



PROGRAM : BACCALAUREUS INGENERIAE
CIVIL ENGINEERING

SUBJECT : CONCRETE TECHNOLOGY 1B

CODE : BTK1B21 & BTKC1B1

DATE : SUMMER EXAMINATION
NOVEMBER 2019

DURATION : 3 HOURS

WEIGHT : 50 : 50

TOTAL MARKS : 100

ASSESSOR : MR J J BESTER

MODERATOR : MR D KRUGER Pr Eng (UJ)

NUMBER OF PAGES : 4 PAGES

INSTRUCTIONS : CALCULATORS MAY BE USED.
: SHOW **ALL** CALCULATIONS.
: STATE **ALL** ASSUMPTIONS.

REQUIREMENTS : QUESTION PAPERS MUST BE HANDED IN WITH THE
ANSWER SHEET.

INSTRUCTIONS TO STUDENTS

PLEASE ANSWER ALL QUESTIONS.

QUESTION 1 [19]

You are a concrete foreman working for JKL Consultants. Your company has been awarded a contract to construct a multi-storey office block. The materials that will be used in the construction were sent to an independent laboratory for determining the material properties. Given the following information, calculate the mix proportions for a concrete mix design for a floor slab. (11)

Stone RD = 2,90
Sand RD = 2,92
Cement RD = 3,14
Fineness modules = 3,12
CBD = 1 500 kg/m³
Initial water content = 200 liter
K-value = 1
w:c = 0,55

The sand properties is not sufficient for casting the slender columns which are required for the multi-storey structure. The sand supplier now needs to be changed as you are forced to use a different sand for these slender columns. The new values are indicated below, re-calculate the concrete mix proportions. (8)

Initial water content = 210 liter
Sand RD = 2,85
Fineness modules = 3,25
w:c = 0,50

QUESTION 2 [10]

- 2.1 Segregation in fresh concrete is not desirable, and is caused by a separation of the different materials that concrete is manufactured from. List three (3) additional factors that cause segregation in fresh concrete. (3)
- 2.2 During the properties of fresh concrete practical you performed, one of the mixes that were used had a reduction of sand and an increase in stone content. Discuss the effect of the increase in stone concrete on the fresh and hardened properties of concrete. (7)

QUESTION 3

[10]



Picture 1: Concrete cubes being cured on site

- 3.1 You are a professionally registered civil engineer, and work as a independent consultant. The consulting engineer supervising the construction of a multi-storey building is worried that the compressive strength test results obtained from cubes are not consistent. He has send you a photo (Picture 1), and has asked you to express your opinion on the site practice shown in the picture. Discuss the good, as well as the bad site practice evident in Picture 1. In addition, discuss the effects that the bad site practice will have. (9)
- 3.2 When the acceptance criteria is applied to the compressive strength results of the cubes in Picture 1, and the results fails to meet the acceptance criteria, what other options are available to the engineer to determine the compressive strength of the concrete? (1)

QUESTION 4

[14]

- 4.1 With the knowledge that you have gained in this course, comment on the correctness of the following test results: (5)
- Fineness modulus of stone: 12.75
 - Relative density of water: 2,40
 - Relative density of CEM I cement: 100 kg/m³
 - Compacted bulk density of stone: 1 350 kg/m³
 - Compressive strength of concrete: 30,0 MPa

- 4.2 Define the following terms: (9)
- i. Admixture
 - ii. Cold joint
 - iii. Formwork
 - iv. Green Concrete

QUESTION 5 [13]

- 5.1 Name two (2) main reasons why aggregates are used in concrete. (2)
- 5.2 Discuss the effects of deleterious substances in aggregates on the properties of fresh and hardened concrete. (8)
- 5.3 Name three (3) main types of geological rock that is used in the manufacturing of concrete. (3)

QUESTION 6 [18]

- 6.1 List six (6) advantages of buying cement in bulk. (6)
- 6.2 List six (6) advantages, and six (6) disadvantages of using slag in concrete. (12)

QUESTION 7 [16]

- 7.1 Sketch two scenarios of the deterioration and rehabilitation of a concrete structure. (7)
- 7.2 Discuss why concrete will be durable in one environment, but the very same concrete will not be durable in another environment. Give an example. (3)
- 7.3 Name four (4) transport properties of concrete that will influence the durability of the concrete. (4)
- 7.4 Define durability. (2)

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