(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITRY EXAMINATIONS 2022/2023 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN BUILDING CONSTRUCTION

COURSE CODE: CSE 224

COURSE TITLE: ENGINEERING MATERIALS II

DATE: 25TH APRIL 2023 **TIME: 8- 10 A.M**

INSTRUCTIONS:

1. This paper consists of **TWO sections, A and B.**
2. **Section (A) is Compulsory.**
3. **Attempt ALL questions in section A and any ONE question from section B in this booklet.**
4. Marks for each question are indicated in the parenthesis.
5. No unauthorized materials are allowed in the examination room.

Examination duration is **2 Hours**

MMUT observes ZERO tolerance to examination cheating

This Paper Consists of 6 Printed Pages. Please Turn Over.

SECTION A (COMPULSARY)

QUESTION 1 **(17.5 marks)**

a) Define the term cement. (1.5 mark)

b) List the main four compounds of Portland cement. (2 marks)

c) Describe the heat of hydration against time. (5 marks)

d) Describe the wet process of cement manufacture (9 marks)

QUESTION 2 **(17.5 marks)**

a) Outline the classification of aggregates. (3 marks)

b) Define workability. (1.5 marks)

c) List the type of admixtures and describe their functions in concrete. (7 marks)

d) Define creep and state the effects of Creep on mass concrete and reinforced concrete. (6 marks)

QUESTION 3 **(17.5 marks)**

Design a concrete mix for MMUST TVET Building columns with a mean 28 days compressive strength (measured on standard cubes) of 40 MPa with a 8% standard deviation and 10% defective rate (k = 1.28); slump of 125 mm; crushed aggregates with a maximum size of 20 mm; specific gravity of aggregates of 2.65; 60 per cent of fine aggregates passes the 600 *μm* sieve; no air entrainment required; ordinary Portland cement to be used. (17.5 mark)

SECTION B (ANSWER ANY ONE QUESTION)

QUESTION 4 **(17.5 marks)**

Explain the occurrence of the different cracks shown in Figure 4 (17.5 marks)

QUESTION 5 **(17.5 marks)**

a) With aid of a clear sketch, outline four methods of sawing timber from logs. (8 marks)

b) Compare and contrast the Air Seasoning and Kiln Seasoning methods of timber. (7 marks)

c) Discuss the following timber defect:

1) Druxiness. (2.5 marks)

QUESTION 6 **(17.5 marks)**

a) List ways Fly ash can modify the hardened concrete properties? (4 marks)

b) What are the two concrete benefits of Micro Silica? (2.5 marks)

c) Discuss the four methods of processing molten slag. (4 marks)

d) Discuss:

1) The durability effect of Fibre in concrete. (5 marks)

2) The mechanism of Fibre Concrete. (2 marks)

Table 1. Approximate compressive strength (N/mm2) of concrete mixes made with a free-water/cement ratio of 0.5

Type of cement	Type of coarse aggregate	Compressive strengths (N/mm²) Age (days) 3	7	28	91
Ordinary Portland (OPC) or sulphate-resisting Portland (SRPC)	Uncrushed	22	30	42	49
	Crushed	27	36	49	56
Rapid-hardening Portland (RHPC)	Uncrushed	29	37	48	54
	Crushed	34	43	55	61

1 N/mm² = 1 MN/m² = 1 MPa (see footnote on earlier page).

Table 2. Approximate free-water contents (kg/m3) required to give various levels of workability

Slump (mm) / Vebe time(s)		0-10 >12	10-30 6-12	30-60 3-6	60-180 0-3
Maximum size aggregate (mm)	Type of aggregate				
10	Uncrushed	150	180	205	225
	Crushed	180	205	230	250
20	Uncrushed	135	160	180	195
	Crushed	170	190	210	225
40	Uncrushed	115	140	160	175
	Crushed	155	175	190	205

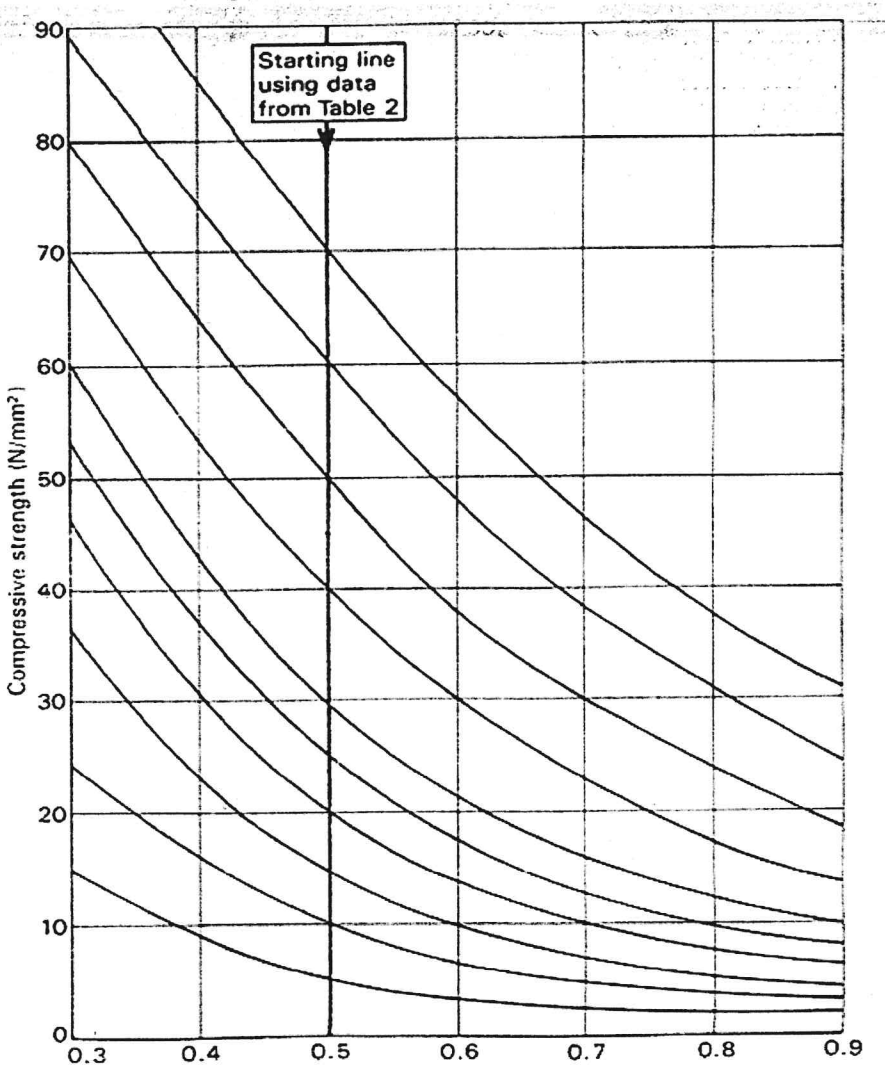

Figure1. Relationship between compressive strength and free-water/cement ratio.

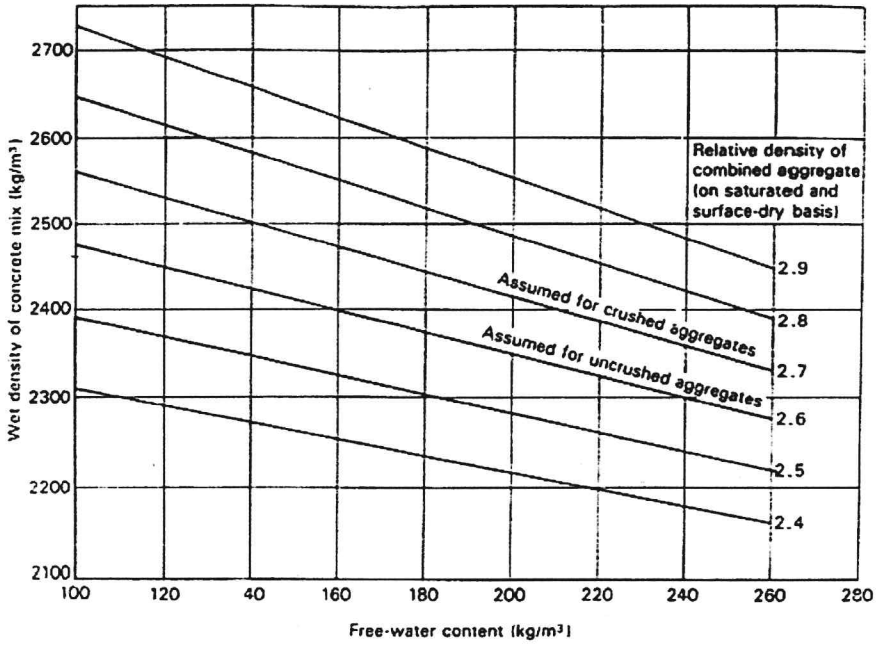

Figure 2. Estimated wet density of fully compacted concrete

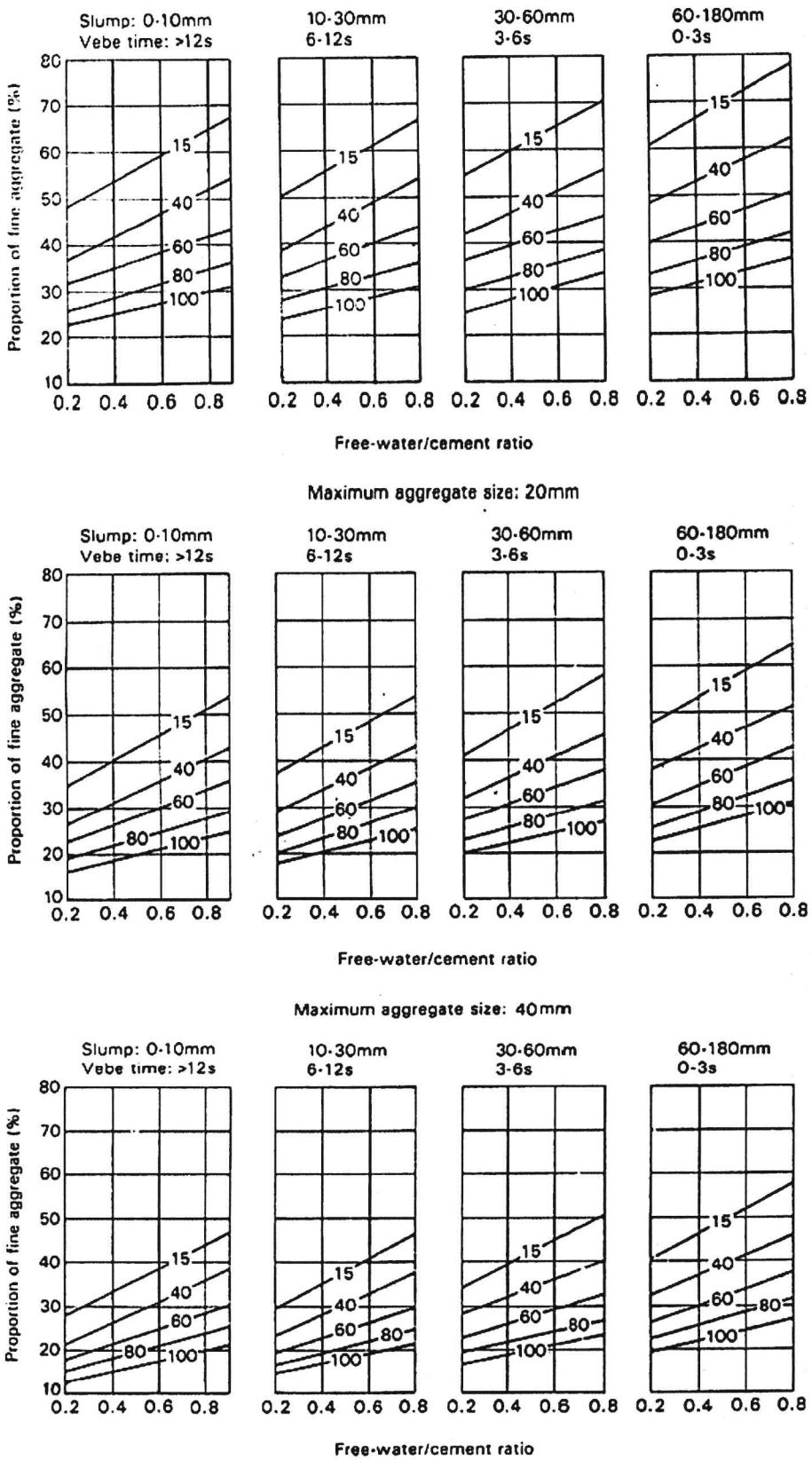

Figure 3. Recommended proportions of fine aggregate according to percentage passing a 600 µm sieve

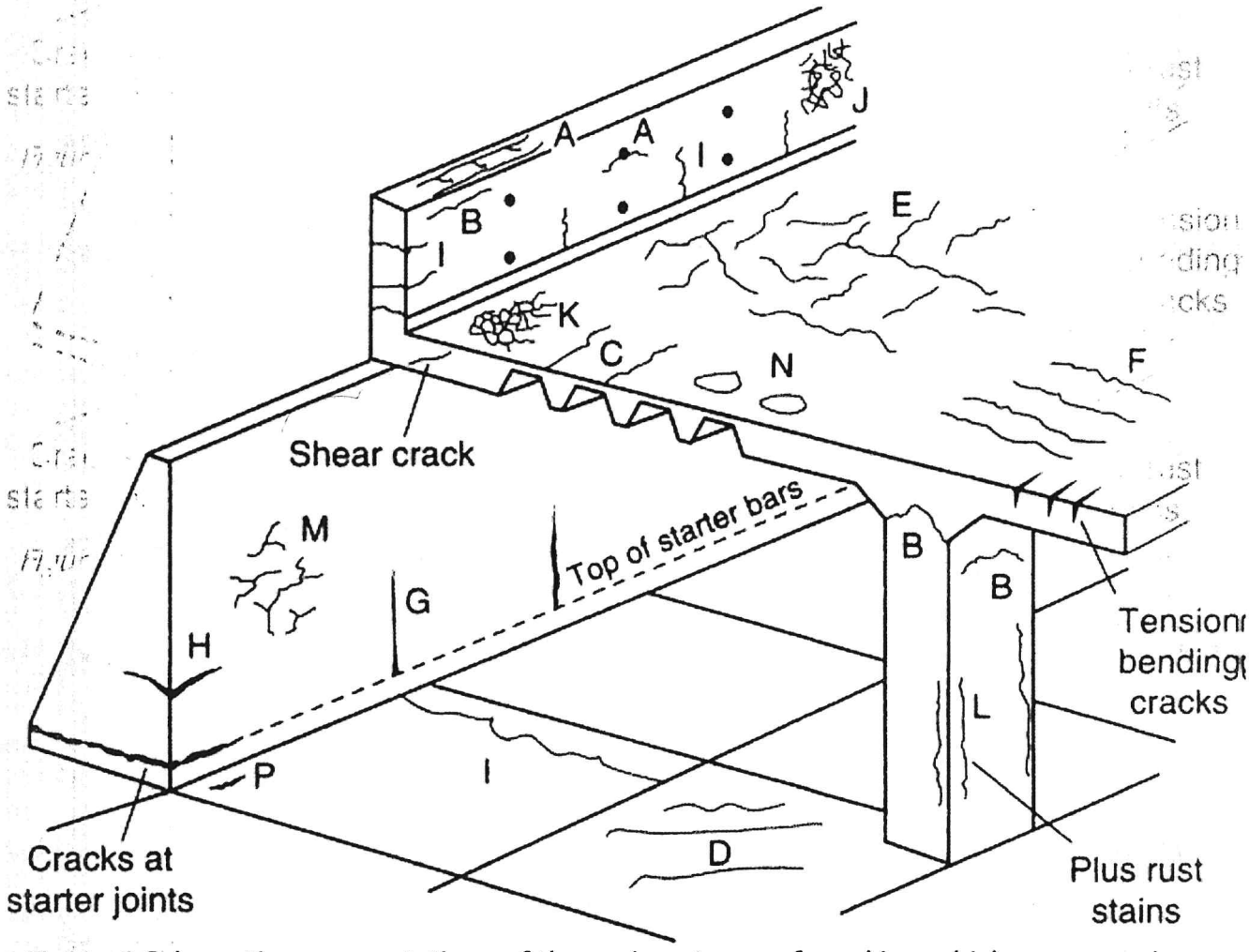

Figure 4 Schematic representations of the various types of cracking which can occur in concrete