TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2407: STRUCTURAL DESIGN I

END OF SEMESTER EXAMINATION

SERIES:APRIL2016

TIME:2HOURS

DATE:12May2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID

This paper consists of five questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Question ONE (Compulsory) – 30 marks

a) Explain why it is necessary to take account of the material factor in steel design. (2 marks)

b) The figure 1 below shows a simply supported beam, which span 6560mm as shown. Design the beam in Grade 43 steel and check for serviceability limit state of defection. Take E = 205kN/mm^2. I = 55400cm^4, Point load (DL=40kN, LL=50kN), Imposed loads (DL=15kN/m and LL=30kN/m).

(28 marks)

Question TWO (20 marks)

a) Outline the THREE concepts of limit state design. (3 marks)

b) Briefly describe the following modes of failure of structural steel elements.

i) Bending
ii) Local Buckling
iii) Shear

(6 marks)

c) Calculate the radii of gyration r_{xx} anf r_{yy} for the rectangular timber beam section shown in the figures 2 below. (8 marks)

d) Calculate the least radius of gyration for the timber column section shown in figure 3 below. Given that the section is 305 x 305 x 42 kg/m UC, I_{xx} = 24605 cm4 , I_{yy} = 8645 cm^4 and A = 134.7 cm^2. (3 marks)

Question THREE (20 marks)

The column in the figure 4 below is pin ended about x-x and y-y axes and the load given is the factored axial load. The column has a tie at the mid-height providing restraint about the y-y axis. Compression flange is semi-compacte. Design the column shown in G43 steel.

Question FOUR (20 marks)

A timber column of Parana Pine grade consisting of a 120mm x 120mm section is restrained at both ends in both positions and direction. The actual column height is 3.5m and protected from the weather. Calculate the maximum axial load that the column can sustain in the long-term.

Question FIVE (20 marks)

a) Describe the following general principles and methods of design.

i) Simple design
ii) Rigid design
iii) Semi-rigid design (3 marks)

b) List the serviceability limit states relevant to structural steel work design according to BS 5950. (3 marks)

c) Design a simply supported beam shown in the figure below given that the compression flange is fully restraint. Use S460 steel given that the dead load is 30kN, the live load is 15kN and the imposed load is 3kN/m.

(14 marks)