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(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS 2023/2024 ACADEMIC YEAR

FIFTH YEAR SEMESTER ONE MAIN EXAMINATIONS

FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING

COURSE CODE: CSE 511

COURSE TITLE: DESIGN OF BUILDINGS

DATE: 15TH DECEMBER 2023   **TIME: 3 P.M – 5 P.M**

INSTRUCTIONS:
1. This paper contains FOUR questions.
2. Question ONE is compulsory.
3. ATTEMPT ANY other TWO questions from SECTION B in this booklet.
4. The use of Eurocode is permitted.
5. where information is deemed to be missing state and make reasonable assumptions with reasons

Examination duration is **2 Hour**

MMUST observes ZERO tolerance to examination cheating.

This Paper Consists of 5 Printed Pages. Please Turn Over.

Question ONE {COMPULSORY} (30 marks)

A) i) Considering the building regulation codes. How is the building sector regulated in Kenya. Elaborate how this is achieved in the various sections of building development including <u>design</u>, and <u>construction</u> phases (5mk)

ii) Who are the key players involved in building development from <u>feasibility studies</u>, <u>design phase</u>, <u>construction</u> phases of building development. Clearly explain their roles. (5mk)

iii) From your understanding of design principles and procedures, explain five key causes of building failure and link them to elements of the design and construction phases. (10 mk)

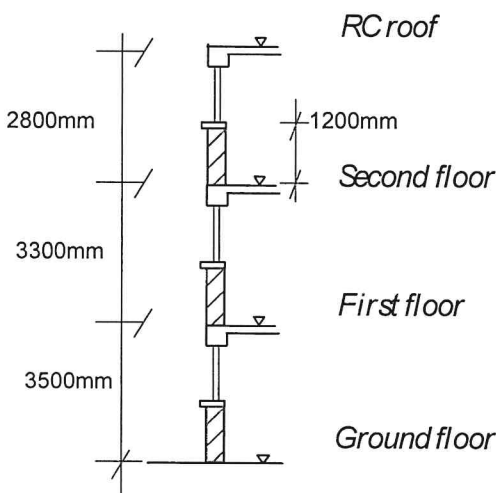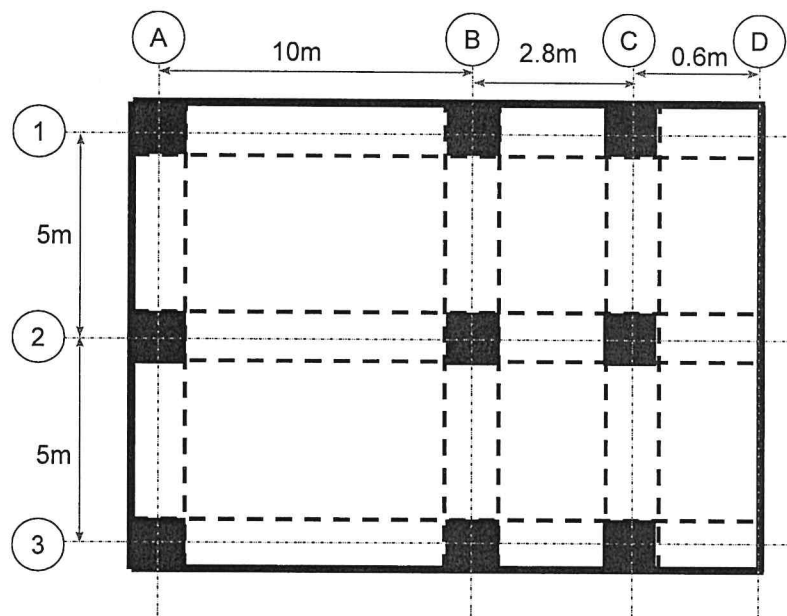Fig. Q1.A   Fig.Q1.B

B) Consider the floor layout plan in figure Fig.Q1

Derive the loads both imposed (variable) and permanent (dead) loads, in terms of kN and kN/m where necessary, on the following structural elements (Note. No need to derive moments);

i) Beam A-D/1 (2mks)
ii) Beam AD/2 (2mks)
iii) Beam B/1-3 (2mks)
iv) Column B/2 (2mks)
v) Column C/3 (2mks)

Question Two (20 marks)

Using Fig.Q1.B and considering slab A-B/1-3. Carryout the following;

i) Determine the mid span reinforcement and support reinforcement. (10mk)
ii) Sketch the reinforcement of the slab (4mk)
iii) prepare a bar bending schedule (3mk)
iv) Calculate the cost of the panel (3mk)

Question Three (20 marks)

Using Fig.Q1.B and considering Beam A-D/2 ; carryout the following;
i) determine the required reinforcement.   (10mk)
ii) Sketch the reinforcement of the beam   (4mk)
iii) prepare a bar bending schedule   (3mk)
iv) Calculate the cost of the panel   (3mk)

Question Four   **(20 marks)**

Consider the structure in Fig.Q1 to be storeyed as shown in Fig.Q1.A.
The RC frame supports a 200 mm thick slab with 25mm screed and tiles
The frame supports a live load of $4.0 kN/m^2$.
i) determine suitable reinforcement for the column section   (10 mk)
ii) Sketch the reinforcement of the beam   (4mk)
iii) prepare a bar bending schedule   (3mk)
iv) Calculate the cost of the panel   (3mk)

Question Five   **(20 marks)**

Fig.Q5

Consider the staircase in Fig.Q5. and assume a live load of $5.0 kN/m^2$.
i) determine suitable reinforcement for the section   (10 Marks)
ii) Sketch the reinforcement of the beam   (4mk)
iii) prepare a bar bending schedule   (3mk)
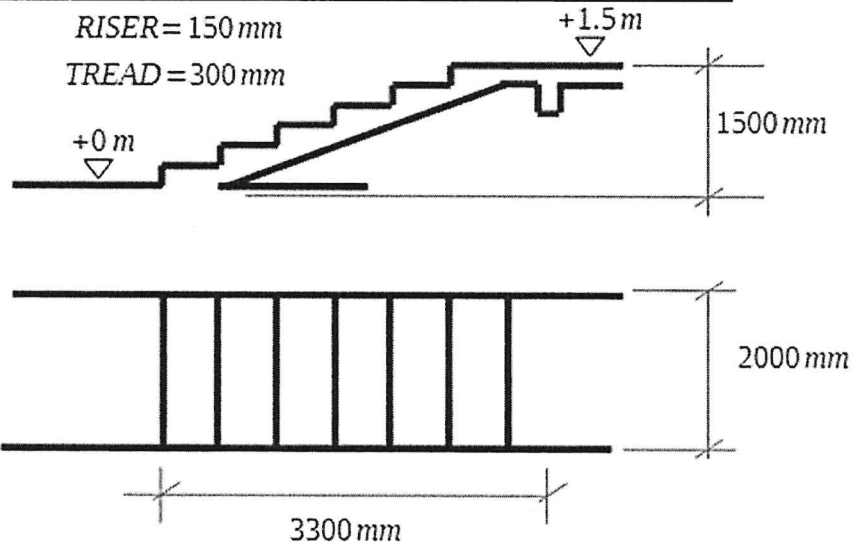iv) Calculate the cost of the concrete and steel works   (3mk)

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MEMORY AIDE
Cross sectional area of number of bars (mm²) - FOR BEAMS

Bar Size (mm)	Number of Bars											
	1	2	3	4	5	6	7	8	9	10	11	12
12	113	226	339	452	565	679	792	905	1018	1131	1244	1357

16	201	402	603	804	1005	1206	1407	1608	1810	2011	2212	2413
20	314	628	942	1257	1571	1885	2199	2513	2827	3142	3456	3770
25	491	982	1473	1963	2454	2945	3436	3927	4418	4909	5400	5890

Cross sectional area of bars per metre (mm²/m) - FOR SLABS

Bar Size (mm)	Bar Spacing (mm)											
	50	75	100	125	150	175	200	225	250	275	300	400
6	565	377	283	226	188	162	141	126	113	103	94	71
8	1005	670	503	402	335	287	251	223	201	183	168	126
10	1571	1047	785	628	524	449	393	349	314	286	262	196
12	2262	1508	1131	905	754	646	565	503	452	411	377	283
16	4021	2681	2011	1608	1340	1149	1005	894	804	731	670	503

Link reinforcement in beams, $\frac{A_{sv}}{sv}$ (mm²/mm) - <u>TWO (2) legs</u> - FOR SHEAR IN BEAMS

Bar Size (mm)	Spacing of Links (mm)											
	50	75	100	125	150	175	200	225	250	275	300	400
6	1.13	0.75	0.57	0.45	0.38	0.32	0.28	0.25	0.23	0.21	0.19	0.14
8	2.01	1.34	1.01	0.80	0.67	0.57	0.50	0.45	0.40	0.37	0.34	0.25
10	3.14	2.09	1.57	1.26	1.05	0.90	0.79	0.70	0.63	0.57	0.52	0.39

Link reinforcement in beams, $\frac{A_{sv}}{sv}$ (mm²/mm) - <u>THREE (3) legs</u> - FOR SHEAR IN BEAMS

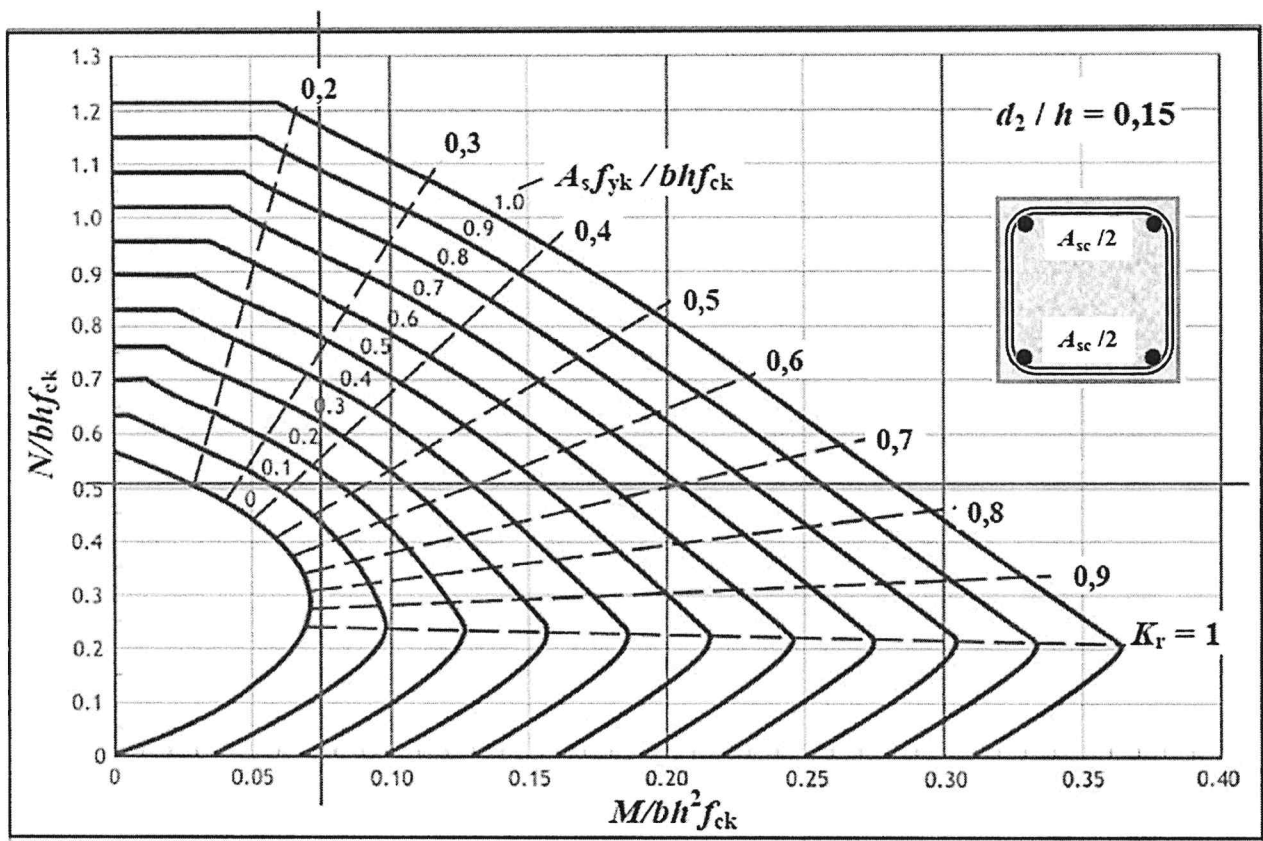| Bar Size (mm)	Spacing of Links (mm)											
	50	75	100	125	150	175	200	225	250	275	300	400
6	1.70	1.13	0.85	0.68	0.57	0.48	0.42	0.38	0.34	0.31	0.28	0.21
8	3.02	2.01	1.51	1.21	1.01	0.86	0.75	0.67	0.60	0.55	0.50	0.38
10	4.71	3.14	2.36	1.88	1.57	1.35	1.18	1.05	0.94	0.86	0.79	0.59

Figure: Column Design Chart for $\frac{d_2}{h} = 0.15$

Cost calculation information

- RC concrete rate = 25,000 Kshs/m^3

- Steel cost 400 Kshs/kg

- Calculate the weight per m (in kg per m) as $\left[\frac{D^2}{162}\right]$ kg/m where D is the diameter of the bar