Code No: R2021012 **R20** SET - 1

II B. Tech I Semester Regular Examinations, Feb/March - 2022
STRENGTH OF MATERIALS - I
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
~~~~~~~~~~~~~~~~~~~~~~~~~

1 a) A cylindrical bar is 25 mm diameter and 1200 mm length subjected to tensile force. The longitudinal strain is 4 times the lateral strain. Find the change in volume when the bar is subjected to a hydrostatic pressure of 125 N/mm^2. Also find the rigidity modulus if E = 1.2 x 10^5 N/mm^2. [7M]

b) A bar of 14 mm diameter is stretched by an amount 3.5 mm under a steady load of 15 kN. What stress can be produced in the same bar by a weight of 750 N falling through 75 mm before commencing to stretch the rod if it is initially unstressed? Take E = 200 GPa. [7M]

OR

2 a) A steel tube 50 mm external diameter and 3 mm thick encloses centrally a solid copper bar of 35 mm diameter. The bar and the tube are rigidly connected together at the ends at a temperature of 30°C. Find the stresses in each metal when temperature is raised to 180°C. Also find the increase in length if the original length of the assembly is 350 mm. E_s = 200 GPa, E_c= 100 GPa, α_s = 1.08 x 10^{-5} per°C, α_c = 1.7 x 10^{-5} per°C [8M]

b) Draw the stress stress strain diagram for mild steel and explain its salient features. [7M]

3 A cantilever of length 6 m carries two point loads of 2kN and 3kN at a distance of 1 m and 6 m from the fixed end respectively. In addition to this the beam is also carries a uniformly distributed load of 1 kN/m over a length of 2 m at a distance of 3 m from fixed end. Draw the shear force and bending moment diagram. [14M]

OR

4 Draw the shear force and bending moment diagrams for the cantilever beam as shown in Fig.2. [14M]

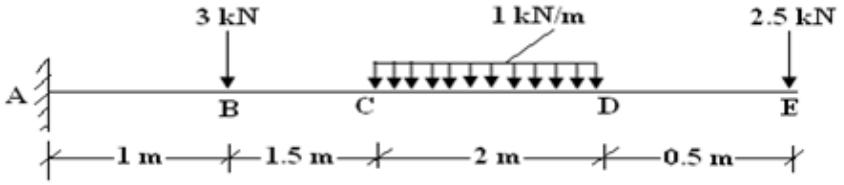

Fig.2

5 a) A simply supported beam of span 4 m carries a point load of 15 kN at a distance of 3 m from left support. The cross section of the beam is I – section has an overall depth of 175 mm. Each flange is 100 mm wide and 15 mm thick and the web is 10 mm thick. Determine the tensile and compressive strength at a section which is at a distance of 3.25 m from the left support. [7M]

b) A beam of T – section has a flange of dimension 200 mm x 20 mm and web 250 mm x 30 mm. If it is used as simply supported beam of span 3 m and subjected to u. d. l of 5 kN/m over entire span and a point load of 10 kN at centre, then find the shear stress at neutral axis. [7M]

OR

|'''|'|'|''|''||'|||
~~~~~~~~~~~~~~~~~~~~~~~~~

6 a) A T – section is made up of two planks of wood, 300 mm x 20 mm and 200 mm x 20 mm, with larger of the plank kept horizontal. If the permissible stresses in tension and compression are 8 MPa and 12 MPa. Find the maximum load the beam can carry as a simply supported beam subjected to u. d. l over the entire beam. Length of the beam is 3 m. [7M]

b) A simply supported beam of I – section has an overall depth of 175 mm. It carries a point load of 40 kN at the midpoint on a simply supported beam of span 2.5 m. Each flange is 100 mm wide and 15 mm thick and the web is 10 mm thick. Find the shear stress at neutral axis and also draw the shear stress distribution. [7M]

7 A beam ABC of length 12 m, one support at the left end and other support is at a distance of 8 m from the left end. The beam carries a point load of 10 kN at the overhanging end (12 m from left end). Find the slope at each support and maximum upward deflection between the supports. Take E = 200 GPa and I = 5 x 10^8 mm^4. [14M]

OR

8 A beam is 10 m long and is simply supported at the ends. It carries concentrated loads of 125 kN and 75 kN at distances of 2 m and 5 m respectively from left end. Calculate the deflection under each load. Take I = 16 x 10^8 mm^4 and E = 2.1 x 10^5 N/ mm^2. [14M]

9 a) A thin cylindrical pressure vessel has an internal diameter of 150 mm and a wall thickness of 5 mm. It is subjected to an internal pressure of 7 N/mm^2. If the cylinder is 900 mm long and E = 200 GPa, find the stresses induced and also find the Poisson's ratio for the material if the change in volume under this pressure is 15,000 mm^3. [9M]

b) Find the thickness of metal required for a cylindrical shell of internal diameter 120 mm to withstand an internal pressure of 40 MPa. The maximum hoop stress is not to exceed 130 MPa. [5M]

OR

10 a) A cylindrical pressure vessel, of diameter 1 m and length 2m, is subjected to an internal pressure of 2 MPa. If the hoop stress is limited to 42 MPa and the longitudinal stress to 28 MPa, find the minimum thickness required. What will be the change in volume of the cylinder under this pressure? E = 2 x 10^5 N/mm^2 and $\nu = 0.3$. [6M]

b) A thick cylinder, of internal radius 50 mm and outside diameter 100 mm is subjected to an external pressure of 15 MPa and internal pressure of 50 MPa. Find the maximum hoop and radial stresses. [8M]