TECHNICAL UNIVERISTY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2215: THEORY OF STRUCTURES II

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: FEBRUARY 2013
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
   - *Answer Booklet*
   - *Non-Programmable Scientific Calculator*
This paper consists of **FIVE** questions.
 Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **TWO** printed pages

Question One (Compulsory)

a) A horizontal steel girder having a uniform cross-section area is 14m long and simply supported at its ends. It carries two concentrated loads as shown below in figure 1. Using Macaulay's method, calculate the deflection under loads C and D.
Take $E = 200 \times 10^3 \text{N/mm}^2$
   $I = 160 \times 10^6 \text{mm}^4$ 12kN   **(18 marks)**

Figure 1

b) From the first principles of slope and deflection, show that, the maximum deflection for a simply supported beam with a uniformly distributed load by double integration is given by:

$$yc = \frac{5wl^4}{384EI}$$

(12 marks)

Question Two

a) Figure 2 shows a three span continuous beam supported on ABC and D and loaded as shown using 3-moment theorem. Determine the moments along the beam, reactions at supports and hence draw the bending moment diagram indicating the positive and negative points along the beam. **(17 marks)**

b) Define influence line and briefly explain its two uses in engineering. **(3 marks)**

Question Three

a) Figure 3 shows a uniformly distributed load of 50KN/m of 6M crossing a girder of 40m from left to right. With the help of influence line, determine the values of shear force and bending moment at 12m from the left support, when the head of the load is 16m from the left support. **(15½ marks)**

Figure 1

b) List **THREE** rules observed when using Macaulay's Method. **(3 marks)**

c) List any **THREE** methods used to determine slope and deflection of a beam. **(1½ marks)**

Question Four

Figure 4 shows a roof truss carrying the loads point C and D as shown. Determine vertical displacement at point D using the method of complimentary virtual work. (20 marks)

(Assume uniform EI)

Question Five

a) A timber beam of rectangular section has a span of 4.8m and is simply supported at its ends. It is required to carry 4500KN uniformly distributed load over a whole span. Find the maximum values of the breadth (b) and depth (d) of the beam if the maximum bending stress is not to exceed $70KN/cm^2$ and maximum deflection is limited to 9.5mm.
Take E = 105 x $10^2KN/cm^2$. **(14 marks)**

b) A timber beam 50mm wide by 100mm deep is required to support a uniformly distributed load over span of 3.0m. Determine the safe load the beam would carry over its entire span if maximum deflection is limited to span/300. Use double integration method.
Take Etimber = $10.5KN/mm^2$. **(6 marks)**