(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY SPECIAL/SUPPLEMENTARY EXAMINATIONS 2019/2020 ACADEMIC YEAR

FIFTH YEAR FIRST SEMESTER EXAMINATIONS

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

COURSE CODE: CSE 511

COURSE TITLE: DESIGN OF BUILDINGS

DATE: Monday 25th January 2021   TIME: 8:00 – 10:00 AM

INSTRUCTIONS:
1. This paper contains FOUR questions
2. ATTEMPT ANY THREE (3NO) questions in this booklet
3. Marks for each question are indicated in the parenthesis.
4. The use of BS 8110 as well as Eurocode is permitted.
5. **WHERE INFORMATION IS DEEMED TO BE MISSING STATE ANDMAKE REASONABLE ASSUMPTIONS WITH REASONS**

Examination duration is **2 Hour**

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

Question one (25 marks)

A simply supported beam (500x300) Height; h=500mm and breadth, b=300mm spans over a clear span of 5 m. The applied load produces a maximum bending moment (M_{max}) =275 kN.m and the Maximum shear force (V_{max}) =185kN. Given f_{cu}=40N/mm², and f_y=460N/mm², use a cover of 25mm to

a) Design the required reinforcement for the beam to resist bending forces

(10 marks)

b) Check for shear and calculate the link spacing   **(6marks)**

c) Sketch the beam reinforcement   **(4 marks)**

d) Prepare a bar bending schedule   **(5 marks)**

Question two (25 marks)

Design a single column footing using the following information. Column size 400x400mm, dead load from column = 700 kN, live load from column = 550kN. Assuming Characteristic strengths of concrete f_{cu} 25 N/mm², steel f_y=460 N/mm². Cover =50mm

- Calculate the reinforcement requirement for the RC pad foundation **(15 marks)**
- Sketch the reinforcement for the foundation.   **(5 marks)**
- Prepare a bar bending schedule for the footing   **(5marks)**

Question three (20 marks)

Design a two-way slab panel that is 4m long x 3.2m wide dimensions and has a height of 150mm. The slab is supported by beams in all the four sides and a live load of 3.0 kN/m² is exerted on the slab. An extra dead load of 0.5 kN/m² for finishes is expected. Assuming a Characteristic strength of concrete f_{cu} 25 N/mm², steel f_y=460 N/mm². Cover for the slab is 20mm

- Calculate the steel reinforcement required   **(10 marks)**
- Sketch the steel reinforcement for the panel showing clearly the B1, T1, B2 and T2 bars   **(5 Marks)**
- Check for deflection.   **(5 marks)**
- Prepared a bar bending schedule   **(5 marks)**

Question four (25 marks)

Consider a slab for a library that is 5m long experiencing a live load of 3.0 kN/m²

To be constructed out of a one-way spanning ribbed slab as shown in the diagram
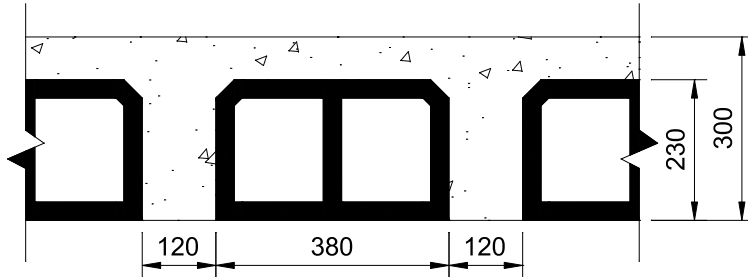
Fig. Q4

Fig. Q4; Hollow pot slab section

Use f_y=460N/mm², f_{cu}=25 N/mm², weight of hollow pot = 16kg (1 kN = 102 kg), cover=20mm to

a) Calculate the required steel reinforcement for the ribbed slab spanning 5m

(20 marks)

b) Check for deflection of the ribbed slab   **(5 marks)**

---   **END**   ---

MEMORY AIDE

Critical Sections for Foundation pad Shear
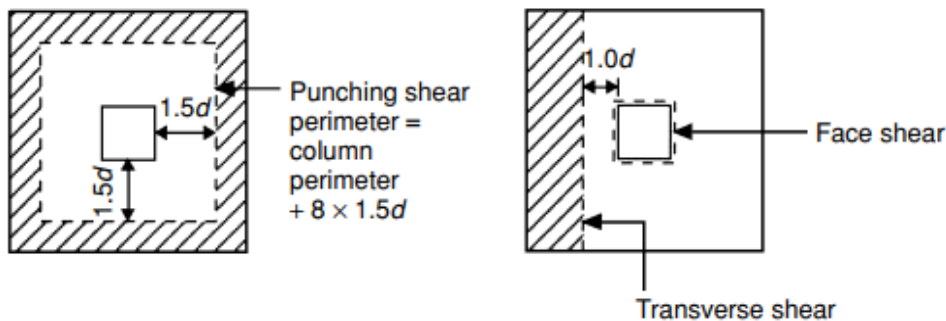
For simply supported beam with a uniformly distributed load maximum moment is given by

$$M_{max} = \frac{\omega l^2}{8}$$

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**
6	28	57	85	113	141	170	198	226	254	283	311	339
8	50	101	151	201	251	302	352	402	452	503	553	603
10	79	157	236	314	393	471	550	628	707	785	864	942
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, 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, 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
12	6.79	4.52	3.39	2.71	2.26	1.94	1.70	1.51	1.36	1.23	1.13	0.85
16	12.06	8.04	6.03	4.83	4.02	3.45	3.02	2.68	2.41	2.19	2.01	1.51