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

The figure 1 below shows a concrete floor supported on G43 steel secondary beams, transferring load to main beams of the same material. Design a suitable section for

i) Secondary beams
ii) Main beams
iii) Check for serviceability limit state of deflection.

Given that the working stress = 165N/mm2, floor design load = 8kN/m2, self-weight of main beam = 15kN, maximum deflection allowed is = (L/360) of the span, E = 205kN/mm^2.

Question TWO (20 marks)

A timber beam with a clear span of 2.85m supports a uniformly distributed load of 10kN including a self-weight of beam. Determine a suitable section for the beam using timber of strength class SC3. Assume that the bearing length is 150mm and that the ends of the beam are held in position and compression edge held in position.

Question THREE (20 marks)

The figure 2 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 and I = 55400cm^4. Point load (DL=40kN, LL=50kN), Imposed loads (DL=15kN/m and LL=30kN/m).

Question FOUR (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 3 below. (8 marks)

d) Calculate the least radius of gyration for the timber column section shown in figure 4 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 FIVE (20 marks)

A timber column of Redwood GS grade consisting of a 100mm x 100mm section is restrained at both ends in both position and direction. The actual column height is 4m and protected from the weather. Calculate the maximum axial long-term load that the column can take.