



ZIMBABWE

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

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

CIVIL ENGINEERING

MODULE: Structural Engineering PAPER NO: 313/22/M06

DURATION: 3 Hours

MAY/JUNE 2024 EXAMINATION

REQUIREMENTS

Non programmable scientific calculator.

INSTRUCTIONS TO CANDIDATE

- 1. Answer at least one (1) question on each Section.**
- 2. Do not tear off pages from the question paper.**
- 3. Do not write anything on the question paper.**

This paper consists of 5 printed pages.

QUESTION 1

- a) A rubber pad for a machine mounting is to carry a load of 5kw and to compress 5mm under this load if the stress in the rubber is not to exceed $280\text{KN}/\text{m}^2$. If the stress in the rubber is not to exceed $280\text{KN}/\text{m}^2$. Determine the diameter and thickness of a pad of circular cross section. Take E for rubber as $1\text{MN}/\text{m}^2$. (5 marks)
- b) Define the following terms:
- Mass
 - Weight
 - Force
- (6 marks)
- c)

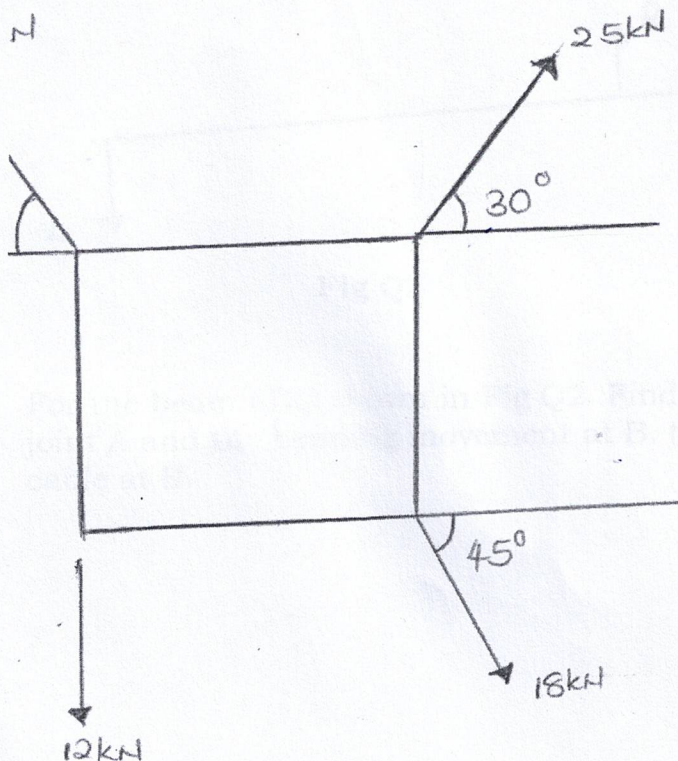


Fig 1C

Find magnitude direction and position of the resultant of the system of forces shown in Fig Q1C. The forces act at the four (4) corners of a square of 3m side. (9 marks)

QUESTION 2

a)

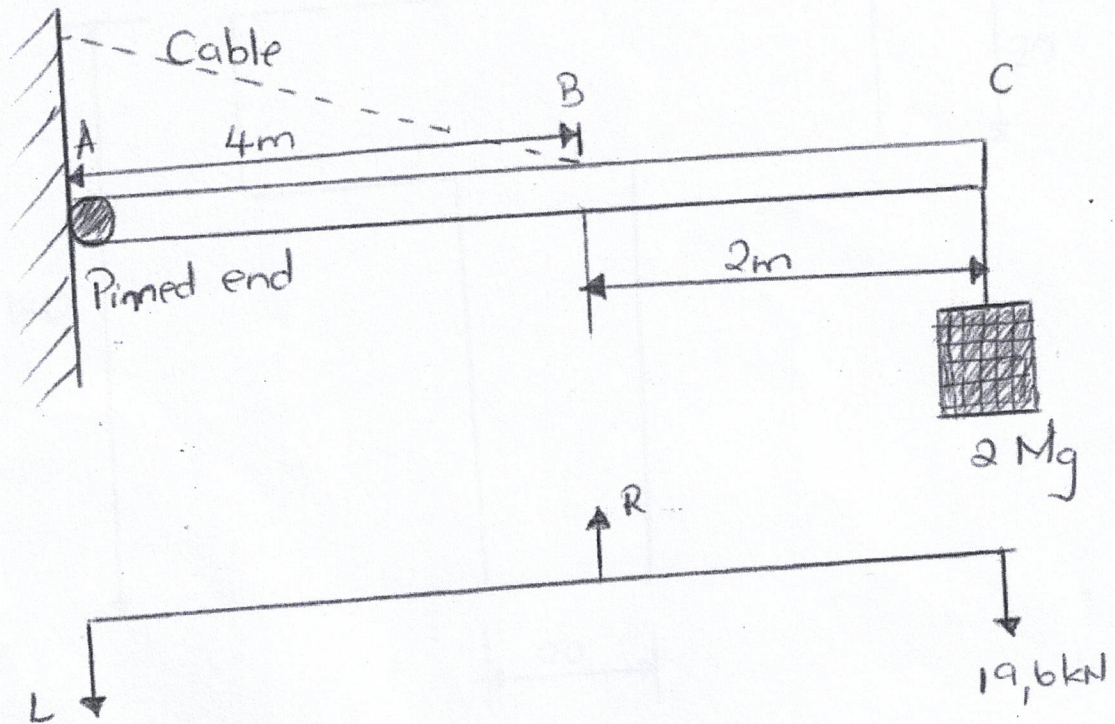


Fig Q2

For the beam ABC shown in Fig Q2. Find the vertical reaction at the pin joint A and the bending movement at B. the beam is supported by a cable at B. (10 marks)

b)

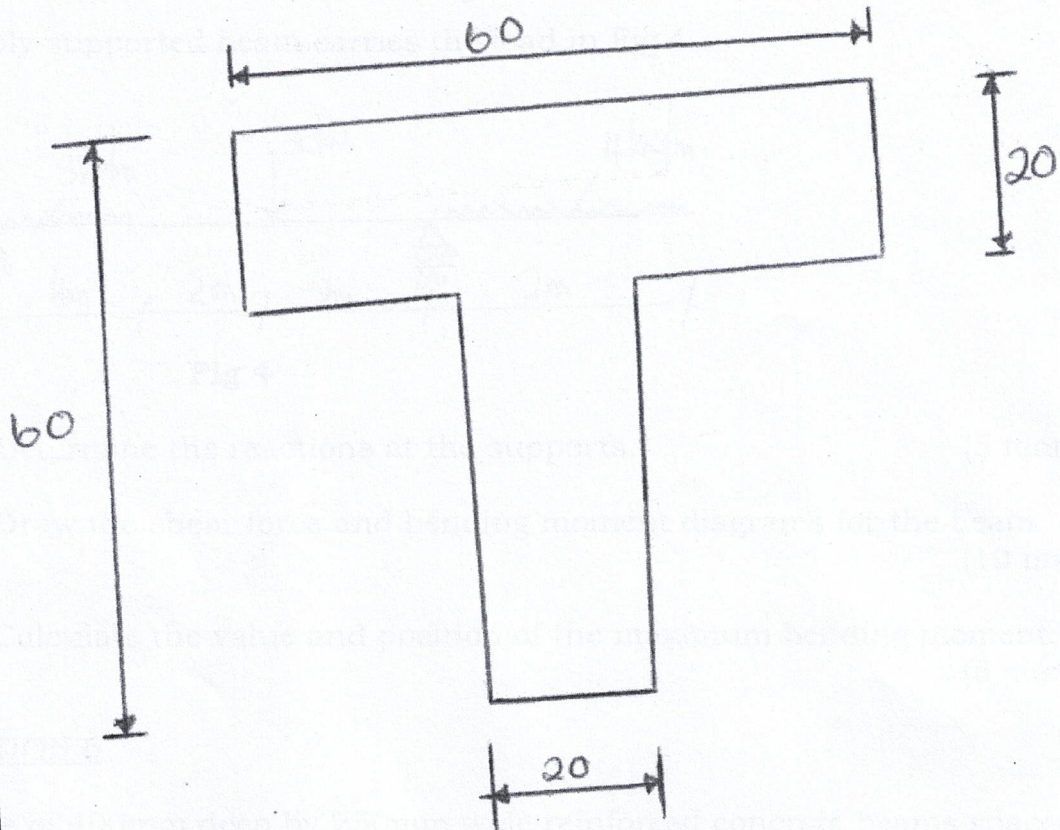


Fig Q2B

Calculate the moment of inertia about horizontal and vertical gravity axes (J_{xx} and I_{yy}) of the section in Fig 5.19. (10 marks)

QUESTION 3

Describe the properties and uses of the following construction materials:

- | | | |
|----|----------|-----------|
| a) | Asphalt | (5 marks) |
| b) | Iron | (5 marks) |
| c) | Timber | (5 marks) |
| d) | Plastics | (5 marks) |

QUESTION 4

- | | | |
|----|--|-----------|
| a) | With the aid of diagrams, describe the bonds in bricks. | (9 marks) |
| b) | i) Give three (3) functional requirements of roofs. | (3 marks) |
| | ii) Outline any three (3) types of roofs of your choice. | (8 marks) |

QUESTION 5

A simply supported beam carries the load in Fig 4.

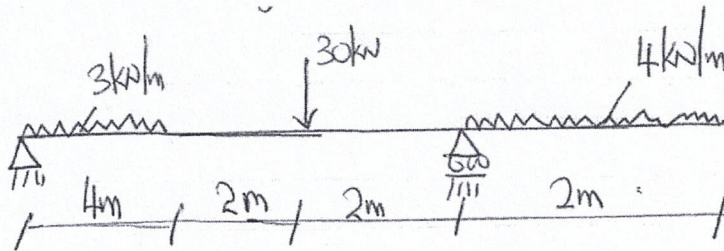


Fig 4

- Determine the reactions at the supports. (5 marks)
- Draw the shear force and bending moment diagrams for the beam. (10 marks)
- Calculate the value and position of the maximum bending moment. (5 marks)

QUESTION 6

A series of 400mm deep by 250mm wide reinforced concrete beams spaced at 5m centres and spanning 7.5m support a 175mm thick reinforced concrete slab.

If imposed floor loading is 3 kN/m^2 and the load induced by the weight of concrete is 24 kN/m^3 . Calculate the total ULS loading for the slabs and beams. (20 marks)

..//fem