



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

DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL
ENGINEERING
[Institutional Based Programmes]

ECE 2515: STRUCTURAL DESIGN IV

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2013
TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions.

Answer question **ONE** any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **FOUR** printed pages

Question One (Compulsory)

- a) With the aid of a labeled sketch illustrate the load transfer from a simply-supported reinforced concrete slab spanning in two directions to the supporting four beams. Outline its behavior under loading. **(10 marks)**

b) Figure 1(b) shows a loaded two-way spanning reinforced concrete slab. Design the reinforcement required using the following information:

- Overall depth of slab = 220mm
 Imposed load = 10KN/m²
 F_{cu} = 30N/mm²
 F_y = 460N/mm²
 Unit weight of concrete = 24KN/m³
 Mild exposure conditions:

Table 1(b) shows bending moment coefficients: Assume any useful information and show it

(20 marks)

Table 1(b): Bending moment coefficients

ly/lx	1.0	1.1	1.2	1.3	1.4	1.5	1.75	2.0
α_{sx}	0.062	0.074	0.084	0.093	0.099	0.104	0.113	0.118
α_{sy}	0.062	0.067	0.059	0.055	0.051	0.046	0.037	0.029

Question Two

Figure Q2 shows a sub-frame where the beams are loaded with characteristic loads dead load (including self weigh) of $G_k = 25\text{KN/m}$ and imposed load $Q_k = 10\text{KN/m}$ uniformly distributed along the beam. The frame is braced and carries vertical loads only. Show the three loading cases and by using the moment distribution method, determine the design moment at A, B, C and D for the first loading case. Sketch the bending moment diagram for the first loading case only.

(20 marks)

Question Three

Design pad footing to resist characteristic axial loads of 1000KN dead and 350KN imposed from a 400mm square column. The safe bearing capacity of the soil is 200KN/m^2 and the characteristic material strengths are concrete = 35N/mm^2 and steel reinforcement = 460N/mm^2 cover to reinforcement is 50mm.
(20 marks)

Question Four

- a) Design a waffle slab for an internal panel of a floor system each panel spanning 6.0m in each direction. The characteristic material strengths are concrete = 30N/mm^2 and steel reinforcement = 460N/mm^2 . Characteristic dead load = 6KN/m^2 (including self-weight) and characteristic imposed load = 2.5KN/m^2
(20 marks)

Question Five

Figure 5 shows the elevation of a stair slab spanning longitudinally and supported on two beams. The effective span is 3.0m and the rise is 1.50m with 260mm treads and 150mm risers. The imposed load is 3.0KN/m^2 and the characteristic material strengths are 30N/mm^2 and 250N/mm^2 for concrete and steel reinforcement respectively. Design suitable reinforcement for the stair slab. Try a 125mm waist and effective depth $d=90\text{mm}$ **(20 marks)**