



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

HIGHER NATIONAL DIPLOMA

IN

CIVIL ENGINEERING

**SUBJECT: Theory of Structures II/ Structural
Analysis**

**PAPER NO: 778/17/S04
778/24/M05**

DURATION: 3 Hours

NOVEMBER/ DECEMBER 2025 EXAMINATION

REQUIREMENTS

1. Calculator.
2. Graph paper.

INSTRUCTIONS TO CANDIDATE

1. Answer any four (4) questions
2. All questions carry equal marks.
3. Do not write anything on the question paper
4. Start every question on a fresh page.
5. Each question carries 25 marks each.

This paper consists of 5 printed pages.

QUESTION 1

A Circular bar ABC, 3m long, is rigidly fixed at ends A and C. The position AB is 1,8m long and of 50mm diameter and BC is 1,2m long and of 25mm diameter. If a twisting moment of 680N is applied at B, determine the values of the resisting moments at A and C and the maximum stress in each section of the shaft. What will be the angle of twist of each portion.
For the material of the shaft $G=80GN/m^2$ (25 marks)

QUESTION 2

At a given section a shaft is subjected to a bending stress of $20MN/m^2$ and a shear stress of $40MN/m^2$.
Determine

- a) The principal stresses
- b) The directions of the principal stresses
- c) The maximum shear stress and the planes on which this acts
- d) The tensile stress which, acting alone, would produce the same maximum shear stress.
- e) Shear stress which acting alone would produce the same maximum tensile principal stress. (25 marks)

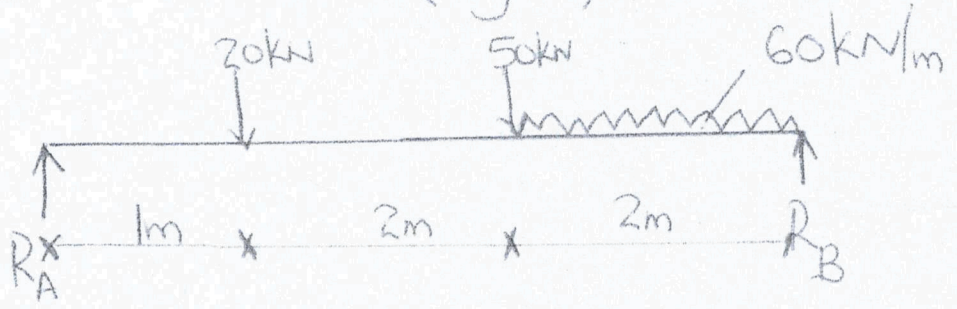
QUESTION 3

Determine the slope and deflection under the 50kN for the beam loading system shown in fig 3. Find also the position and magnitude of the maximum deflection

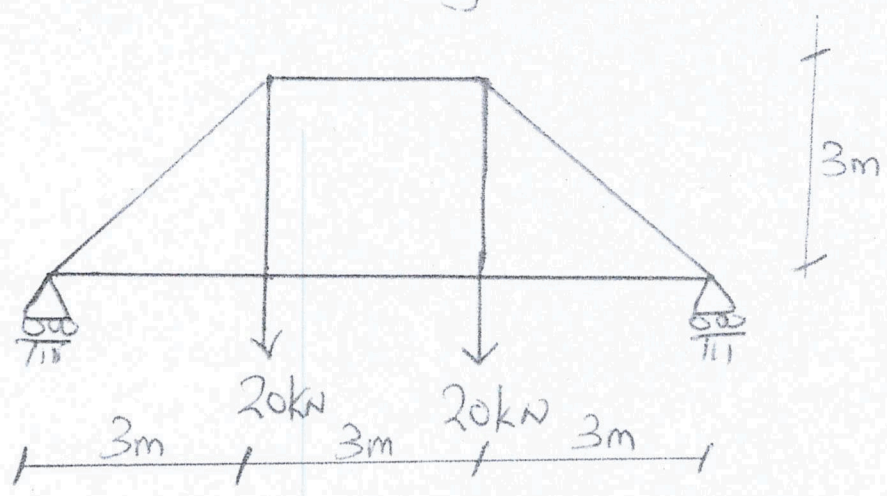
$$E = 200GN/m^2$$

$$I = 83 \times 10^{-6} m^4$$

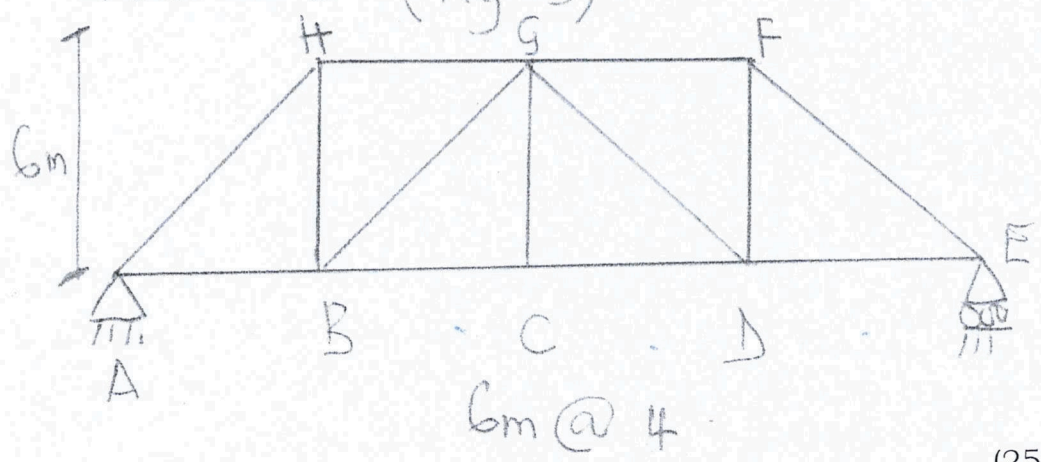
(Fig 3)



Question 4 (Fig 4)



Question 5 (Fig 5)



(25 marks)

QUESTION 4

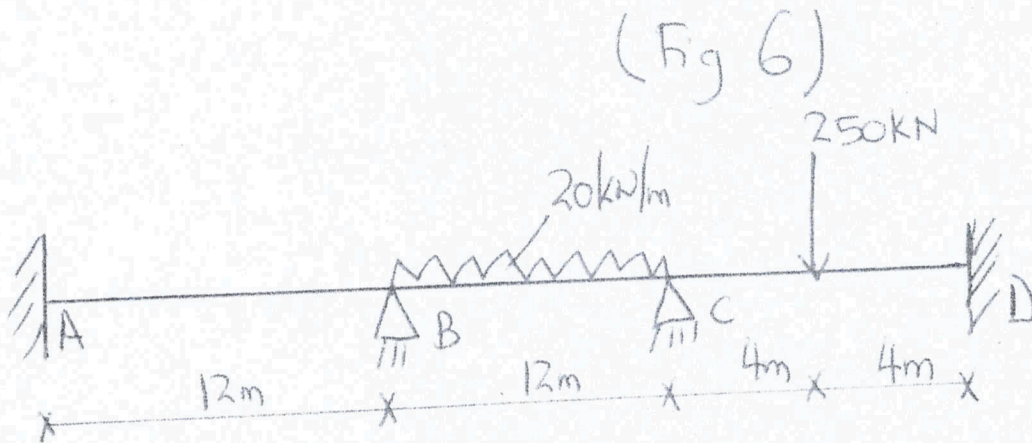
Determine the vertical displacement of joint C of the truss shown in fig 4. Assume that $A=300\text{mm}^2$ and $E=200\text{GPa}$. (25 marks)

QUESTION 5

Construct the influence lines for forces in member GB from the fig below (fig 5). (25 marks)

QUESTION 6

Analyse the beam below in fig 6 using the moment distribution method and draw the BMD and SFD. (25 marks)



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