TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
(BSCE Y4)

ECE 2408: THEORY OF STRUCTURES V

END OF SEMESTER EXAMINATION
SERIES: APRIL 2014
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer booklet*
- *Scientific Calculator*

This paper consists of **FIVE** questions.
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
All questions carry equal marks
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (COMPULSORY)

a) With clear illustrations compare and contrast the following structural analysis methods:
- **i.** Classical versus matrix methods **(4 marks)**
- **ii.** Matrix versus finite element methods **(3 marks)**

b) The spring system shown in figure Q1 (b) has the following properties. K_1 = 100N/mm, K_2 = 200N/mm, K_3 = 100N/mm, P = 500N $u_1 = u_4 = 0$. Find:
- **i.** The global stiffness matrix for the spring system. **(4 marks)**
- **ii.** Displacement of nodes 2 and 3 **(4 marks)**
- **iii.** The reaction forces at nodes 1 and 4 **(2 marks)**
- **iv.** The force in the spring 2 **(3 marks)**

Figure 1 (b)

c) A simple plane truss is made of two identical bars (with E, A and L), and loaded as shown in figure Q1 (c). Find:

i. Displacement of node 2 **(5 marks)**

ii. Stress on each bar **(5 marks)**

Figure 1 (c)

Question Two

a) Discuss any FOUR classes of framed structures that may be utilized in construction. **(8 marks)**

b) Write this local stiffness matrix for the members of beams and use the matrix to determine the stiffness matrices for the beam shown in figure Q2 (b). **(12 marks)**

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Question Three

The plane pin-jointed truss shown in figure Q3 is composed of uniform section members with the same material properties. If the truss is subjected to load as shown, determine the displacement at node 1 and the forces in the members of the truss using the matrix method of analysis. **(20 marks)**

Figure 3

Question Four

a) Briefly discuss the three fundamental relationships employed in matrix analysis of structures. **(9 marks)**

b) Determine the nodal displacements for the uniform section beam shown in figure Q4 (b), which can be assumed to be fully fixed at its ends. **(11 marks)**

Figure 4 (b)

Question Five

Using matrix displacement method, determine the nodal bending moments for the rigid jointed frame shown in figure 5. E and I are constant for the whole frame. **(20 marks)**

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