TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

HIGHER DIPLOMA IN BUILDING & CIVIL ENGINEERING

EBC 3215: 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 **THREE** printed pages

Question One

a) Define the following as applied to structural timber:
   (i) Basic stress
   (ii) Modification factor
   (iii) Permissible stress
   (iv) Grade stress and state THREE methods of grading timber. **(8 marks)**

b) Timber joists spaced at 2.5 centres are supported 200mm block walls over a clear span 3.0m. Select a suitable timber section of bending requirement and check for:
   (i) Shear
   (ii) Deflection **(12 marks)**

- Permissible shear stress = $1.2N/mm^2$
- Permissible deflection = Span/300
- Permissible bending stress = $10N/mm^2$
- Medium term loading duration

Question Two

Figure 1 shows a U.N section supporting a uniformly distributed load of 30KN/m over the entire length.

a) Select a suitable U.B section for bending.
   (i) Shear
   (ii) Web backling at A
   (iii) Bearing at B
   (iv) Deflection between A and B **(12 marks)**

Data:

- Permissible shear stress = $115N/mm^2$
- Permissible bearing stress = $190N/mm^2$
- Permissible deflection = span/300
- E_{steel} = $210KN/mm^2$
- Permissible bending stress = $165N/mm^2$

U.C

Question Three

a) Define the following as applied to stanchions and illustrate diagrammatically:
   (i) Effective length
   (ii) Slenderness ratio **(6 marks)**

b) An axially loaded stanchion of actual length 4.0 – is to support a load of 400KN. The stanchion is fully fixed at bottom but pinned at top.
   (i) Select a suitable U.C section and check its adequacy
   (ii) Design stanchion base **(14 marks)**

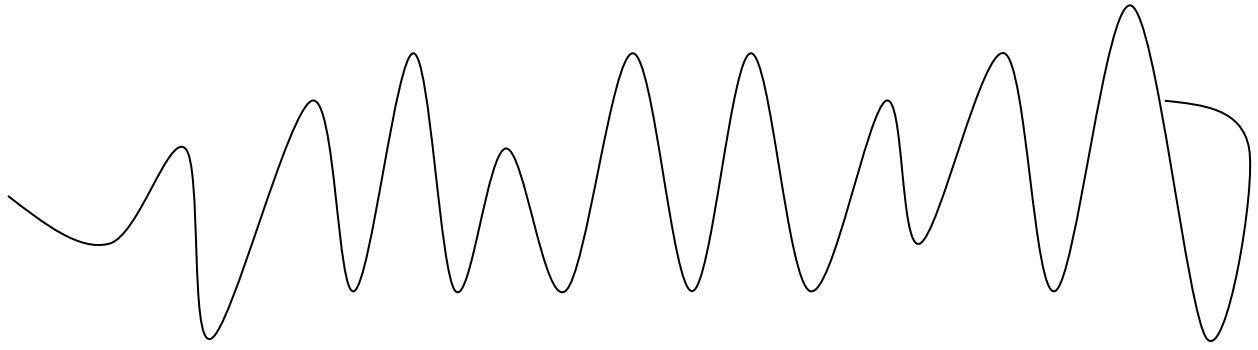
Data:

P_{bct} = 185N/mm^2
P_{cc} = 5.3N/mm^2

Question Four

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

b) Figure 2 shows an eccentrically loaded stanchion carrying an axial load of 200KN from upper floors. In addition, it carries a uniformly distributed load of 15KN/m from an incoming 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 grade 43u.c. section and check its adequacy. **(16 marks)**



Question Five

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

b) A U.B section of span 5.0m is supported on the u.c. sections by means of 15mm thick angle cleats at both ends. The beam carries a total load of 150KN over its entire span. Select a suitable U.B section for bending requirement and checks for:

(i) Shear
(ii) Deflection
(iii) Buckling
(iv) Bearing **(14 marks)**

Data

- Permissible bending stress = $165N/mm^2$
- Permissible bearing stress = $190N/mm^2$
- Permissible deflection = Span/360
- E_{steel} = $210KN/mm^2$
- Permissible shear stress = $115N/mm^2$