MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY(MMUST)

UNIVERSITY EXAMINATIONS

2013/2014 ACADEMIC YEAR

**FOURTH YEAR FIRST SEMESTER EXAMINATIONS
FOR THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING**

COURSE CODE: CSE 411

COURSE TITLE: STRUCTURAL STEEL DESIGN

DATE:

DURATION: 3 HOURS

INSTRUCTION TO CANDIDATES

Candidates should have the following for this examination.

- BS 5950, Euro code 3 and any other standard applicable to the subject

- Steel Tables for standard sections

Answer any **FOUR** questions of the following five questions. Marks for each

question are indicated in the parenthesis.

1. a) Outline the assumptions taken in designing pin-jointed structure.

(4marks)

b) Select a suitable UB section to function as a simply supported beam carrying 150mm thick concrete slab together with an imposed load of $7.5\,kN/m^2$. Beam span is 8m (fig. 1) and are spaced at 4m intervals. The slab may be assumed capable of providing continuous lateral restraint to the beam's top flange. Assuming use of grade 43 steel and no material greater than 16mm thick. Due to restraint from slab there is no possibility of lateral-torsional buckling. Design the beam for:

i) Moment capacity

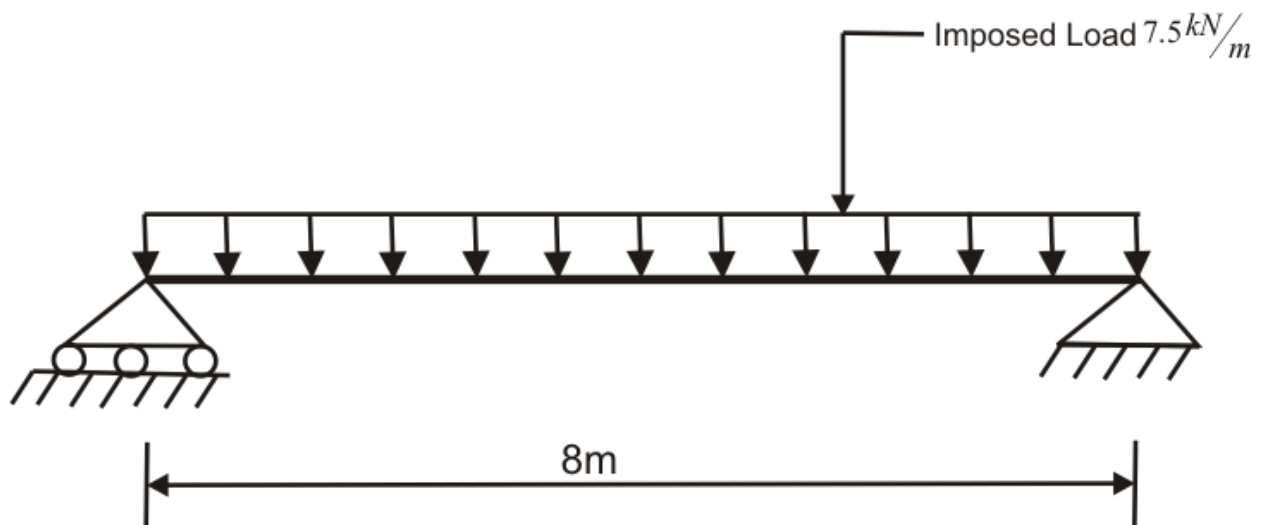ii) Shear capacity

iii) Deflection limit

Imposed Load $7.5\,kN/m$

8m

Figure 1

(16 marks)

2. a) Classify structures according to use and need citing examples.

(4 marks)

b) Calculate the compressive resistance of $305\text{x}305\text{x}137\,kgm^{-1}UC$ column shown in figure 2 if it is encased in concrete of compressive

strength $25 \, N/mm^2$. Assume that the effective length of the column about both axes is 4m. Use grade 43 steel
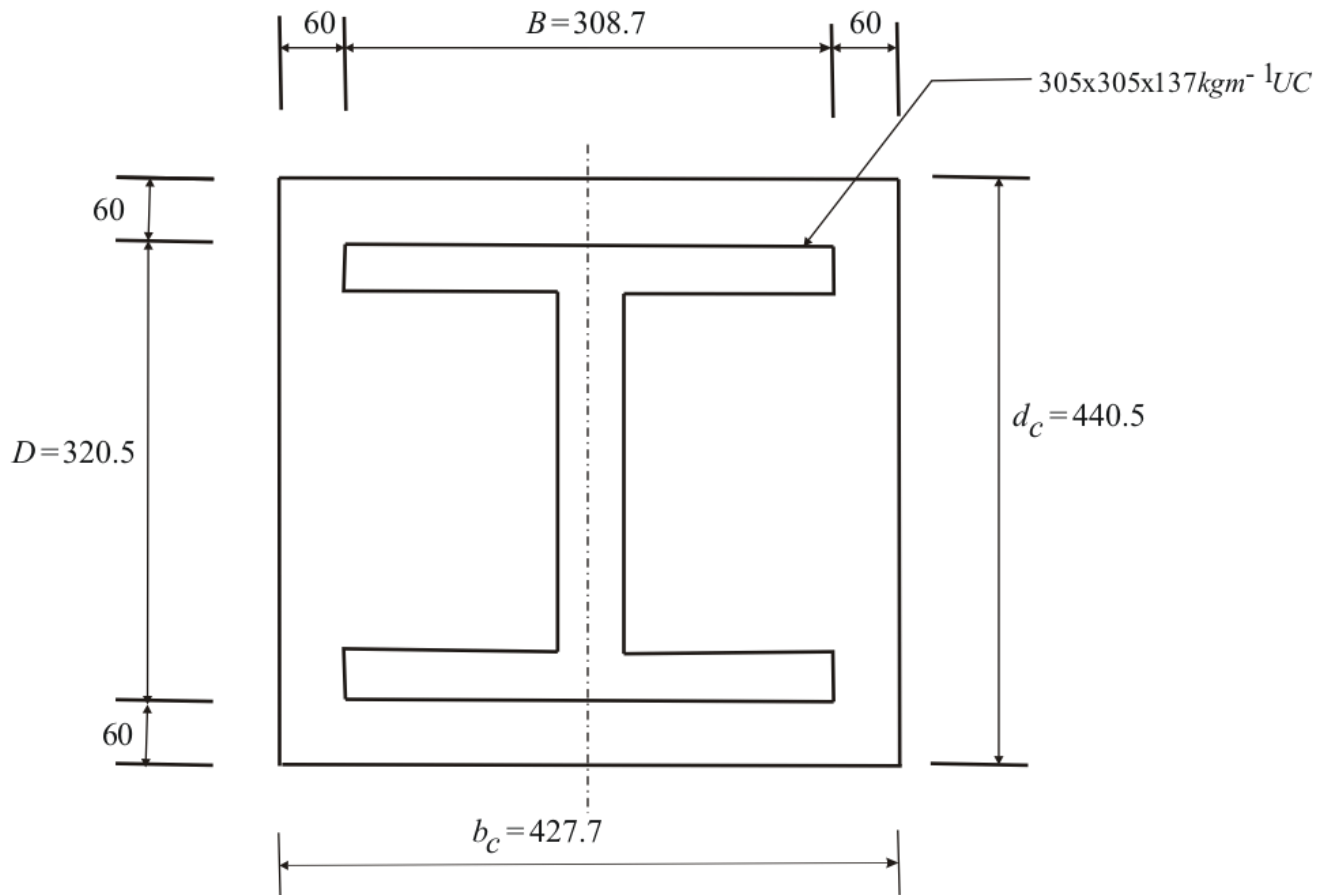

Figure. 2

(16 Marks)

3. a) Briefly explain the following designs checks required for struts and columns.

   (i) Overall buckling

   (ii) Local capacity

(6 marks)

b) A strut 8m long whose section is 203x203x46 UC in grade S275 (43) with pinned ends is to be used in the construction of engineering complex of Masinde Muliro University of Science and Technology. It will carry axial loads only. Determine its compressive resistance.

(14 marks)

4. a) Briefly explain the ultimate limit states used in steel design.   (6 marks)
b) Show that the splice connection shown in figure 3 is suitable to resist a design bending moment, 300kNm and shear force 320kN. Assume the steel S275 (grade 43) and the bolts are general grade, M24, HSFG bolts.
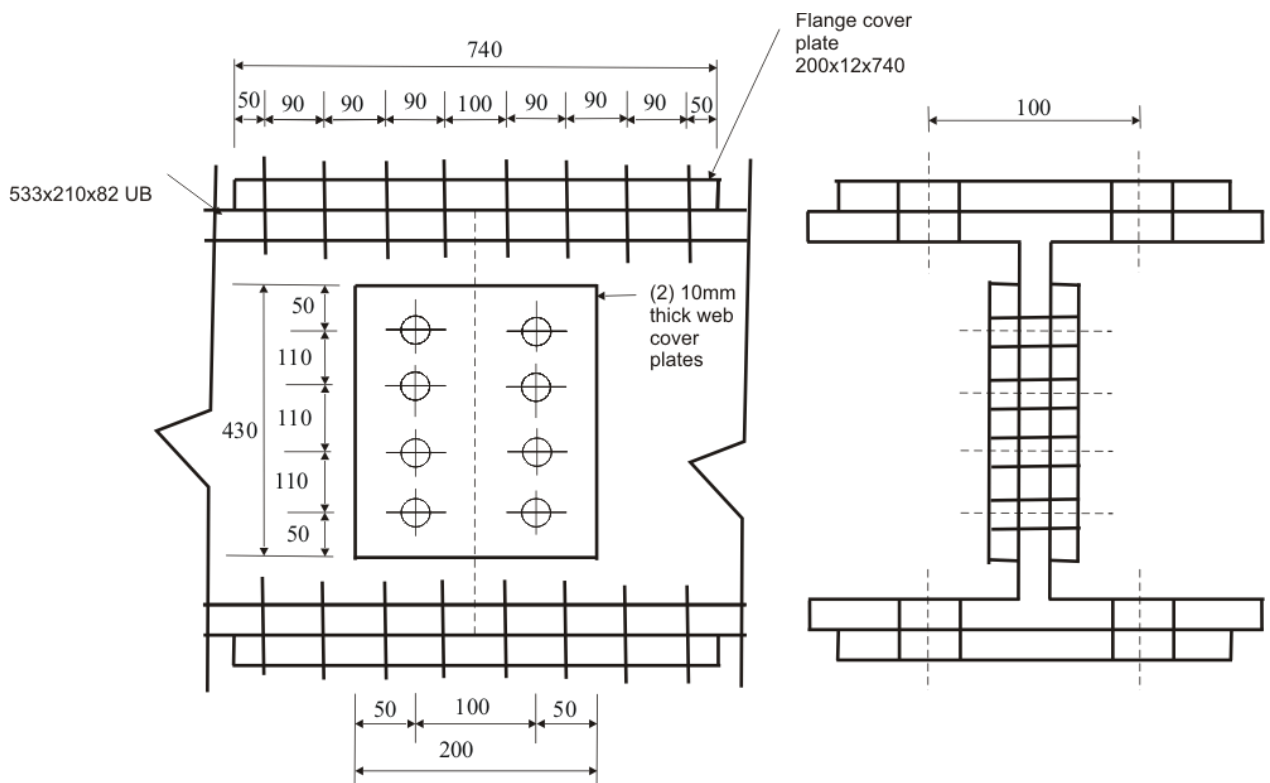
Figure 3

(14 marks)

5. a) Briefly explain the FOUR classes of steel sections according to their strength.

(4 marks)

b) A pratt truss shown in figure 4 is to be used in the construction of parking bay in MMUST. Design a tie for the member AB. Tensile force in member AB is taken as:

Dead load $=150kN$

Imposed load $=250kN$
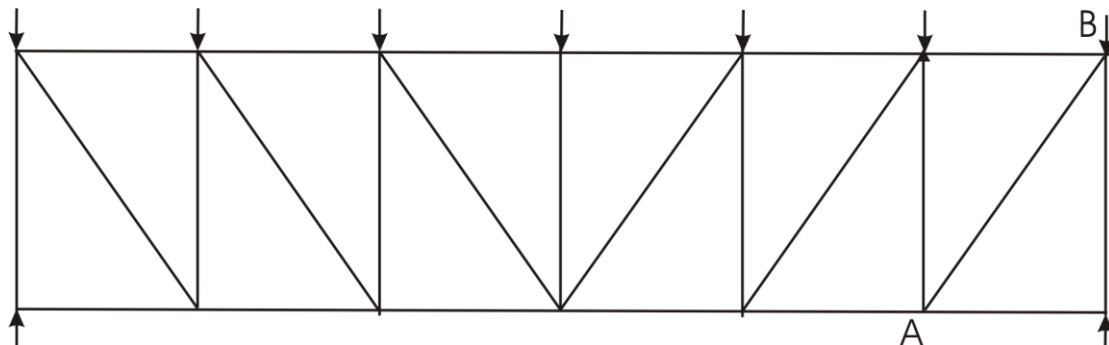
Material: Grade 50 steel.

Figure 4

(16 marks)