



TECHNICAL UNIVERSITY OF MOMBASA  
**Faculty of Engineering &  
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DECREE IN:

**BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE)**

ECE 2515: STRUCTURAL DESIGN IV

**END OF SEMESTER EXAMINATION**

SERIES: APRIL 2015

**TIME ALLOWED: 3 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*
- *Calculator*
- *BS 8110*
- *BS 6399*

This paper consists of **FIVE** questions. Answer questions **ONE (Compulsory)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

Use neat, large and well labeled diagrams where required

This paper consists of **THREE** printed pages

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**Question One (Compulsory)**

a) Concrete structural design requires formula to determine to right area of steel and members sizing. These formulas can be derived from 1<sup>st</sup> principles. Derive the following formulas:

- Ultimate moment of resistance
- Area of tension reinforcement
- Leverm
- Shear resistance

Show their relevance in BS 8110

**(12 marks)**

b) Using relevant BS clamer, design the slab showing in figure 1, below and show the sled in the section

## Figure 1

Assume:

- 150mm thick flow
- Moderate exposure
- Fire resistance 1 ½ hours
- Partition loady = 1.5KN/m<sup>2</sup>
- Any other necessary data

Apply all necessary checks

**(18 marks)**

- c) A T-shaped cross-section of a beam shown in figure 2(b) is subjected to a vertical shear force of 10KN. Calculate the shear stress at the neutral axis and at the neutral axis and at the junction of the web and the flange. Moment of inertia about the horizontal axis is 11340cm<sup>4</sup>

### Question Two

Figure 2 below shows a floor system of a multistory building of solid reinforced concrete structure:

- (i) Design the L-beam 1 – 1
- (ii) Design the T- beam

**(20 marks)**

Figure 2

### Question Three

- a) Concrete like any other building material has various failures which if not addressed can cause failure of the whole structure. Discuss THREE of these failures **(9 marks)**
- b) Study figure 3 below carefully and design column B2, given the following assumptions:

- Nominal cover 40mm
- $f_{yk} = 460\text{N/mm}^2$
- $f_{cu} = 75\text{N/mm}^2$
- $b = 400\text{mm}$
- $h = 200\text{mm}$
- Effective height 395m

**(11 marks)****Question Four**

- a) When Engineers receive drawings from the Architect, they initiate a process before actual structural design. Discuss this process **(8 marks)**
- b) A multistory building (column shown in figure 5) carries factored dead load of 241kN and live load of 164kN. Design as suitable base to carry to column. Assume:
- o  $BC = 500\text{kN/m}^2$
  - o Cover = 40mm

**(12 marks)**

Reg

3x

2

1

GL

**Figure 1****Question Five**

- a) Structure, particularly multistory structures even when load design have done and checked still face the problem of wind and seismic loading. Discuss the effects of these loadings. Compare the concrete vs steel structure **(8 marks)**
- b) Figure 5 shows elevation of a concrete stair slab spanning longitudinally on two beams. The effective span  $h = 3000\text{mm}$  and the rise is 1500 with 260mm tread and riser of 180mm. Design the stair and show the reinforcement in the section **(12 marks)**