(3 Hours) [Total Marks: 80

N.B: (1) Question **No. 1** is compulsory.
    (2) Attempt any **Three** questions out of remaining five questions.
    (3) Assume suitable data wherever required and state it clearly.
    (4) Illustrate your answers with neat component sketches wherever required.

1. Attempt the following
  a. State assumptions made in pure bending.   04
  b. Derive the expression for core section of hollow circular section   04
  c. Explain angle of oblique plane and angle of obliquity.   04
  d. Derive the relation between shear force and rate of loading   04
  e. Draw the SFD and BMD for cantilever beam of length 'L' carrying concentrated load   04
    'W' at mid length.

2. a. A simply supported beam of span 10 m carries central point load of 150 kN. The cross   08
    section of beam consist of ' T ' section having overall depth 125 mm, flange 140 mm
    wide and 20 mm. thick and web thickness 20 mm. Draw shear stress distribution diagram.
  b. Exlain flitched beam.   04
  c. A flitched beam consist wooden joist 200 mm X 350 mm is strengthened by two steel   08
    plates each 8 mm thick and 350 mm depth attached on either side of wooden joist
    symmetrically. Calculate maximum UDL supported by flitched beam over a simply
    supported span of 6 m. Permissible stresses in wood and steel are 7 MPa and 125 MPa
    respectively

3. a. Draw Shear force, Bending moment and Axial force diagram for beam shown.   12


  b. What is core section ? Determine the dimension of core section for hollow rectangular   08
    section having External dimension are twice the internal.

4. a. A hollow rectangular steel column of size 100 mm X150 mm. externally and thickness   08
    10 mm The length of column is 4.5 m. Both ends of column are rigidly fixed. Find safe
    load carried by column using Eulers and Rankines theory. Take $E = 200$ GPa, $\alpha =$
    $1/1600$, $\sigma_c = 330$ MPa $E = 200$ Gpa. Factor of safety 1.5.
  b. At a point in a strained material the stresses on two mutually perpendicular plane are   08
    100 MPa (tensile) and 60 MPa (compressive) accompanied with shear stress 40 MPa
    Find magnitude and direction of resultant stress on oblique plane which makes an angle
    of 60^0 with plane of 60MPa stress. Use Mohr's circle method.
  c. State the assumption made Euler's theory of column.   04

5. a. A shell 3.5 m. long. 1m diameter and 10 mm thick are subjected to internal pressure   06
    1.00 N/mm^2. Find change in dimension of shell. Take $E = 2 \times 10^5 N/mm^2$, $1/m = 0.3$

1/2

b. A steel block is subjected load on three mutually perpendicular planes as shown. Find change in volume and change in each dimension. Take $E = 2 \times 10^5 \, N/mm^2$, $1/m = 0.3$ 07
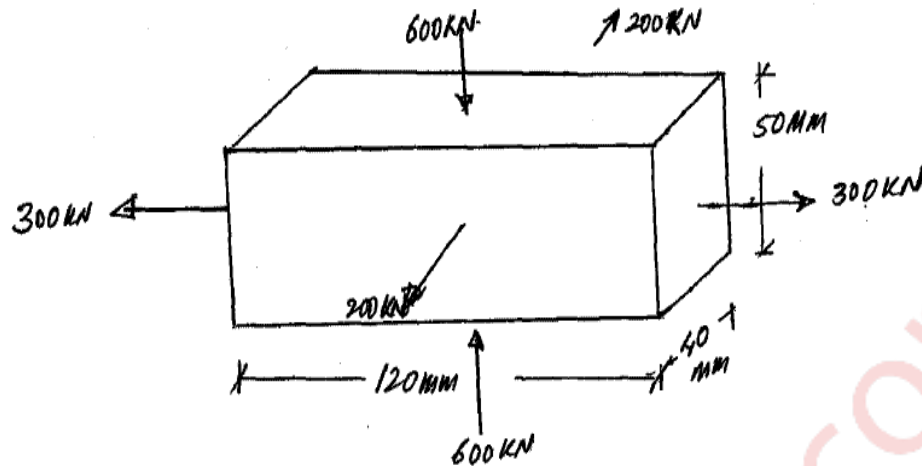
c. A hollow square masonry chimney of size 2.4 m X 2.4 m.(External) and thickness 40 mm subjected to horizontal wind pressure 1.2 kN/m^2 along one of the diagonal. The cross section of chimney is uniform. Find safe height of chimney. Weight of masonry 24 kN/m^3 07

6. a. A hollow shaft, having an internal diameter 40 % of its external diameter, transmits 562.5 kW power at 100 rpm. Determine diameter of shaft if shear stress not to exceed 60 N/mm^2 and a twist in a length of 2.5 m should not exceed 1.3°. Assume maximum torque is 1.25 times the mean torque. Take $G = 9 \times 10^4 \, N/mm^2$ 08

   b Derive the expression for deformation of solid conical tapering bar.   08

   c. A steel rod 30 mm diameter and 5 m. long is connected is fixed in support at temperature of 95 ^{0}C . determine the stress when temperature falls 30 ^{0}C if support yields by 1.2 mm. Take $E = 2 \times 10^5 \, N/mm^2$ and $\alpha_t = 12 \times 10^{-6} \, /^0 C$ 04

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