



**TECHNICAL UNIVERSITY OF MOMBASA**

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**FACULTY OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF BUILDING AND CIVIL ENGINEERING**

**DIPLOMA IN BUILDING AND CIVIL ENGINEERING**

**EBC 2209: REINFORCED CONCRETE AND MASONRY DESIGN**

**END OF SEMESTER EXAMINATION**

**SERIES: APRIL 2016**

**TIME: 2 HOURS**

### **INSTRUCTIONS TO CANDIDATES**

You should have the following for this examination

- Answer booklet
- Scientific calculator
- BS 8110 – Part 1: 1997 Structural use of Concrete

This paper consists of **FIVE** questions

Answer any other **THREE** questions

Use neat, large and well labelled diagrams where required

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed papers.



**SGS ISO 9001:2008 Certified**

### QUESTION ONE (20 Marks)

A 150mm thick simply supported reinforced concrete slab spans 3m. Grade C30 concrete and high yield reinforcements will be used. Design suitable slab to carry a total ULS loading of 13kn/M<sup>2</sup>.

### QUESTION TWO (20 Marks)

A 400mm square column carries a dead load of 1000 KN and imposed load of 350 KN. The safe bearing capacity of the soil is 200KN/m<sup>2</sup>. Given  $f_{cu}=30\text{N/mm}^2$  under mild exposure conditions and  $f_y =460 \text{ N/mm}^2$ .design a square pad footing.

### QUESTION THREE (20 Marks)

A simply supported reinforced concrete beam, with an effective span of 4 metres is 200mm wide by 450mm deep carries a uniformly distributed imposed load of 15KN/m and a dead load of 15Kn/m (excluding its self-weight). Given  $f_{cu}=30\text{N/mm}^2$  under mild exposure conditions and  $f_y =460 \text{ N/mm}^2$ . Design the beam for Lateral Buckling Bending, ULS, Deflection SLS, Shear ULS

### QUESTION FOUR (20 Marks)

A simply supported floor slab in an office building has effective spans of 4.6M by 6.5M with a depth of 200mm. the slab supports a live load of 10Kn/m<sup>2</sup>. Given  $f_{cu}=30\text{N/mm}^2$  under mild exposure conditions and  $f_y =460 \text{ N/mm}^2$ . Design the slab.

### QUESTION FIVE (20 Marks)

- a) A short braced column 250mm by 250mm is 2.7m high and supports an axial load of 1000kn.chose suitable high yield reinforcement bars that will be required for main bars reinforcement and links.
- b) A short braced column is required to support an ultimate axial load of 1200KN .assuming a 2% main steel, calculate the diameter of a circular column required. Choose suitable mild steel reinforcement to be used as main bar reinforcements. Take  $f_{cu}=30\text{N/mm}^2$  under mild exposure conditions.



Table 3.13 — Bending moment coefficients for slabs spanning in two directions at right angles, simply-supported on four sides

$\frac{l_y}{l_x}$	1.0	1.1	1.2	1.3	1.4	1.5	1.75	2
$\alpha_{sx}$	0.062	0.074	0.084	0.093	0.099	0.104	0.133	0.118
$\alpha_{sy}$	0.062	0.061	0.059	0.055	0.051	0.046	0.037	0.029

Table: Values of  $A_{sv}/S_v$

Diameter of links (mm)	Spacing of links(mm)										
	85	90	100	125	150	175	200	225	250	275	300
8	1.183	1.118	1.006	0.805	0.671	0.575	0.503	0.447	0.402	0.336	0.335
10	1.847	1.744	1.57	1.256	1.047	0.897	0.785	0.698	0.628	0.571	0.523
12	2.659	2.511	2.26	1.808	1.507	1.291	1.13	1.004	0.904	0.822	0.753
16	4.729	4.467	4.02	3.216	2.68	2.297	2.01	1.787	1.608	1.462	1.34

Table: Cross-sectional areas of groups of bars (mm<sup>2</sup>)

Bar Size (mm)	Number of bars									
	1	2	3	4	5	6	7	8	9	10
6	28.3	56.6	84.9	113	142	170	198	226	255	283
8	50.3	101	151	201	252	302	352	402	453	503
10	78.5	157	236	314	393	471	550	628	707	785
12	113	226	339	452	566	679	792	905	1020	1130
16	201	402	603	804	1010	1210	1410	1610	1810	2010
20	314	628	943	1260	1570	1890	2200	2510	2830	3140
25	491	982	1470	1960	2450	2950	3440	3930	4420	4910
32	804	1610	2410	3220	4020	4830	5630	6430	7240	8040

Table: Cross-sectional area per metre width for various bar spacing (mm<sup>2</sup>)

Bar Size (mm)	50	75	100	125	150	175	200	250	300
6	566	377	283	226	189	162	142	113	94.3
8	1010	671	503	402	335	287	252	201	168
10	1570	1050	785	628	523	449	393	314	262
12	2260	1510	1130	905	754	646	566	452	377
16	4020	2680	2010	1610	1340	1150	1010	804	670
20	6280	4190	3140	2510	2090	1800	1570	1260	1050
25	9820	6550	4910	3930	3270	2810	2450	1960	1640
32	16100	10700	8040	6430	5360	4600	4020	3220	2680

