(03 HOURS) **TOTAL MARKS : 80**

Instructions : (1) Question No .1 is compulsory
(2) Answer any ***Three Questions*** from the remaining.
(3) Each full question carries **20** marks.
(4) Assume suitable data, if needed and state it clearly.

Q.1 Attempt **any four**

a) A reinforced concrete column of 400 mm diameter supports a load of 500 KN axially. The reinforcement consists of 8 steel rods each of 20 mm diameter Find how much stresses develop in the rods and the concrete of if Young's modulus of steel is 18 times that of concrete. **(05M)**

b) Draw the shear force and bending moment diagrams for a cantilever of length L carrying a uniformly distributed load of w per unit length over the entire length. **(05M)**

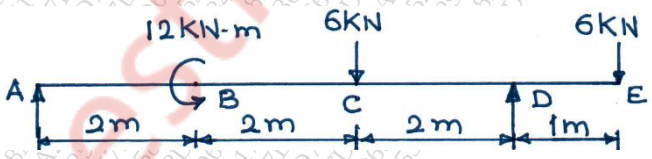
c) Define Section Modulus. Find an expression for section modulus a rectangular section and hollow circular section **(05M)**

d) Derive the expression for Elongation of a bar due to its own weight **(05M)**

e) Derive an expression for the strain energy in a member subjected to gradually applied an axially tensile load. **(05M)**

Q.2 a) Determine extension, change in lateral dimension, change in volume of a steel tie bar 1.1 m long and 50 mm diameter is subjected to a tensile stress of 120 MN/m^2. Assume that E=200 GN/m^2 and Poisson's Ratio μ =0.3 **(08M)**

b) Define Point Of Contra flexure. Draw the shear force and bending moment diagram for diagram as shown in figure and locate position of point of contra flexure. **(12M)**



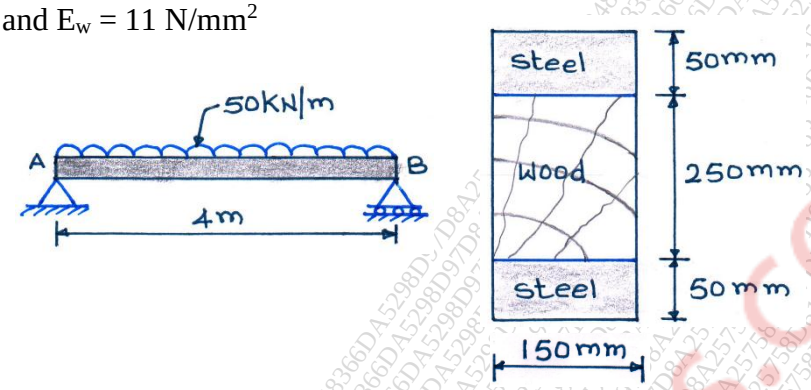
Q.3 a) A cantilever beam has hollow rectangular cross section with outer dimensions 300 mm x 600 mm and inner dimensions 200 mm x 400 mm asymmetrical about both X and Y axis. The larger dimensions are along the depth. The beam has span of 3 m and is loaded with u.d.L. of l0 kN/m of full span. Determine the maximum bending stresses developed. **(10M)**

b) What assumptions are made in the theory of pure torsion? **(04M)**

c) Derive the relation between three moduli (E,G and K) **(06M)**

Q.4 a) A T-section with flange 200 mm x 50 mm and web 200 mm x 50 mm is subjected to a vertical shear force of 200 KN. Calculate Shear stress at the junction of the flange and web and Shear stress at the Neutral axis. Sketch the shear stress distribution diagram. **(10M)**

b) A compiste beam shown in the fig is simply supported and carries a total uniform load of 50 kN/m on a span 4 m . The beam is built of a wood member having cross sectoional dimensions 150 mm x 250 mm and two steel plate of cross sectional dimensions 150 mm x 50 mm. Determine the maximum stresses σ_s & σ_w in the steel and wood respectively. If the modulii of elasticity are E_s =209 N/mm^2 and E_w = 11 N/mm^2 **(10M)**



Q.5 a) A hollow steel shaft having internal diameter half the external diameter transmits 147 kw at 225 r. p. m. lf the maximum allowable shear stress is not to exceed 6 kN/cm^2 and the angle of twist is not to exceed 1 degree in length of 20 times the external diameter . Determine the suitable section of shaft assuming G=10^4 kN/cm^2. **(10M)**

b) A cylindrical shell 100 cm long and 20 cm internal diameter having thickness of metal as 10 cm is filled with fluid at atmospheric pressure. If an additional 20 cm^3 of fluid is pumped into the cylinder, find (i) the pressure exerted by the fluid on the cylinder and (ii) the hoop stress induced. Take E = 2 x 10^5 N / mm^2 and Poisson's ratio = 0.3 **(10M)**

Q.6 a) A short column of external diameter 500 mm and internal diameter 250 mm, caries an eccentric load of 100 kN. Find the greatest eccentricity which the load can have without producing tension on the cross section. **(06M)**

b) Find the Rankine's crippling load for a hollow cylindrical cast iron column 200 mm external diameter, 25 mm thick, 6 m long and fixed at both ends. Take α =1/1600 and σ_c = 500 N/mm^2. **(04M)**

c) At a point two mutually perpendicular direction the stresses are 80 N/mm^2 tensile and 40 N/mm^2 tensile. Each of above stress accompanied by a shear stress of 60 N/mm^2. Determine graphically normal stress, shear (tangential) stress and resultant stress on an oblique plane inclined at an angle 45^0 with the axis of minor tensile stress. Use Mohr's Circle Method. **(10M)**

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