



TECHNICAL UNIVERSITY OF MOMBASA
**Faculty of Engineering &
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DECREE IN:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE)

ECE 2407: STRUCTURAL DESIGN I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2015

TIME ALLOWED: 3 HOURS

Instructions to Candidates:

You should have the following for this examination

- Answer Booklet
- Pocket 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

Use neat, large and well labeled diagrams where required

This paper consists of **TWO** printed pages

Question One (Compulsory)

A simply supported beam of span 10.0m supports uniformly distributed characteristic dead and imposed loads of 10KN/m and 5KN/m respectively. Assuming the beam is fully laterally restrained and there is nominal torsional restraint at supports, check the suitability of Grade 5275 steel section 457 x 152 x 60UB to satisfy bending and shear considerations **(30 marks)**

Question Two

- a) Outline the central concepts of limit state design and state the respective limit states **(4 marks)**
- b) Explain the **THREE** principal methods of steel design **(4 marks)**
- c) Explain the following method of beam failure using sketches **(7 ½ marks)**
 - (i) Local buckling
 - (ii) Shear failure
 - (iii) Web buckling

- d) Using suitable sketches illustrate the following:
(i) Single V butt weld and name all the parts
(ii) Any THREE weld defects (4 ½ marks)

Question Three

- a) State the purpose of K-factors in timber design to BS 5268 (2 marks)
- b) Name the following K-factors:
(i) K2
(ii) K3
(iii) K5
(iv) K7 (2 marks)
- c) Explain K5 factor using suitable sketches and state its formula (4 marks)
- d) A timber beam of length 3.0m is supported on bearings of width 150mm each at both ends. The beam carries a uniformly distributed load of 10kN including its self-weight. Check the suitability of class SC3 timber of section size 75mm x 250mm for the beam assuming its ends are held in position and compression edge is held in line (12 marks)

Question Four

Figure 1 shows a part floor plan of an office floor comprising of a rigid jointed steel structure. The internal column marked A is 4.0m long and is concentrically loaded with 232kN dead load inclusive of self weight and 68.4kN imposed load. Assuming that the fixity at the top and bottom of the column gives effective rotational restraints, determine the suitability of grade S275 steel section 254 x 254 x 107UC for use for the column in accordance with BS 5950-1:2000. Assume structure is braced (20 marks)

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Question Five

A 5.0m long RC column of section size 425 x 425mm encases a grade S 275 steel section size 305 x 305 x 118UC. The column is rigidly fixed at both its ends and the compressive strength of the concrete may be taken as 20N/mm². Determine the compressive resistance of the steel section to BS 5950-1:2000 (20 marks)