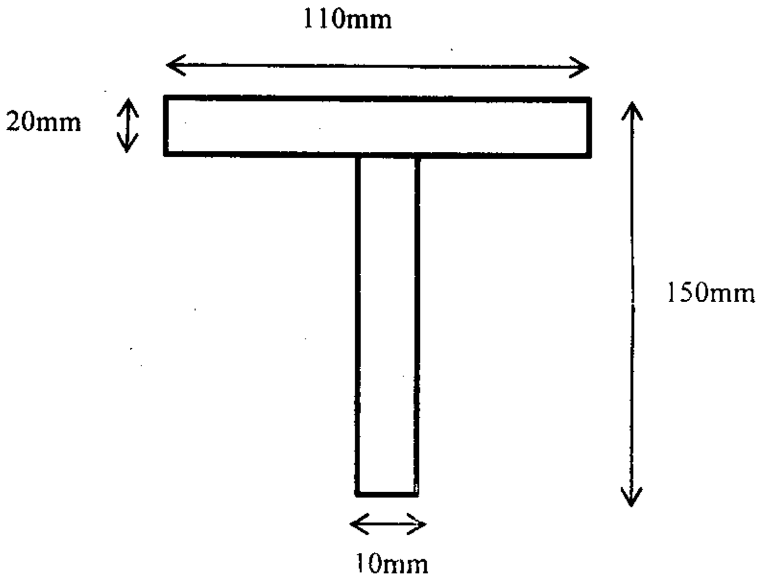
EX/ARCH/CE/T/215/2017

# B. ARCHITECTURE 2ND YR 1ST SEM. EXAM. 2017

**Subject: THEORY OF STRUCTURE- I** **TIME: 3 Hours** **Full Marks: 100**

Assume any necessary data if required

| No. of questions | Answer any Five questions. | Marks (5x20=100) |
|---|---|---|
| 1. | | 10+10 = 20 |
| a) | Prove the basic equation of theory of simple bending of a rectangular beam section i.e. $M/I = \sigma / y = E/R$. | |
| b) | Dimensions of a T section are given in the figure 1. A cantilever beam of 4 m long made by this section. Determine the point load W at the free end so the maximum stress in the section does not exceed 90 $N/mm^2$.   Figure 1. | |
| 2. | | 10+10=20 |
| a) | Show that maximum shear stress of a rectangular beam section is 1.5 times the average shear stress of that section i.e. $\tau_{max} = 1.5\ \tau_{av}$ with neat sketch. | |
| b) | A wooden beam of rectangular cross section 150 mm x 300 mm is simply supported over a length of 4 m. It carries a udl of 4 kN/m throughout its length. What is the maximum shear stress developed in the beam section. | |

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| | | |
|---|---|---|
| 3.<br>a) | Draw the mohr's circle for the following cases of stress conditions<br>i) When normal stresses are equal magnitude but opposite in sign i.e $\sigma_x = -\sigma_y$<br>ii) When only $\sigma_x$ exist and $\sigma_y$ is zero | 10+10 =20 |
| b) | The principal tensile stresses at a point across two perpendicular planes are 80 $N/mm^2$ and 40 $N/mm^2$. Find the normal and tangential stresses on a plane at 20 degree with the major principal plane. | |
| 4.<br>a) | Write down the assumptions and limitations of Euler's theory of column buckling. | 10+10=20 |
| b) | Derive the Euler's formula for column buckling for a column with both end hinged condition. | |
| 5.<br>a) | Write down the first and second theorem of moment area method with neat sketch | 10+10 =20 |
| b) | Derive the end slope $\theta_A$ and maximum deflection $\delta_C$ of the simply supported beam shown in figure 2. Assume moment of inertia I and young's modulus E for the material of the beam are constant throughout.<br>(C is midpoint of the beam). | |

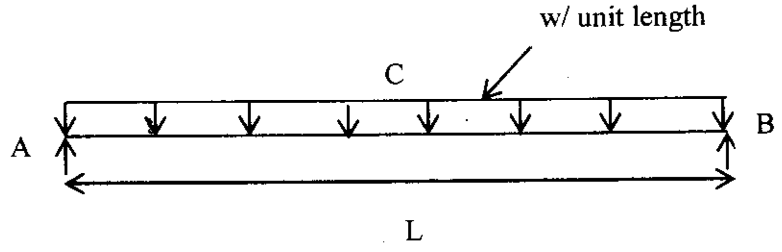


Figure 2.

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| | | |
|---|---|---|
| 6.<br>a) | A solid round bar 60 mm dia and 2.5 m long is used as column, one end of which is fixed while other end hinged. Find the safe compressive load for the column using Euler's formula. Assume E =200 x$10^9$ N/$m^2$ and factor of safety 3. | 10+10 =20 |
| b) | Deduce and draw the shear stress distribution of a standard symmetrical I-section. | |