

**Eastern Mediterranean University**  
**Department of Civil Engineering**  
**CIVL284 Materials of Construction**  
**Fall 2012/2013, Midterm Examination**

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Instructor: Prof. Dr. Özgür EREN

**TIME ALLOWED: 45 minutes (part A) + 45 minutes (part B)**

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Student name, surname: SOLUTIONS

Student i.d. number:

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Question No.	Mark
1	
2	
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7	
8	
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10	
11	
TOTAL	%

**IMPORTANT RULES (READ BEFORE YOU START):**

1. Calculators (not cell phones) can only be used for Part A.
2. Do not borrow any material from your friends.
3. Do not forget to write your name and number on your paper.
4. Do not ask any question to the invigilator.
5. Do not look around during the exam.
6. If you complete part A earlier than 45 minutes, you can start part B.
7. Put off your cell phone and kept in your pocket.

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**CIVL284 – MIDTERM EXAMINATION****PART A****DURATION: 45 MINUTES**

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1. Six 150x300 (DxL) mm sized cylindrical concrete specimens prepared from the same mix were crushed at 28 days under uniaxial compressive loads of 980 kN, 925 kN, 899 kN, 1000 kN, 869 kN and 909 kN. (12%)

- a. Calculate the standard deviation of these samples. HINT:  $s = \sqrt{\frac{\sum(x-m)^2}{n-1}}$

m (average) is calculated to be 930 kN.

n= 6

standard deviation can be calculated by hand or by a scientific calculator.

Therefore. s = 50.09 kN.

- b. What will be the minimum average tensile load (N) needed if the same cylindrical samples are tested for splitting tensile test. Assume that splitting

tension of concrete is 15% of compression. HINT:  $\sigma_{split} = \frac{2P}{\Pi DL}$

Since splitting tensile strength is equal to 15% of the compressive strength, compressive strength should be calculated first.

Compressive strength = (failure load)/cross-sectional area

Failure load: 930 kN. Cross-sectional area:  $3.14 \times (150)^2 / (4)$

Compressive strength = 52.65 MPa

Splitting tensile strength = 15% (52.65) = 7.89 MPa.

Using formula provided above, one can obtain minimum splitting load as 557 kN.

2. From the results of a sieve analysis of fine aggregates given below; Calculate the fineness modulus of this aggregate (12%).

Table 1. Sieve analysis results.

Sieve size (mm)	Amount Retained (gr)	% Retained	Cumulative % Retained	Cumulative % Passing
5.00	242	9	9	91
2.36	389	15	24	76
2.00	301	12	36	64
1.18	250	10	46	54
0.600	506	19	65	35
0.300	543	21	86	14
0.150	341	13	99	1
0.075	11	0	100	0
Pan	20	0	100	0

Total 2603 grams

FM=?  $(9+24+46+65+86+99)/100 = 3.29$

3. Use BRE method (tables and figures attached) to design below specified concrete mixture. Fill in Table 1 properly. Make a trial mix for **0.05 m<sup>3</sup>** of concrete (22%).

Specifications:

Characteristic Compressive Strength of concrete (150 mm cubic sample)= 20 MPa (28 days). Proportion Defective= 2.5% (k=1.96); Standard Deviation= 5 MPa (out of 30 results). Cement strength class= 52.5; Slump required= 30-60 mm.

Maximum aggregate size= 20 mm (use ratios of 1:2 for combination of 10:20 mm sizes); Coarse aggregate is uncrushed; Fine aggregate is crushed (80% passes 600 micron sieve); Minimum cement content allowed= 300 kg/m<sup>3</sup>; Maximum cement content allowed= 400 kg/m<sup>3</sup>; Maximum allowable free- w/c ratio= 0.50; Relative density of aggregates (SSD)= 2.65

See attached Tables/figures.

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**CIVL284 – MIDTERM EXAMINATION**  
**Fall 2012-2013, PART B**  
**DURATION: 45 MINUTES**

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4. Give one advantage & one disadvantages of gypsum for constructions? (6%)

**Advantage: very good heat resisting material.**

**Distadvantage: Disintegrates easily in moist places.**

5. What is the difference between hydraulic & nonhydraulic limes? (6%)

**Hydraulic limes can harden without air but non-hydraulic ones can not. They do not gain strength if there is no air in the medium.**

6. Suppose that you have “OPC, Sulfate Resisting PC, Rapid Hardening PC, High Alumina Cement, White PC, Portland Blast Furnace Slag Cement” in your hands. Which type(s) of these would you prefer to use for the conditions given below: (12%)

- a. Concreting near Golden Sand Beach, Karpaz: **SRPC or PBFSC**
- b. Reinforced-concrete column: **OPC**
- c. Concreting in Cyprus at an air temperature above 35°C: **PBFSC**
- d. Reinforced concrete water tank construction: **SRPC or PBFSC**

7. Discuss the effect of cement composition on setting times. (5%)

**Setting time shorten due to increased rate of reactions if cement composition increases.**

8. Why saturated & surface dry (SSD) condition of aggregates is important. (5%)

**Because aggregates are in SSD condition at the time of setting in concrete. Therefore, it is important to know these conditions in order to make a proper mix design calculation.**

9. Compare well graded aggregates and uniform size of aggregates in terms of below points considering them in concrete. (9%):

-Friction:

**Friction is more for well graded aggregates.**

- Interlocking:

**Interlocking is better for well graded aggregates.**

- Amount of voids:

**Amount of voids is more for uniform size of aggregates.**

10. What is the effect of water on the workability of fresh concrete? Explain (5%)

**As water content increases, the workability of fresh concrete increases up to a level. But above this level there is a risk of loss of cohesiveness and risk of segregation.**

11. What are the factors affecting autogenous shrinkage? Give two of them. (6%)

**Chemical composition of cement, initial water content, temperature & time.**