TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE)

ECE 2408: THEORY OF STRUCTURES V

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2013
TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Drawing Instruments*

This paper consists of **FIVE** questions.
Answer question **ONE (COMPULSORY)** in section **A** and any other **TWO** questions from section **B**
Maximum marks for each part of a question are as shown
This paper consists of **TWO** printed pages

SECTION A

Question One (Compulsory)

a) With the aid of labeled sketches, outline the concept of the finite element method. **(10 marks)**

b) Develop the stiffness matrix for the beam element shown in figure Q1 (b) with respect to the co-ordinates 1 and 2. **(10 marks)**

c) Outline the main merit and limitations of the finite element method **(10 marks)**

SECTION B (Attempt any TWO questions)

Question Two

Analyze the fixed beam shown in figure Q2 by the matrix stiffness method. Sketch the bending moment diagram **(20 marks)**

Question Three

a) Develop the stiffness matrix for a rod element whose length is "l" modulus of elasticity "E" and cross-sectional area "A". The ends of the rod element are subjected to axial forces P_1 and P_2 resulting in displacements u_1 and u_2 respectively. Explain all the terms of the stiffness matrix. **(10 marks)**

b) Figure Q3 (b) shows a structure composed of two structural elements modeled as two springs of different stiffness connected in series. Develop the structural or system stiffness matrix for the three co-ordinate shown. **(10 marks)**

Question Four

Analyze the continuous beam shown in figure Q4 by the stiffness matrix method and sketch the bending moment diagram. **(20 marks)**

Question Five

A beam is fixed at its ends and subjected to moments M_1 and M_2 resulting in rotations Q_1 and Q_2 respectively. In addition, the beam experiences vertical forces Y_1 and Y_2 resulting in vertical displacements V_1 and V_2 at modes 1 and 2 respectively. Develop the element stiffness matrix for the beam. (Hint: derive the slope-deflection equations first) **(20 marks)**