TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE 12J)

EBC 2311: STRUCTURAL STEEL & TIMBER DESIGN

END OF SEMESTER EXAMINATION
SERIES: APRIL 2014
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination

- *Answer booklet*
- *Drawing Paper*
- *Drawing Instruments*

This paper consists of **FIVE** questions. Answer any **THREE** questions of the **FIVE** questions
All questions carry equal marks
Maximum marks for each part of a question are as shown
This paper consists of **FOUR** printed pages

Question One

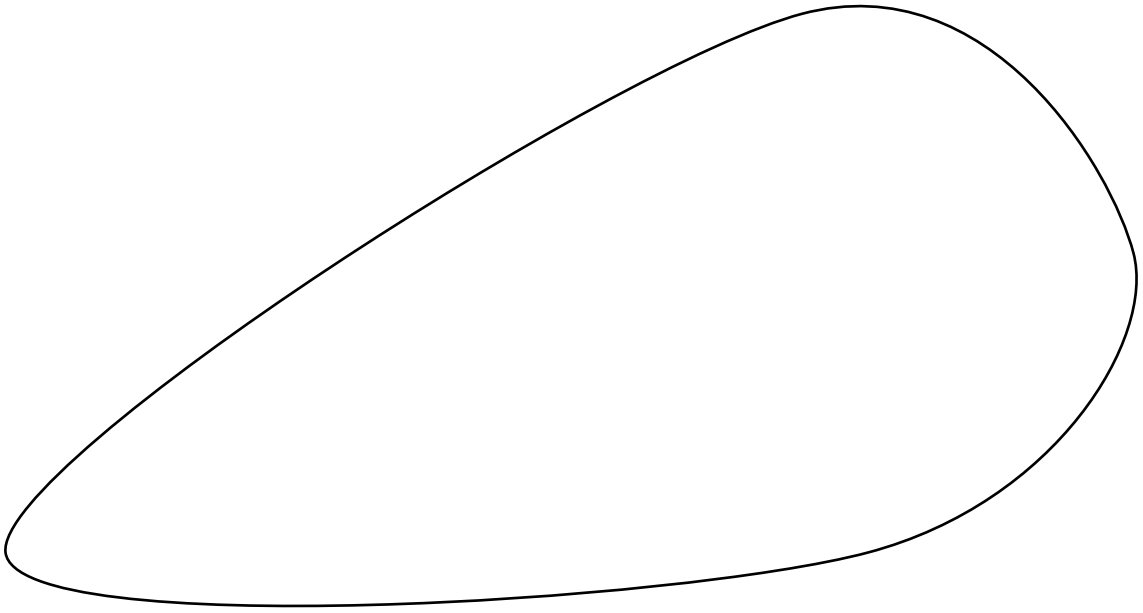
Figure 1 shows a U.B section carrying a uniformly distributed load of 25KN/m over the entire length.

a) Select a suitable U.B section for bending requirements. **(8 marks)**

b) Check for:
   (i) Shear
   (ii) Deflection between supports A and B
   (iii) Web buckling at B
   (iv) Bearing at B **(12 marks)**

Data:

- Permissible shear stress = 115N/mm^2
- Permissible deflection = Span/360
- Permissible bearing stress = 190N/mm^2
- Esteel = 210KN/mm^2
- Permissible bending stress = 165N/mm^2



Question Two

a) Define the following as applied to stanchions. Illustrate diagrammatically:
   (i) Actual length
   (ii) Effective length
   (iii) Slenderness ratio **(6 marks)**

b) An axially loaded stanchion of actual length 4.5m is required to carry a load of 450KN. The stanchion is fully fixed at top and bottom.
   (i) Select a suitable grade 43 U.C. section and check its adequacy
   (ii) Design stanchion base

Data

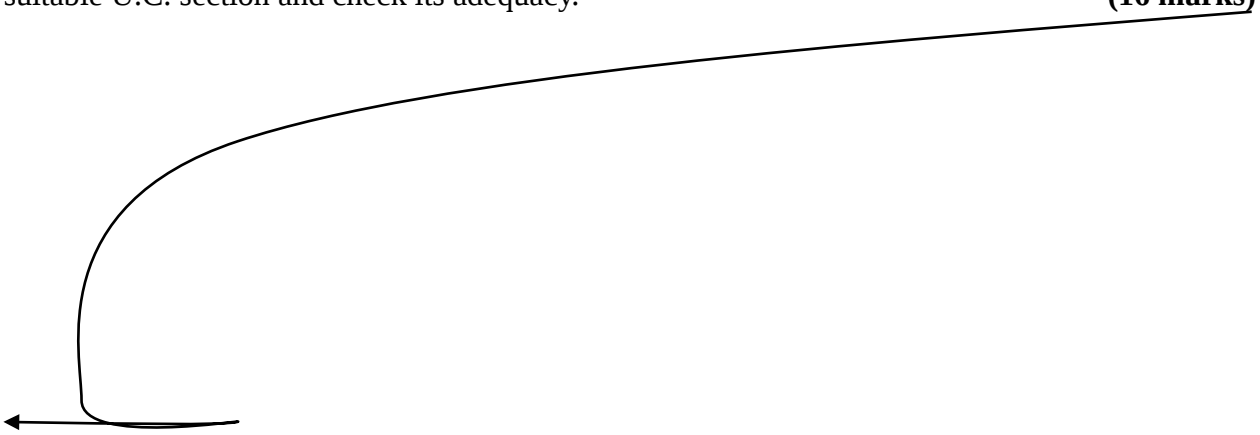
Pec = $5.3N/mm^2$

Pbct = $185N/mm^2$

Question Three

a) State advantages of structural steel over reinforced concrete. **(4 marks)**

b) Figure 2 shows an eccentrically loaded stanchion supporting an axial load of 250KN from upper floors. In addition, it supports a uniformly distributed load of 12KN/m from an in-coming beam over a span of 4.0m. The stanchion has an actual length of 4.5m and is fully fixed at both ends. Select a suitable U.C. section and check its adequacy. **(16 marks)**



Question Four

a) State advantages of welded and bolted connections. **(6 marks)**

b) A U.B section of span 6.0m is supported onto u.c. sections by 15mm thick angle cleats at both ends. The beam carries a total load of 120KN over its entire span. Select a suitable U.B. Section for bending requirement and check for:
   (i) Shear
   (ii) Deflection
   (iii) Web buckling
   (iv) Web crushing

Data

- E_{steel} = $210KN/mm^2$
- Permissible bearing stress = $190N/mm^2$
- Permissible deflection = Span/360
- Permissible bending stress = $165N/mm^2$ **(14 marks)**

Question Five

a) Define the following as applied to structural timber:

(i) Green stress
(ii) Basic stress
(iii) Modification factor
(iv) Permissible stress
(v) Grade stress and state THREE methods of grading timber. **(8 marks)**

b) Timber joists spaced at 2.0m centres are supported on 200mm block walls over a clear distance of 3.0m. Select a suitable section for bending requirement and check for:

(i) Shear
(ii) Deflection **(12 marks)**

- Permissible deflection = span/300
- Permissible shear stress = $1.2N/mm^2$
- Permissible bending stress = $10N/mm^2$
- E_{steel} = $210N/mm^2$