UNIVERSITY OF JOHANNESBURG

PROGRAMME	:	BTECH: ENGINEERING: CIVIL
SUBJECT	:	CONCRETE TECHNOLGY 4
CODE	:	TBJ421
DATE	:	SUMMER EXAMINATION 2016 19 NOVEMBER 2016
DURATION	:	(SESSION 2) 12:30 - 15:30
WEIGHT	:	40:60
TOTAL MARKS	:	100%

ASSESSOR	:	PROF SALIM RW
MODERATOR	:	DR WEKESA BW
NUMBER OF PAGES	:	7 PAGES

INSTRUCTIONS	:	ONLY ONE CALCULATOR PER CANDIDATE MAY BE USED.
REQUIREMENTS	:	NONE.

INSTRUCTIONS TO STUDENTS

1. PLEASE ANSWER ALL SIX QUESTIONS
2. TABLES 1 TO 5 AND FIGURE 1 MAY BE USED WHEN NEED ARISES. IF THE TABLE(S) AND THE FIGURE ARE USED THEN YOU MUST SUBMIT THEM TOGETHER WITH THE ANSWER SCRIPT(S)

NOTE: SYMBOLS HAVE THEIR USUAL MEANING

QUESTION ONE

[20 Marks]

You have been assigned to be a lead Technologist in a major infrastructure project for client ABC (Pty) Ltd. Your company CEO has requested that you write a brief to the client by defining sustainability and explaining the triple bottom line concept with respect to the client project. (The minimum number of words to be used is 800 words while the maximum should be 1000 words)

BACKGROUND INFORMATION FOR ANSWERING QUESTIONS TWO TO FIVE

The Gledhow Sugar Company (Pty) Ltd Mill and Refinery is located in Stanger situated in a sugarcane growing area in KwaZulu-Natal. During the recent The Gledhow Sugar Company (Pty) Ltd Exco meeting it was decided to expand structures housing the mills and the refinery. All the foundations and columns will be reinforced concrete. The company will pay for the construction of the expansions. Your consulting company are the lead consultants.

MATERIALS AVAILABE

- Characteristics of the fine and coarse aggregate to be used for production of the concrete:

□ Stone:	Size:	26.5mm
	Compacted Bulk Density (CBD):	1625kg/m^3
	Relative Density (RD):	2.69
	Loose Bulky Density (LBD):	1465kg/m^3
□ Sand:	Crusher Sand	
	Fine Modulus (FM):	2.875
	Relative Density (RD):	2.65
	Loose Bulky Density (LBD):	1789 kg/m^3
	Compacted Bulk Density (CBD):	1960kg/m^3
	Moisture Content:	2.25%

From the background information given and your knowledge of concrete technology answer questions two to five.

QUESTION TWO **[20 Marks]**

(a) Elaborate to the contractor of the extensions two critical factors that will influence the Specified characteristic cube strength of the concrete. Include figures in your elaboration. (5 Marks)

(b) Write short notes on the following:

i. Setting and hardening of cement paste (7 Marks)

ii. Difference between "false set" and "flash set" (5 Marks)

(c) The soil at the site where the expansion of the refinery is to be done is contaminated by sugar. Explain how this will affect the project implementation. (3 Marks)

QUESTION THREE **[20 Marks]**

The company has proposed that since the ready mix plant is too far the concrete will be batched at the site

(a) What will be the advantages and disadvantages of the decision of batching on site?

(4 Marks)

(b) Discuss **FOUR (4)** factors that need to be considered in arriving at the cost of the concrete. (4 Marks)

(c) Discuss the good and poor practices of receiving and storing of cement and aggregate on site for use during site batching. (8 Marks)

QUESTION FOUR **[20 Marks]**

On the basis of test results for course and fine aggregate given on page two above and also the following information that you had specified in the tender documents:

- Specified characteristic cube strength: 35 MPa
- Concrete will be moderately vibrated
- Stanger General Dealers will supply the cement (70% CEM I 42.5 and 30% Fly Ash) for the concrete works
- Minimum amount of cement to be used
- Water: Tap water

The contractor has proposed the content of the concrete mix design per m^3 to be as follows:

- CEM I 42.5: 254.4kgs
- Fly Ash: 63.6kgs
- Tap water: 210litres
- Stone: 1025kgs
- Sand: 799kgs

Is it correct to give the contractor site instruction to proceed and do site batching? Support your answer by providing objective reasons, motivation and necessary calculations. Use C&CI Method

QUESTION FIVE **[10 Marks]**

(a) Distinguish between Specified Characteristic Strength and Target Average Strength (3 Marks)

(b) Discuss the acceptance criteria for small number of concrete test results. (3 Marks)

(c) What are the acceptance criteria for large number of concrete test results? (4 Marks)

QUESTION SIX **[10 Marks]**

What is the difference between High Density Concrete and Low Density Concrete? Base your differentiation on definition, composition, manufacture, placing, curing and properties

Total Marks for the examination paper **[100 Marks]**

$$Stone\ content\left(kg/m^3\ of\ concrete\right) = CBD_{st}\ x\ (k - 0.1\ x\ FM)$$

$$Mass\ of\ sand\ (for\ 1\ m^3\ of\ concrete) = \left\{1000 - \left[\frac{Cement}{RD_c} + \frac{Stone}{RD_{st}} + Volum\ water\right]\right\} xRD_{sand}$$

DESIGN TABLES

TABLE 1: Water requirement of concrete mixes (19.0mm stone and 75mm slump)

Sand quality	Water content, ℓ/m^3	
	Natural	Crusher
Very poor	240	235
Poor	225	225
Average	210	215
Good	195	205
Excellent	180	195

TABLE 2: Adjustment to water content to compensate for stone sizes other than 19.0mm

Maximum size of stone, mm	9,5	13,2	19,0	26,5	37,5
Correction, ℓ/m^3	+20	+10	0	-10	-20

TABLE 3: Increase of stone when using Fly Ash

FA content as % by mass of total cementitious material	Percentage additional stone
15	3
25	4
30	5
40	6
50	7

TABLE 4: Values of *k* for determining of stone

Approximate slump range, mm	Placing requirement	K				
		Maximum size of stone, mm				
		9,5	13,2	19,0	26,5	37,5
75 - 150	Hand compaction	0,75	0,84	0,94	1,00	1,05
25 - 100	Moderate vibration	0,80	0,90	1,00	1,06	1,10
0 - 25	Heavy vibration	1,00	1,05	1,08	1,10	1,15
60 - 125	Pumped	-	0,83	0,86	0,87	-
25 - 50	Concrete roads*	-	-	-	-	1,2

* Calculated on CBD of 37,5-mm stone when using a blend of 37,5- and 19-mm stone

TABLE 5: Particle Relative Densities of cementitious materials

Material	Particle relative density
CEM I	3,14
GGBS	2,9
FA	2,3
CSF	2,1

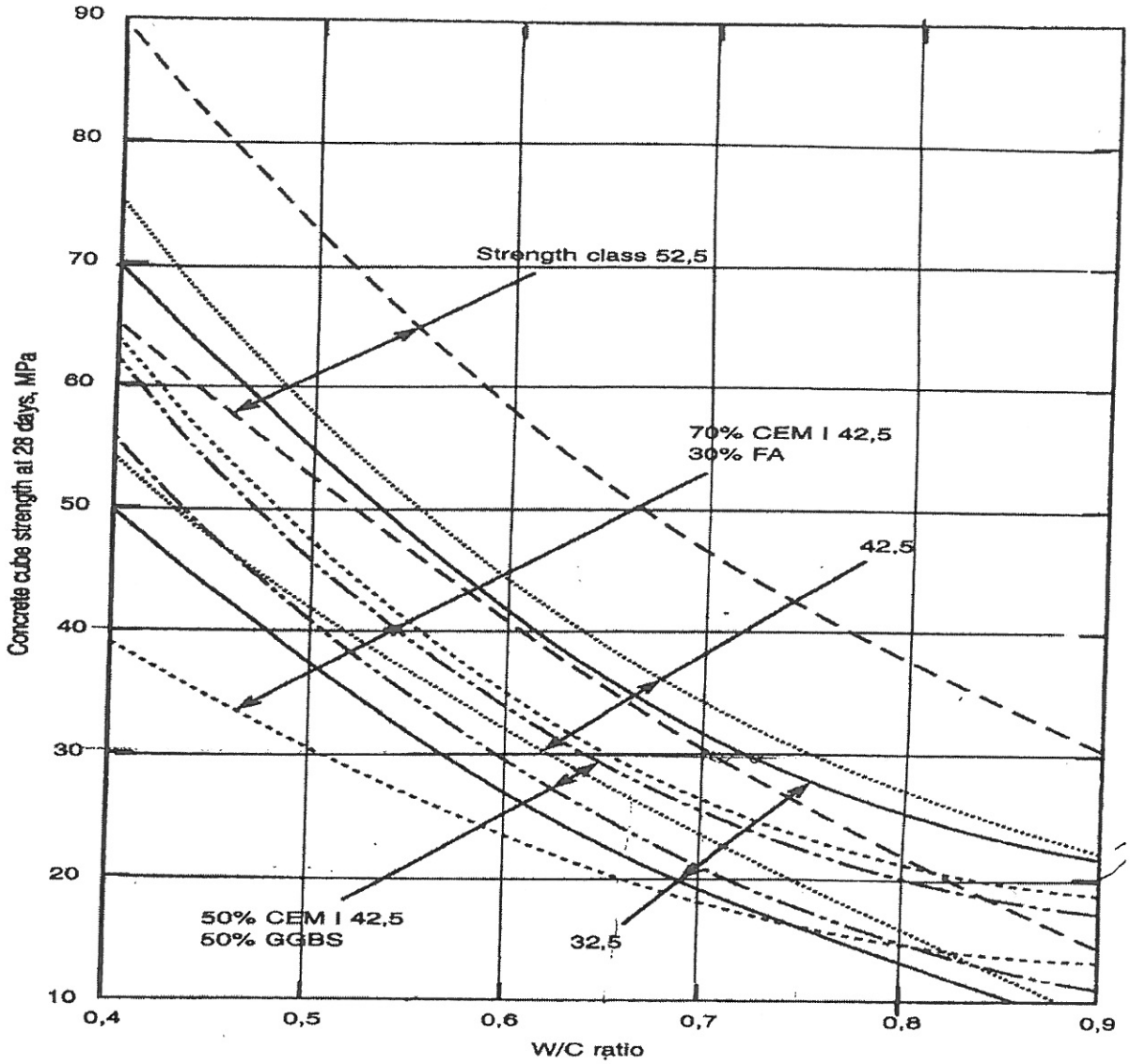

Figure 1: Ranges of compressive strength performance of South African cements used in concrete