7. (a) Give Rankine's formula and its advantages. 10

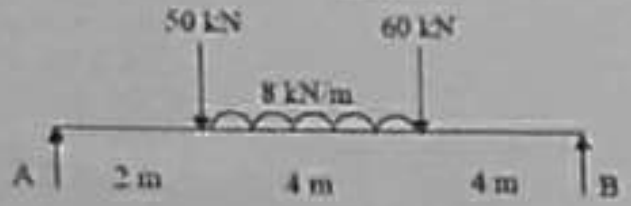
(b) Derive the expression for the 'Secant Formula' with neat sketch. 10

## SECTION – D

8. (a) A simply supported beam of span L, carrying a point load P at 0.4L from left support. Determine (i) mid-span deflection (ii) deflection under the load and (iii) slopes at the supports. Use Conjugate beam method. Assume constant flexural rigidity for the beam. 15

(b) Explain principal of virtual work. 5

9. (a) Draw the S.F and B.M diagrams. 15




(b) Explain Willot-Mohr diagram. 5



Roll No. _____

# 24064

## B. Tech 3rd Semester (Civil) Examination – February, 2022

### STRUCTURAL ANALYSIS-I

**Paper : CE-201-F**

*Time : Three hours ]* *[ Maximum Marks : 100*

*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

*Note :* Question No. 1 is ***compulsory***. Each question carries equal mark (20 marks). Students have to attempt *five* questions in total selecting ***one*** question from each Section. Assume suitable data.

1. (i) Draw the B. M. diagram of a cantilever beam of span L, subjected to a couple M at the free end.

4 × 5 = 20

(ii) Find the section modulus for a hollow circular section of external diameter, D and internal diameter, d, if internal diameter is 60% of external diameter.

(iii) State and prove the moment area theorems.

(iv) Explain Slenderness ratio.

(v) A steel cantilever of length 2.5 meter fails when a load of 30 KN is applied at the free end. Determine the stress at failure if the section of the cantilever is 35 mm × 45 mm.

## SECTION – A

2. (a) A steel rod of 3 cm diameter and 5 m long is connected to two grips and the rod is maintained at a temperature of 90° C. Determine the stress and pull exerted when the temperature falls to 30°C, if (i) the ends do not yield and (ii) the ends yield by 0.13 cm. Take $E = 2.1 \times 10^5 N/mm^2$ and $\alpha = 12 \times 10^{-6}/°C$. 10

(b) Deduce the relation between the Modulus of Elasticity and Modulus of Rigidity from fundamentals. 10

3. (a) The Modulus of rigidity for a material is $0.51 \times 10^5 N/mm^2$. A 10 mm diameter rod of the material was subjected to an axial pull of 10 kN and the change in diameter was observed to be $3 \times 10^{-3}$ mm. Calculate Poisson's ratio and the modulus of elasticity. 10

(b) Define Mohr's circle. Calculate principal stresses and strains for two unequal unlike principal stresses with the help Mohrs circle method 10



## SECTION – B

4. (a) Derive the bending equation from fundamentals $M/I \times f/y = E/R$ 10

(b) A 120 mm × 50 mm I- section is subjected to a shearing force of 10 kN. Calculate the shear stress at the neutral axis and at the top of the web. Given $I = 220 \times 10^4 mm^4$, Area $= 9.4 \times 10^2 mm^2$, web thickness = 3.5 mm and flange thickness = 5.5 mm. 10

5. (a) Prove that the ratio of depth to width of the strongest beams that can be cut from a circular log of diameter, d is 1.414. 10

(b) A hollow steel shaft 5m long is to transmit 160 kW of power at 120 r.p.m. The total angle of twist is not to exceed 2° in this length and allowable shear stress is $50 N/mm^2$. 10

## SECTION – C

6. (a) What is Euler's theory for different end condition of long column ? Write down the assumptions of Euler's Formula. 10

(b) Find the Euler's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3 m and hinged at both ends. Take $E = 205 kN/mm^2$. 10