NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING

DEPARTMENT OF CIVIL AND WATER ENGINEERING

STRUCTURAL ANALYSIS II

ECW 3108

Main Examination Paper

DECEMBER 2024

This examination paper consists of 5 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: NONE

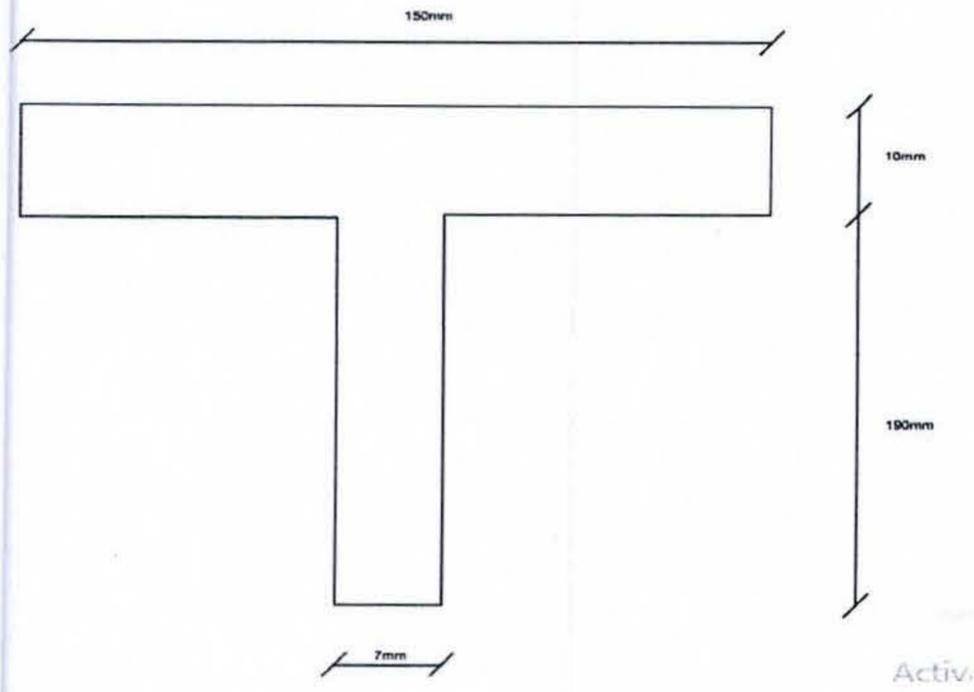**Examiner's Name:** Eng F.Mudhindi

             :Mr P. Nkomo

INSTRUCTIONS

1. Answer ANY FOUR (4) questions
2. Each question carries 25 marks
3. Use of calculators is permissible
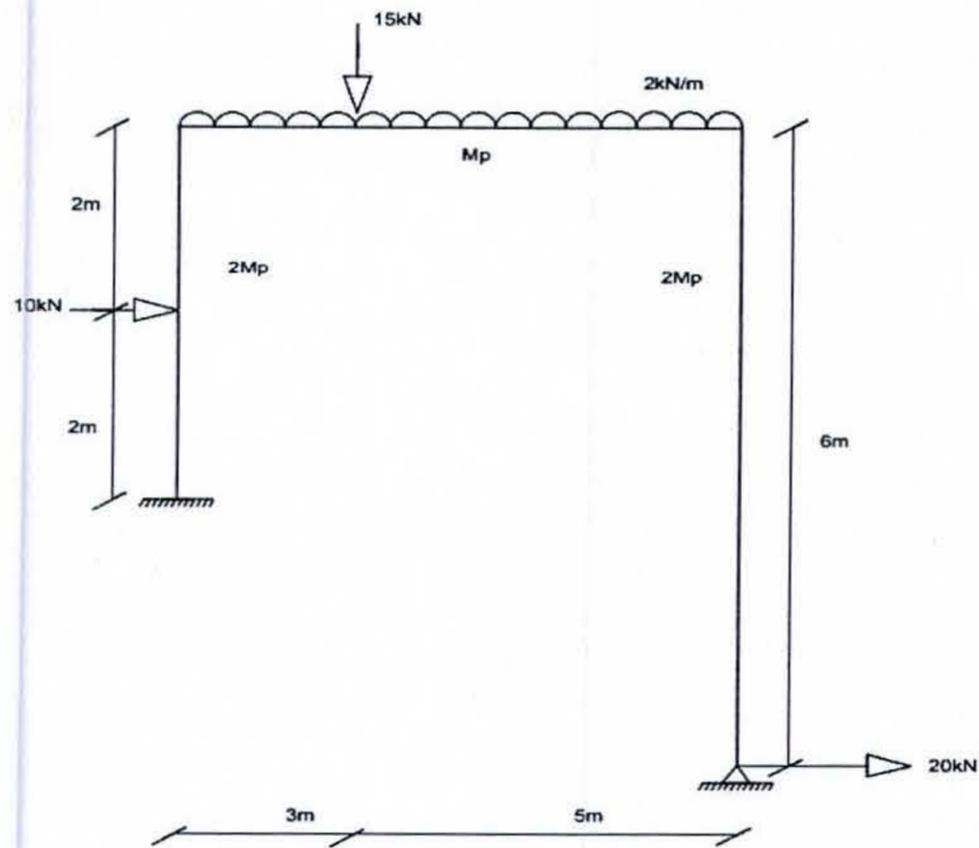
MARK ALLOCATION

| QUESTION		MARKS
1.		25
2.		25
3.		25
4.		25
5.		25
TOTAL		100

ECW 3108

1. For the T-section shown below, determine the shape factor and the plastic moment. Given the yield strength, $f_y = 400MPa$ [25]


2. Determine the value of the collapse load for the portal frame shown in the figure below. [25]

ECW 3108

3. Describe the formation of yield lines in an isotropic reinforced concrete slab [5]

b. Determine the support and field moments for the slap shown below using yield line analysis. Assume isotropic (uniform) reinforcement distribution, given that $w = 20kN/m^2$ [20]
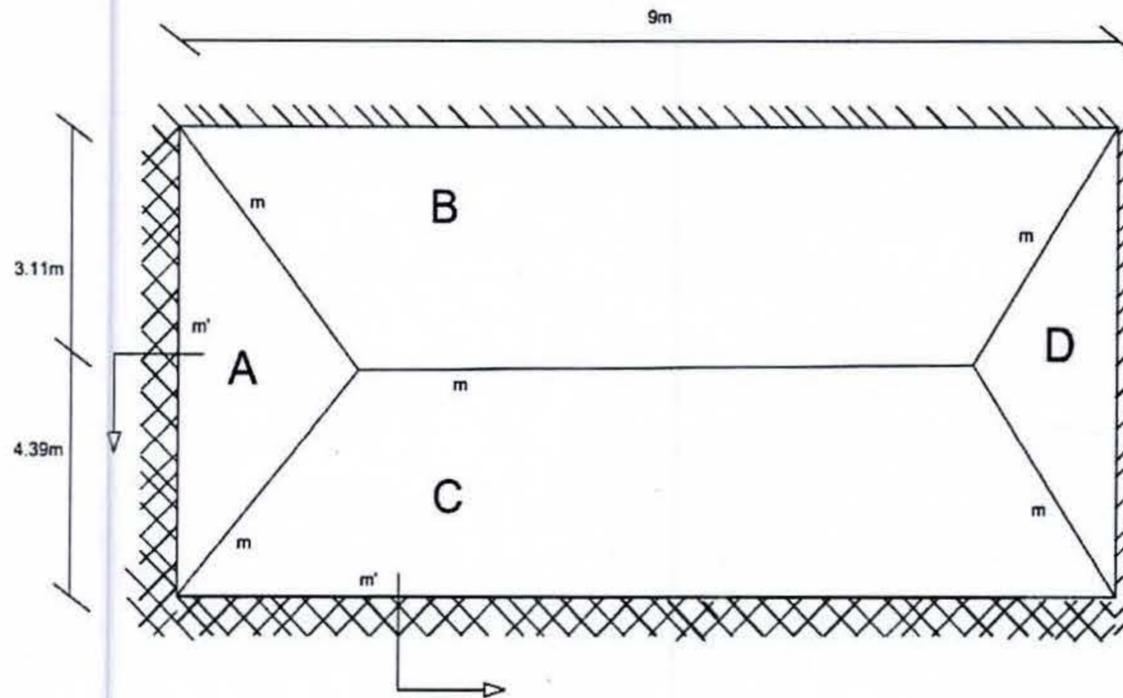
4. A uniformly loaded isotopically reinforced concrete slab is supported as shown. Using the principle of virtual work, find the collapse load. Assuming that the plastic moment of resistance per meter width of slab for positive and negative sections are $25kNm$ and $40kNm$ respectively [25]

Copyright: National University of Science and Technology, 2024

ECW 3108
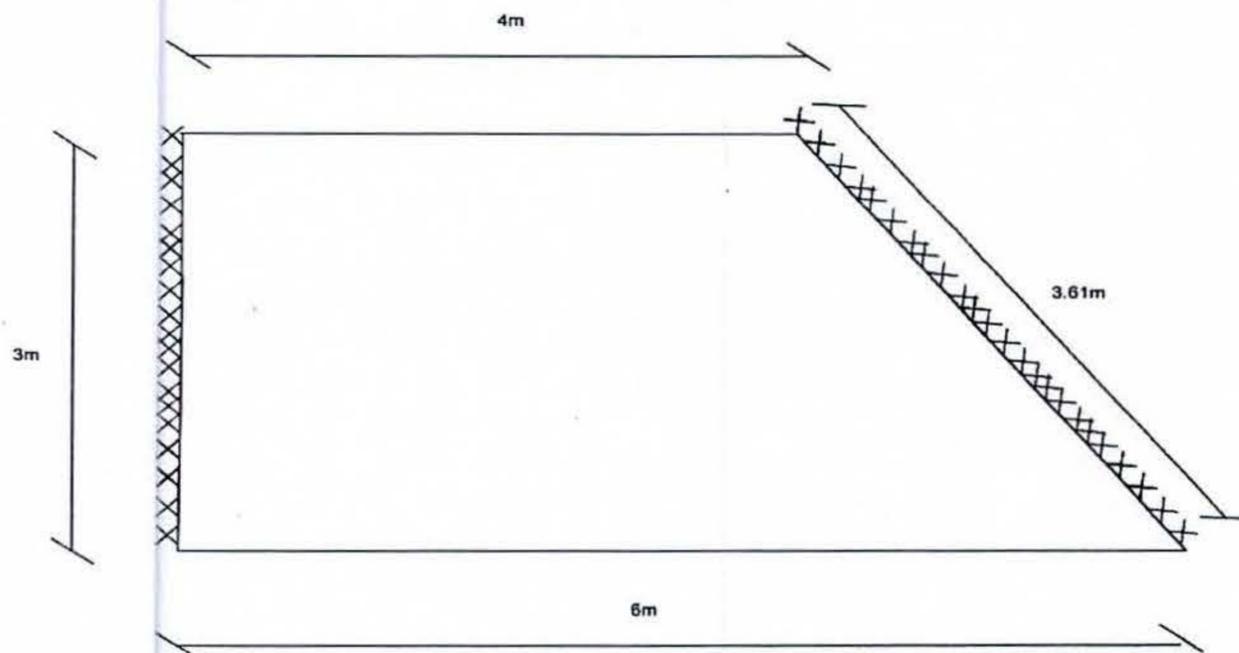
5. A platform of weight 18kN is being supported by four equal columns which are clamped to the foundation. Experimentally, it has been computed that a static force of 5kN applied horizontally producing the displacement of $2.5mm$. It is estimated that the damping in the structure is of the order of 5% critical damping. Compute the following:

  i. Undamped natural frequency [2]

  ii. Damping coefficient [2]

  iii. Logarithmic decrement [4]

  iv. Number of cycles and time required for amplitude of motion to be reduced from an initial value of $2.5mm$ to $0.25mm$ [5]

b. A single degree of freedom system of mass, $m = 20kg, k = 350N/m$ is given an initial displacement of 10mm and initial velocity of $10mm/s$. Find:

  i. Natural frequency [2]

  ii. Period of vibration [3]

  iii. Amplitude of vibration [3]

  iv. Time at which the third maximum peak occur [4]

ECW 3108

LIST OF FORMULAS

$$t = \frac{n\pi}{\omega\sqrt{1-\xi^2}} \qquad \ln\frac{U_0}{U_n} = n\delta \qquad \delta = 2\pi\xi \qquad C = 2\xi\sqrt{km}$$

$$FEM = \frac{PL}{8} \qquad FEM = \frac{Pb^2a}{L^2} \qquad FEM = \frac{2PL}{9} \qquad FEM = \frac{WL^2}{12} \qquad \tan\theta \approx \theta$$

$$U(t) = x_0\cos(\omega t - \beta) \qquad x_0 = \sqrt{U_0^2 + \left(\frac{\dot{U}_0}{\omega}\right)^2} \qquad \beta = \tan^{-1}\left(\frac{\dot{U}_0/\omega}{U_0}\right)$$

ECW 3108