(*University of Choice*)

# MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

## MAIN CAMPUS

## UNIVERSITY EXAMINATIONS

## 2019/2020 ACADEMIC YEAR

## SECOND YEAR FIRST SEMESTER EXAMINATIONS

## FOR THE BACHELORS DEGREE

## IN

## TECHNOLOGY EDUCATION (CIVIL AND STRUCTURAL ENGINEERING)

**COURSE CODE: TEB 211**

**COURSE TITLE: THEORY OF STRUCTURES I**

**DATE: MONDAY 20TH JANUARY 2020 TIME: 8.00 – 10.00 AM**

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**INSTRUCTIONS:**

1. Answer Question **ONE** and any other **TWO** Questions
2. Marks for each question are indicated in the parenthesis.
3. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

**SECTION A (30 MARKS)**

**QUESTION 1**

a) With the aid of sketches explain FOUR Structural Forms. **[6 Marks]**

b) Differentiate between:

i. Pinned and roller support

ii. Simply supported and continuous beam

iii. Statically determinate and statically indeterminate structures. **[6 Marks]**

**c)** Determine the degree of indeterminacy for the frames shown in **Figure 1.**

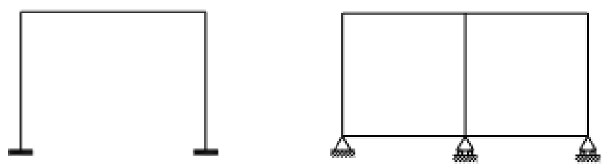

**Fig 1a** **Fig 1b** **[4 Marks]**

**d)** Calculate the force $R_A$ and distance d for the beam shown in **Figure 2**. The mass of the beam should be neglected and equilibrium conditions assumed.

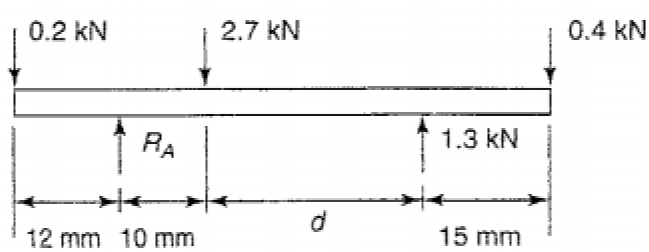


**Figure 2** **[10 Marks]**

e) State the Castigliano's theorem and outline the assumptions made in its application **[4 Marks]**

**SECTION B (40 MARKS)**

**QUESTION TWO (20 MARKS)**

(a) The cross-sectional area of each member of the truss shown in **Figure 3** is A = 400 $mm^2$ and E = 200 GPa. Use method of virtual work.

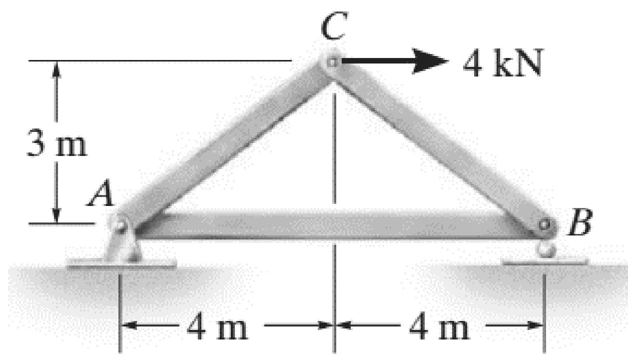


**Figure 3**

i. Determine the vertical displacement of joint C if a 4-kN force is applied to the truss at C.

**[10 Marks]**

ii. If no loads act on the truss, what would be the vertical displacement of joint C if member AB were 5 mm too short? **[5 Marks]**

(b) Draw the influence lines for the vertical reaction at D and the shear at E in **Figure 4**

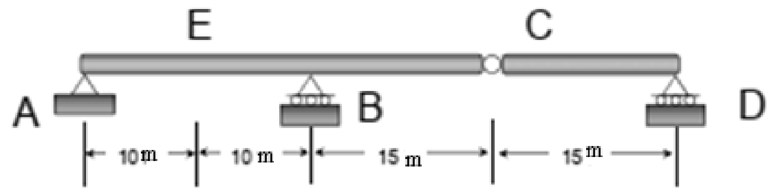


**Figure 4** **[5 Marks]**

**QUESTION THREE (20 MARKS)**

(a) A simply supported beam of length 10m, carries the uniformly distributed load and two point loads as shown in **Figure 5.** Draw the shear force and bending moment diagrams for the beam. Also calculate the maximum bending moment.

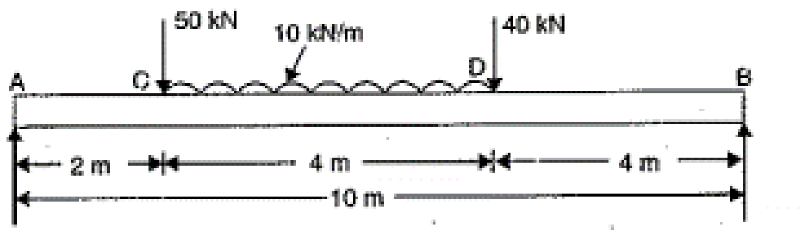


**Figure 5** **[16 Marks]**

(b) Define influence lines and state the Müller-Breslau principle **[4 Marks]**

**QUESTION FOUR (20 MARKS)**

Determine the force in each member of the roof truss shown in the photo. The dimensions and loadings are shown **in Figure 6**. State whether the members are in tension or compression.

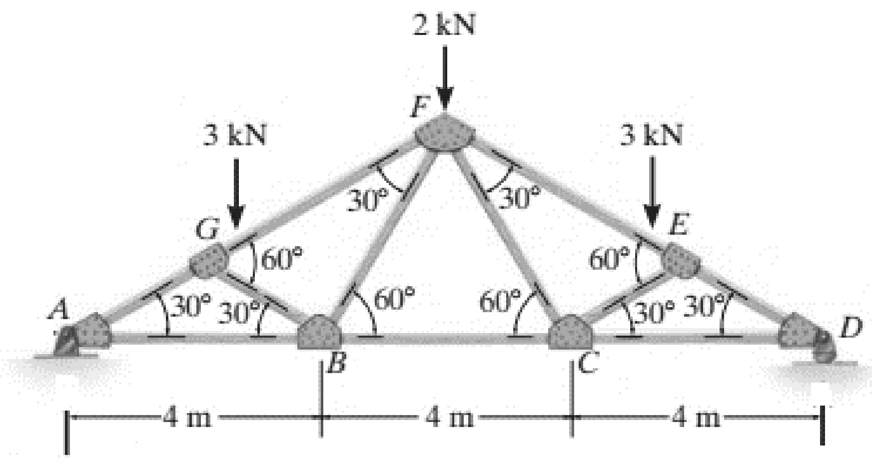


**Figure 6** **[20 Mark]**