



THE TECHNICAL UNIVERSITY OF KENYA  
FACULTY OF ENGINEERING SCIENCES & TECHNOLOGY  
SCHOOL OF INFRASTRUCTURE AND RESOURCE ENGINEERING  
DEPARTMENT OF CIVIL & CONSTRUCTION ENGINEERING

END OF SEMESTER 1 YEAR 3 EXAMINATION DECEMBER 2018  
DEGREE OF BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING

ECCI 3151: ANALYSIS OF STRUCTURES IIA

DATE: SEPTEMBER/DECEMBER 2018

TIME: 2 HOURS

**INSTRUCTIONS:** Answer question ONE and other TWO questions. All symbols have their usual meaning

**QUESTION ONE (30 marks)**

The plane pin-jointed truss shown in Fig. Q1 is composed of uniform section members, with the same material properties. If the truss is subjected to the load as shown, determine the displacements at node 1, reaction forces at nodes 2, 3, 4 and the forces in the members of the truss using the matrix method of analysis. (20 Marks)

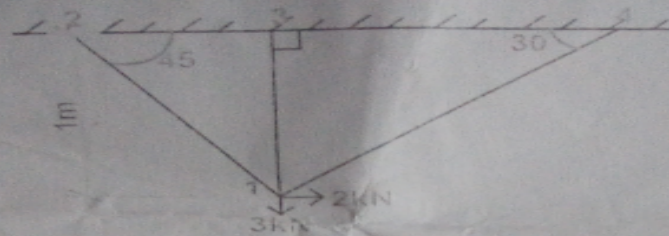


Fig. Q1

QUESTION TWO (20 Marks)

Analyse the continuous beam shown in Fig. Q2. Assume that the supports are unyielding and that  $EI$  is constant for all members.

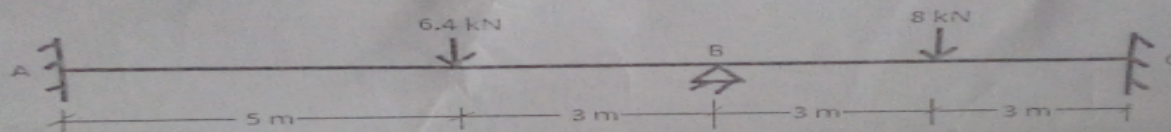


Fig. Q2

QUESTION THREE (20 Marks)

For the spring assemblage with arbitrarily numbered nodes shown in figure Q3, obtain:

- (a) The global stiffness matrix (5 marks)
- (b) The displacements of nodes 3 and 4 (5 Marks)
- (c) The reaction forces at nodes 1 and 2 (5 Marks)
- (d) The forces in each spring (5 Marks)

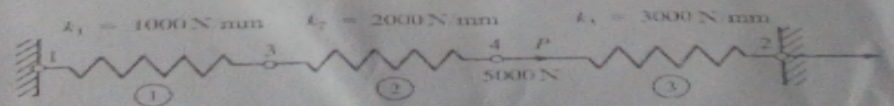


Figure Q3

QUESTION FOUR (20 Marks)

For the frame shown in Fig. Q4, use the stiffness matrix method to determine:

- (a) The deflection and rotation at B (10 Marks)
- (b) All the reactions at supports (10 Marks)

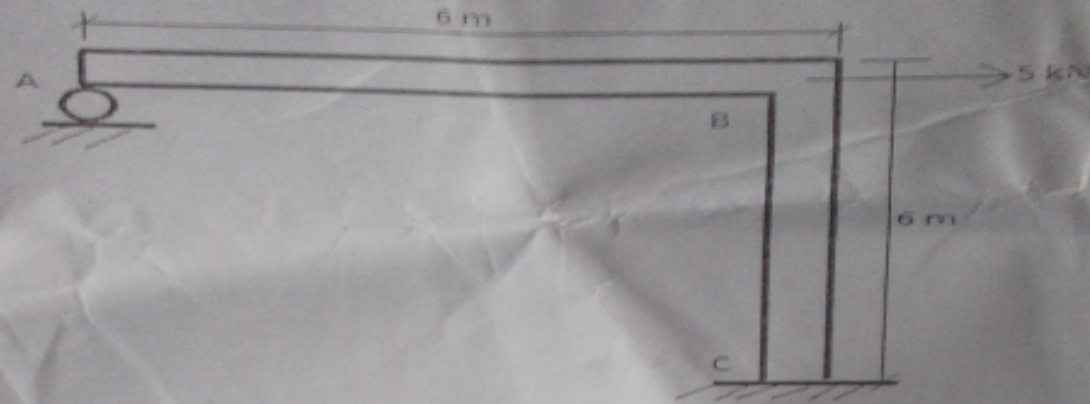


Figure Q4

QUESTION FIVE (20 Marks)

- (a) Discuss any four classes of framed structures that may be utilized in construction (8 marks)
- (b) The bars shown in Figure Q5(b) is subjected to  $F_3 = 15\text{kN}$  and  $A_1=100\text{mm}^2$ ,  $A_2=75\text{mm}^2$ ,  $A_3=50\text{mm}^2$  and  $E=200\text{GPa}$ . Determine the nodal displacements, the reactions, and the forces transmitted through each element. (12 Marks)

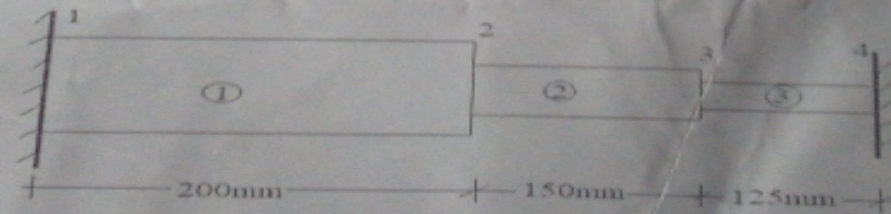


Figure Q5(b)