TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATIONS FOR DEGREE IN
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2407: STRUCTURAL DESIGN I

END OF SEMESTER EXAMINATIONS
SERIES: APRIL 2014
TIME: 2 HOURS

INSTRUCTIONS:

– Answer question **ONE (Compulsory**) and any other **TWO.**
– Only relevant BS codes are allowed.
– All standard symbols have their normal meaning.

This paper consists of Three printed pages

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QUESTION 1 (Compulsory)

a) Explain with the aid of sketches the connection details which will give rise to the following end conditions:
   i) Restrained in position and direction   **(3 marks)**
   ii) Restrained in position but not in direction   **(3 marks)**
   iii) Unrestrained in position and direction   **(3 marks)**

b) A structural steel section column of effective length 2.4m has to support an axial load of 1370KN. Assuming that both ends are held in position but are provided with no restraint in direction, select a suitable universal column section from the list given in Table Q 1 (b).   **(15 marks)**

Table Q 1 (b)

Section No.	Size	Cross-sectional area	Radius of gyration
1	152*152*23kg/m	29.8 cm²	3.68cm
2	203*202*46kg/m	58.8cm²	5.11cm
3	203*203*60kg/m	75.8cm²	5.19cm

c) State factors that may induce buckling failure in compression members subjected to axial loading.

(6 marks)

QUESTION 2

a) Discuss **FOUR** factors that can affect the strength of timber once used in construction of structural elements. **(8 marks)**

b) A timber column of redwood Gs grade consists of a 100mm square section which is restrained at both ends in direction but not in position. Assuming that the actual height of the column is 3.75m, calculate the maximum axial long term load that the column can support. **(12 marks)**

QUESTION 3

a) Briefly discuss the modes in which structural steel beams may fail in service. **(8 marks)**

b) A simply supported timber roof beam spanning 5m supports a total uniformly distributed load of 11KN. Determine a suitable section for the beam using timber of strength class C16. Assume that the bearing length is 125mm and the compression edge is held in position. **(12 marks)**

QUESTION 4

Given the following data for as simply supported universal beam, select a suitable beam section:
Effective span = 6m
Uniformly distributed dead load = 9KN/m
Uniformly distributed live load = 4KN/M

Check the adequacy of the beam in deflection given that the maximum allowable deflection is given by span/360 and that the elastic modules of steel, E =205 KN/mm². **(20 marks)**

QUESTION 5

A stud wall, as shown in Fig. Q5, has an overall height of 4.0m. The vertical studs are positioned at 600mm centres with noggins at mid-height. Carry out design calculations to show that studs of 44 *

100mm section in C1 timber under service class 1 are suitable to sustain a long-duration load of 10KN/M. **(20 marks)**