TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY
Department of BUILDING & Civil engineering
UNIVERSITY EXAMINATION FOR:

DIPLOMA IN CIVIL ENGINEERING
DCE 2110 : STRUCTURES I

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: MARCH 2025
TIME: 2 HOURS

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID, scientific calculator

This paper consists of **five** questions.
Attempt any THREE questions.
Do not write on the question paper.

QUESTION ONE (20 Marks)

a) A mass concrete circular column 400mm diameter and 3.2m long carries an axial compressive load of 1700KN. Calculate:
   i. The stress in the concrete at the base of the column.
   ii. The amount of shortening that will occur in the column given the density of concrete as 2400 kg/m^3 and the Young's Modulus of Elasticity as 13.8 KN/mm^2. **(10 marks)**

b) A rectangular reinforced concrete column 450x300 mm is reinforced with 8No steel bars and is subjected to a load of 1300KN. The stresses in the concrete and steel must not exceed 7N/mm^2 and 140 N/mm^2 respectively. Calculate:
   iii. The diameter required for the bars.
   iv. The stresses occurring in the concrete and steel under the specified load.

Take the modular ratio m as 15 . **(10 Marks)**

QUESTION TWO (20 Marks)

Draw the shearforce and bending moment diagrams for the simply supported beam shown in fig 1, showing values at salient points.

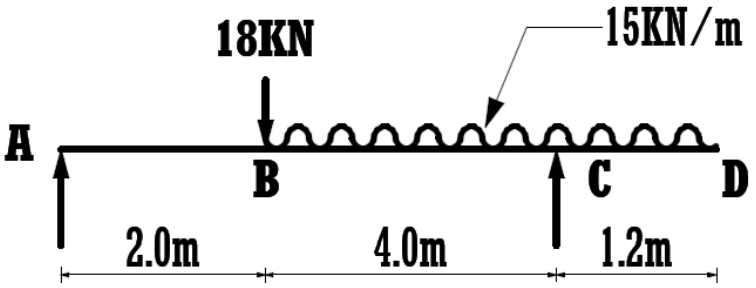

Fig 1

QUESTION THREE (20 Marks)

Fig 2 shows an overhanging simply supported beam loaded with a uniformly distributed load and a point load. Draw the shearforce and bending moment diagrams for the beam showing values at salient points and hence, calculate:

a. The point of contraflexture
b. The maximum bending moment

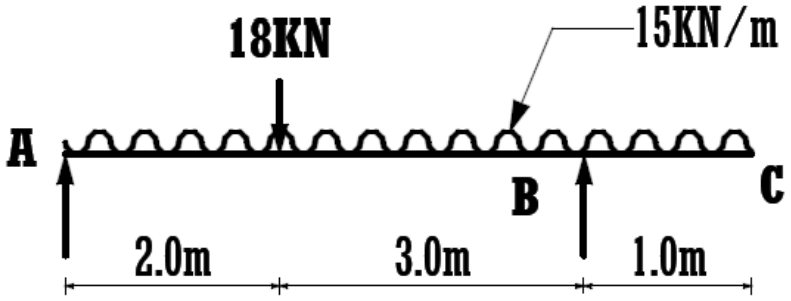

Fig 2

QUESTION FOUR (20 Marks)

a) Shown in fig 3 are two rods A and B supporting a rigid beam. The diameter of bar A is 40mm. Given that the wires are of the same length and that the rigid beam remains horizontal both before and after the application of the 120KN load. Calculate:
   i. The diameter of rod B
   ii. The stress in each rod.

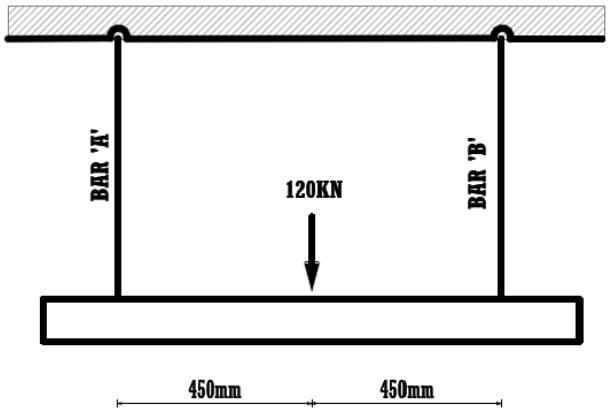

Fig 3

Take the respective Young's Moduli of Elasticity rods A and B as 205KN/mm^2 and 90KN/mm^2.

(9 Marks)

b) A steel rod ABC as shown in fig 4 is 18m long, with a cross-sectional area of 80mm^2 and weighs 42N. Given the Young's Moduli of Elasticity as 210KN/mm^2. Calculate the elongations at A and B.

(8 Marks)

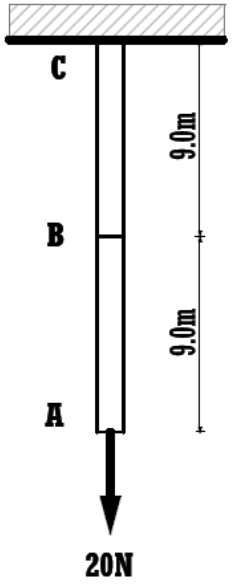

Fig 4

c) A steel specimen of diameter 5mm sustained a maximum load of 24KN in a tensile test. Adopting a factor of safety of 3 , calculate the breadth of flat bar having a thickness of 16mm(in the same steel) that would safely transmit an axial tensile load of 40KN

(3 Marks)

QUESTION FIVE 20 Marks)

a) Differentiate between the following the following types of support:
    i. Roller
    ii. pin **(3 Marks)**

b) Differentiate between the following pair of terms:
    i. Primary and secondary load effects
    ii. Live and dead loads
    iii. concentrated and distributed loads **(6 Marks)**

c) Draw a graph of stress verses strain of a steel rod when tested in tension to failure and hence illustrate and explain the following terms:
    i. Limit of proportionality
    ii. upper yield stress
    iii. Ultimate limit
    iv. Failure stress **(11 Marks)**