 mm and external diameter 80 mm is subjected to an axial tensile load of 90 kN undergoes an extension of 3 mm over its 8 m length. What is the safe axial load resisting capacity of Column when cylindrical tube is fixed at one end and free at other end. Determine safe load on column taking FOS as 3. **[8]**

OR

Q4) a) The solid circular composite shaft ABC consists of steel and bronze segments as shown in fig.3. Shaft is rigidly fixed at A and free at C, subjected to a torque as shown. Determine angle of twist at free end with respect to fixed end. Take C = 83GPa for steel and C= 35 GPa for bronze. **[9]**

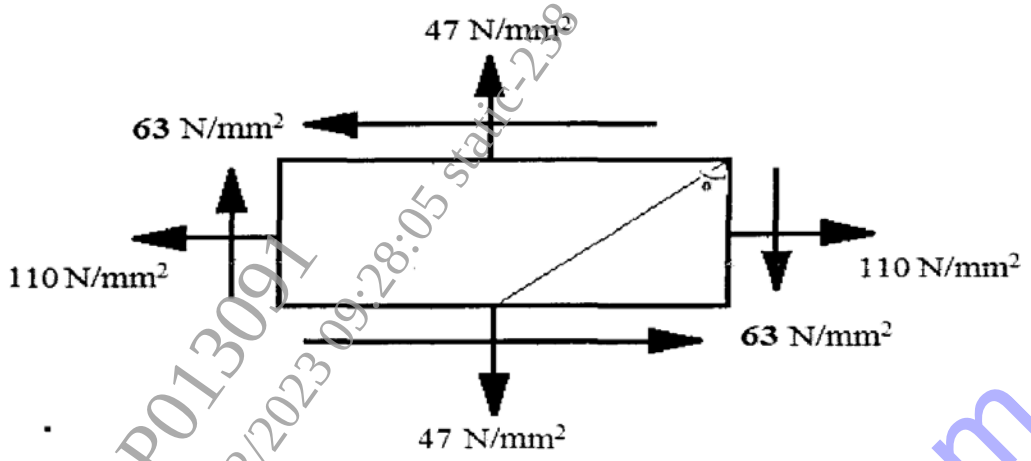


Q.4(a) Fig.3

b) A bar of length 4 m when used as SSB and subjected to UDL of 50 kN/m over the whole span, deflects 20 mm at Centre. Determine the crippling load when it is used as a column with following conditions. **[8]**

i) Both end pinned joints
ii) One end fixed and other end free
iii) Both end fixed

Q5) a) A strained material is subjected to stresses σx = 110 N/mm^2 Tensile, σy = 47 N/mm^2 (Tensile) and τxy = 63 N/mm^2. Determine the intensity of normal tangential and resultant stress and angle of obliquity on a plane inclined at 30° to the plane carrying 110 N/mm^2 stress as shown in Fig.4. Also find Principal stresses and its orientation. Use analytical method.**[12]**

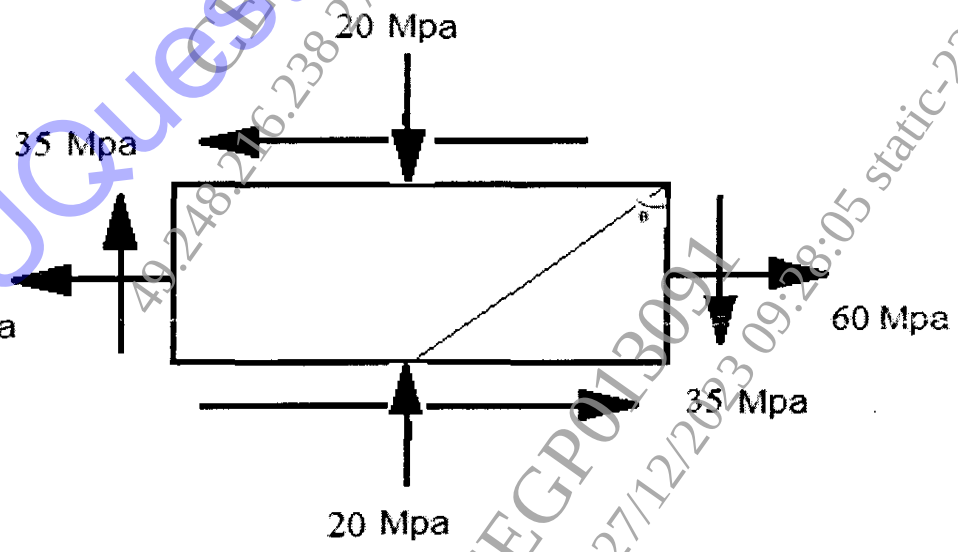


Q.5(a) Fig.4

b) According to maximum shear stress theory determine the diameter of a bolt which is subjected to an axial pull force of 9 kN together with a transverse shear force of 4.5kN. Elastic limit in tension is 225N/mm², factor of safety is 3. **[6]**

OR

Q6) a) The planes are stressed as shown in fig.5, determine the principal stresses and its orientation. Determine normal and tangential stresses on oblique plane inclined at 30° with the plane of 60 MPa. Also determine the maximum shear stress and plane on which it acts using Mohr's Circle method. **[12]**



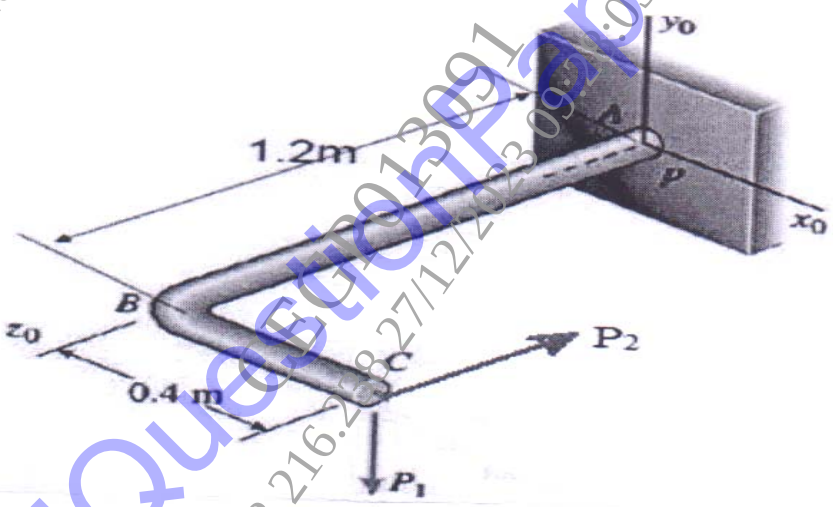
Q.6(a) Fig.5

b) A machine element is subjected to the stress σx = 60 MPa, σy = 45MPa, τ_{xy} = 30 MPa. Find the factor of safety if it is made of C45 steel having yield stress as 353 MPa. Using the following theories. Take 1/m = 0.3. **[6]**

i) Maximum shear stress theory

ii) Distortion energy theory, Maximum principal strain theory.

Q7) a) A horizontal bracket ABC consist two perpendicular arm having circular cross section with diameter 60 mm. At point C, P_1 vertical load 2.02kN and P_2 horizontal 3.07 kN are acting as shown in fig. 6. Neglecting weight of bracket calculate the maximum and minimum stresses developed at support due to P_1 & P_2. **[9]**



Q.7(a) Fig.6

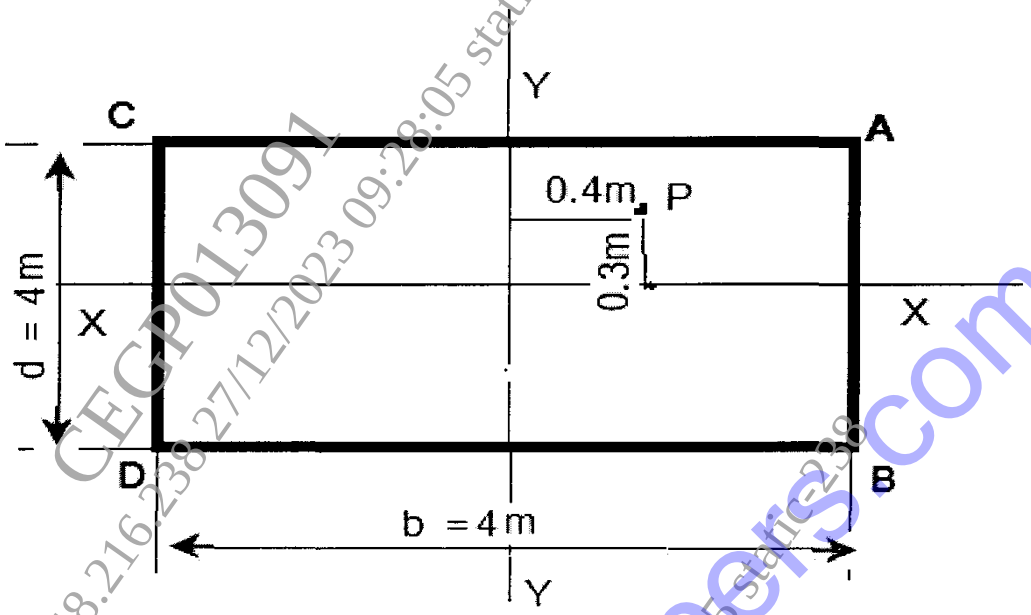
b) A solid shaft of diameter 80 mm is subjected to twisting moment of 8 MN-mm and bending moment of 5 MN-mm at a point. Determine **[8]**

i) Principal stresses and

ii) Position of plane on which it acts.

OR

Q8) a) Determine the resultant stress at four corners of column subjected eccentric load of P= 600 kN as shown in Fig.8. **[9]**



Q.8(a) Fig.8

b) Draw core or kernel of section for a rectangular section having dimensions 600 mm × 450 mm. show the dimension of core/kernel of section in it. **[8]**

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