TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DAPARTMENT OF BUILDING &CIVIL ENGINEERING

DIPLOMA IN BUILDING & CIVIL ENGINEERING

EBC 2209: REINFORCED CONCRETE AND MASONRY DESIGN

Series: August 2019
Time allowed: 2 hours

Instructions to Candidates

You should have the following for this examination:

- Answer booklet
- Scientific calculator
- BS 8110 – 1: 1997 structural use of concrete

This paper consists of **FIVE** questions. Answer any **THREE** of the **FIVE** questions.
All questions carry equal marks.
Maximum marks for each part of a question are as shown
Refer to tables 'A', 'B',and 'C' for values of Asv/Sv, sectional area per metre width for various bar spacings (mm^2), and cross-sectional areas of group of bars respectively.
Use neat large and well labeled diagrams where required
This paper consists of **FOUR** printed pages

Question 1

a) Design the longitudinal steel and links for a 300mm square , short braced column to support dead and imposed loads of 1250KN and 650KN respectively (including self weight), given characteristic material strength for concrete and steel as 25N/m^2 and 460 N/mm^2 respectively.

(7 1/2 Marks)

b) An internal column in a braced three storey building supporting an approximately symmetrical arrangement of beams (300mm wide x 600mm deep) resulting in characteristic dead and imposed loads of 1500KN on the column. The column is 350mm square and has a clear height of 4.5m. Design the reinforcement of the column given fcu = 30N/mm^2 and fy= 460N/mm^2 fyv = 250N/mm^2

(12 1/2 Marks)

Question 2

A reinforced concrete floor slab spanning between 200mm thick beams is as shown in fig 1. Design the floor slab as a one way slab given the following information:

unit weight of concrete = 24KN/m^3
finishes = 1.2KN/m^2
imposed load = 1.5KN/m^2
fcu = 30 N/mm^2
fy = 500 N/mm^2
and mild exposure condition

(20 Marks)

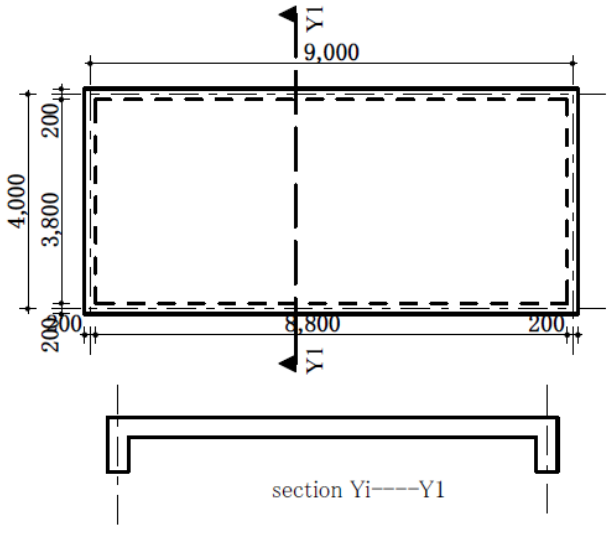

fig 1

Question 3

A 300mm square column carries dead and imposed loads of 1000KN and 400KN respectively. The safe soil bearing capacity of the soil is 200KN/m^2. Design a square pad footing for the column, given characteristic material strength for concrete and steel as 30N/m2and 460 N/m^2 respectively.

(20 Marks)

Question 4

A reinforced concrete beam 300mm wide x 450mm deep is simply supported over a span of 5.0m centre to centre on 200mm wide walls. The beam carries total dead load of 20KN (excluding its self weight) and an imposed load of 15KN. Assuming unit weight of concrete = 24KN/$m^{3,}$ fcu = 30 N/mm^2 , fy = 460 N/mm^2 and fyv = 250N/mm^2 for mild steel and moderate exposure condition. design the beam for bending, shear and deflection.

(20 Marks)

Question 5

The cantilever wall shown in fig 2 is backfilled with granular material having a unit weight of 200KN/m^2 and an internal angle of friction of 28^0. Assuming that the pressure of the soil is 200KN/m^2, the coefficient of friction as 0.4 and the unit weight of reinforced concrete as 24KN/m^3, calculate:

a) The factors of safety with respect to sliding and overturning.
b) The ground bearing pressures
c) Given characteristic material strength for concrete and steel as 25N/m^2 and 460 N/mm^2 respectively, design the stem for bending

(20 Marks)

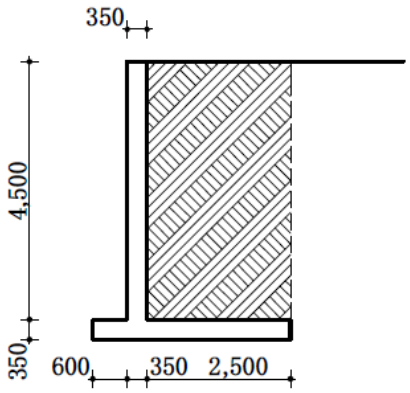

fig 2

Table A: 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 B: Cross-sectional area per metre width for various bar spacings(mm^2)

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
40	25100	16800	12600	10100	8380	7180	6280	5030	4190

Table C: Cross-sectional areas of groups of bars (mm^2)

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
40	1260	2510	3770	5030	6280	7540	8800	10100	11300	12600