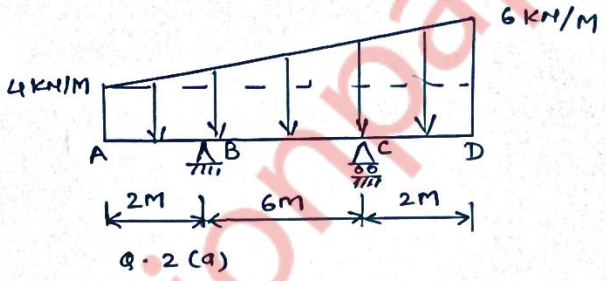
(3 Hours) **[Total Marks: 80**

Note: i. Q. No. 1 is **compulsory**
ii. Attempt **any 3** out of remaining 5
iii. Assume any **Suitable data** if required.

1. Solve the following (20 M)
   A. What is point of contra-flexure.Give the relation between shear force and bending moment
   B. A steel bar 2 m long, 40mm wide and 20mm thick is subjected to an axial pull of 160 KN in the direction of its length. Find the change in length, width and thickness of bar. Take E= 200Gpa and Poisson's ratio= 0.3
   C. Determine the area of the core of section having internal dia. 100mm and external dia. 150mm.
   D. A rectangular column of 230mm x 350mm and 4M long used as a column. If one end is hinged and other is fixed, find the safe load the column can carry if FOS-2.5. use Euler's formula. E=200Gpa.
   E. Calculate strain energy stored in a bar 2m long, 50mm wide and 40mm thick when it is subjected to a tensile load of 60KN. Take E=200 Gpa.

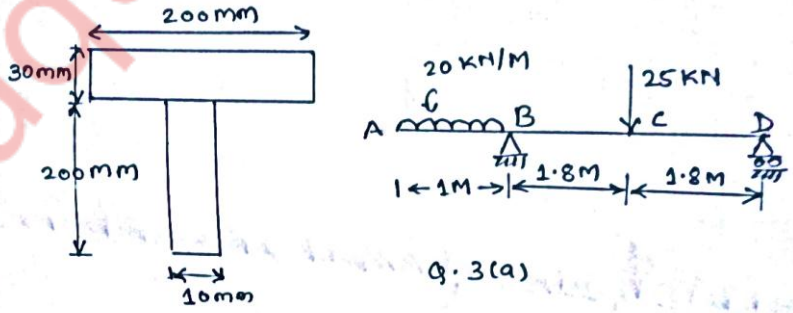
2. A. Draw a shear force and bending moment diagram for the beam loaded as shown in fig. (12 M)



Q. 2 (a)

   B. A laminated wooden beam made of three planks of 100mm X 50mm glued together to form solid section of 100mm X 150mm. The allowable shear stress in the glue joint is 0.35N/mm^2. If the beam is 2m long and simply supported at the ends find the safe point load the beam can carry at mid span. (08 M)

3. A. A simply supported beam with overhang is loaded as shown in fig. Calculate maximum tensile and compressive stress due to bending. (12 M)



Q. 3 (a)

TURN OVER

B. A hollow shaft of diameter ratio 3/8 has to transfer 400KW power at 100 rpm. The maximum torque being 24% greater than mean torque. The maximum shear stress not to exceed 60 N/mm^2 and angle of twist in a length of 4m should not exceed 2^0. Calculate external and internal diameter of shaft. Take G= 84 KN/mm^2 (08 M)

4. A. A composite section consist of steel rod of 150 mm diameter and outer brass tube of internal dia. 150 mm and external dia. 170mm is rigidly fixed over steel rod and having length of 200mm. the composite section carries a load of 600KN. Find the stresses produced in each material and load carried by both the materials. Take Es=2x10^5 N/mm^2 & E_{al} = 1x10^5 N/mm^2 (08 M)

B. At a point in a strained material, a direct tensile stress of 60 N/mm^2 along x direction and compressive stress of 40 N/mm^{2}along Y direction are applied on a plane right angle to each other. If maximum principal stress is limited to 75 N/mm^2. Find the shear stress that may be allowed on the plane. Also find minimum principal stress and maximum shear stress. (08 M)

C. A spherical vessel of 1.2m diameter is subjected to pressure of 1.8 Mpa. Determine the stress in the plate if its thickness is 5 mm. (04 M)

5. A. A steel rod of 15mm dia. Is enclosed in a copper tube of external dia. 50mm and internal dia. 40mm and the supports are unyielding. If the assembly heated to temperature of 60^0 C find the stresses developed in each material. Take Es=2.1x10^5 N/mm^2 ,α Ec=1.05x10^5 N/mm^2 , αsteel=12x10 $^{-6}$ per ^{0}C , αcopper=17.5x10 $^{-6}$ per ^{0}C (08 M)

B. A copper bar of 12mm diameter gets stretched by 1mm under a steady load of 4KN. What stress would be produced in a bar by a weight of 500N falls through 80mm before striking the collar rigidly attached to lower end of the bar. E=100Gpa (08 M)

C. A thin cylindrical shell of 400 mm diameter is to be designed for an internal pressure of 2.4Mpa. Find the suitable thickness of the shell if the permissible circumferential stress is 50 Mpa. (04 M)

6. A. A timber beam 100mm wide and 200mm deep is strengthen by steel plate 100 mm wide and 10mm thick at the top. The beam is fixed at one end and free at another end and carries a UDL of 8 KN/m over the length of 2m. calculate maximum stress in timber and steel. Take Es=20 Et (08 M)

B. A concrete dam of rectangular section 15 m high and 6m wide contains water up to height of 13 m. Find the maximum and minimum stress at the base. Assume unit weight of water and concrete 10 and 25KN/m^3. (08 M)

C. What are the assumptions of Euler's theory in column. (04 M)

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