

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
FACULTY OF ARCHITECTURE AND QUANTITY SURVEYING

**DEPARTMENT OF ARCHITECTURE**  
BACHELOR OF ARCHITECTURAL STUDIES (HONOURS) DEGREE

PART I SUPPLEMENTARY EXAMINATIONS – AUGUST 2004  
**AAR 1104 – INTRODUCTION TO MATERIALS AND CONSTRUCTION**

**Instructions**

**Time : 2 Hours**

***Answer All Questions.***

**QUESTION 1**

- a) Explain briefly the dry process in cement manufacturing.
- b) Composition of cement includes lime (Ca O) silica (SiO<sub>2</sub>), Calcium Sulphate (Ca SO<sub>4</sub>) Iron oxide (FE<sub>2</sub>O<sub>3</sub>) among others. Briefly explain their functions in cement.
- c) Discuss the effect of tricalcium silicate (C<sub>3</sub>S) and Dicalcium silicate (C<sub>2</sub>S) in the setting and hardening process of cement after hydration.
- d) Answer d(i) or d(ii)
  - (i) Discuss the field test for cement
  - (ii) Discuss the storage of cement at site
- (e) Fineness and soundness are some of the properties of cement. Differentiate the two and explain how one of them can be measured in the laboratory.

**QUESTION 2**

- a) Discuss the voids method in concrete preparation and explain briefly why this method of minimum voids of proportioning concrete does not give satisfactory results.
- b) The fineness modulus is one of the methods used to determine the proportion of fine aggregate to coarse aggregate in concrete preparation. Aggregate having the following sieve analysis is to be used and 1 quintal of cement mix is to contain 0,46m<sup>3</sup> of combined aggregates of 40 mm mix size.

Table 1

Sieve Size µm	Fine Aggregate		Coarse Aggregate
	Mass retained on sieve (g)	% of total mass retained on sieve	% retained on sieves
4 750	0		0
2 360	52		5
1 180	256		175
600	109		195
300	153		150
150	65		150
Passing 150	31		-

Determine the fineness modulus of fine aggregate and that of coarse aggregate and then find the proportion of fine aggregates to coarse aggregates. Use table 2 for your calculations.

Table 2

Amount of total aggregates per quintal of cement (m <sup>3</sup> )	Fineness modulus of maximum aggregate size.	
	20 mm	40 mm
0,23	5,1	5,8
0,29	4,9	5,6
0,35	4,8	5,5
0,41	4,7	5,4
0,46	4,5	5,2

(c) Answer c (I) or c(ii)

- (i) Explain how compressive strength of concrete is measured.
- (ii) Given specific gravity of cement to be 3,15 ) that of sand 2,65 with unit weight of 16 kN/m<sup>3</sup> while that of coarse aggregate is 2,8 with unit weight 15 kN/m<sup>3</sup> water – cement ratio 0,60; unit weight of water 10kN/m<sup>3</sup>. Calculate the yield of concrete per 50 kg bag of cement which contains 0,035 m<sup>3</sup> of cement on mix of 1:3:6 by rule of thumb.

### **QUESTION 3**

a) Answer 3 a (I), (ii) or (iii)

Sand (fine aggregate) is one of the components of mortar. Briefly explain

- (i) Classification of sand  
(ii) Test for impurities in sand  
(iii) Bulking of sand and how it can affect the volumetric preparation of concrete.

b) Write brief notes on the test adhesiveness to building units of mortar. [9]

c) Answer c (I) or (ii)

Discuss (i) The quality of good building stones [5]

- (ii) Reasons why stones are gradually losing their popularity as building materials. [5]

d) I) Explain how efflorescence can be measured on bricks [8]

ii) Why is it necessary to wet bricks before mortar is applied. [2]