Eastern Mediterranean University
Department of Civil Engineering

CIVL284 Materials of Construction

Fall 2012-2013, Final Examination

Instructor: Dr. Özgür EREN

TIME ALLOWED: 90 minutes (Part A) + 90 minutes (Part B)=Total 180 minutes

Student Name-Surname:
Student i.d. number:

Question	Mark (%)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
TOTAL	

Plese read before you start:

1. **Calculators can only be used for Part A.**
2. **Do not borrow any material from your friends.**
3. **Do not ask any question to the invigilator and do not look around.**
4. **You can take and start Part B if you finish Part A earlier than specified period.**
5. **Write your answers neatly.**

PART A (49%)

DURATION: 90 MINUTES

1. Make a trial mix of 0.05 m^3 for specifications given below. Fill Table 1 for design. Use BRE method (tables and figures attached) (25%).

Class of concrete: C40/50 (use TSEN206-1 given below)
Proportion Defective: 10% (k=1.28); Standard Deviation: 8 MPa (out of 30 results)
Cement strength class: 42.5
Slump required: 65-80 mm
Maximum aggregate size: 40 mm (use ratios of 1:1,5:3 for combination of 10:20:40 mm sizes)
Coarse aggregate: crushed; Fine aggregate: crushed (80% passes 600 micron sieve)
Minimum cement content allowed: 300 kg/m^3; Maximum cement content allowed: 500 kg/m^3
Maximum allowable free- w/c ratio: 0.55
Relative density of aggregates (SSD): 2.70
Make the necessary moisture corrections for conditions given below:
Total Moisture content for Coarse Aggregate: 2.0%; Total Moisture content for Fine Aggregate: 2.5%
Absorption capacity for coarse aggregate: 1.5%; Absorption capacity for fine aggregate: 2.0%

TSEN 206-1 standard for concrete classes.

28 Days-Compressive Strength (MPa)						
Cylinder (150 mm dia, 300 mm height)				**Cube** 150 mm		
Concrete Class (cyl/cube)	Minimum Characteristic Compressive Strength (Fck)	Average Compressive Strength (Fcm)	Any Single Minimum Compressive strength Test Result (Fci)	Minimum Characteristic Compressive Strength (Fck)	Average Compressive Strength (Fcm)	Any Single Minimum Compressive strength Test Result (Fci)
C8/10	8	12	4	10	14	6
C12/15	12	16	8	15	19	11
C16/20	16	20	12	20	24	16
C20/25	20	24	16	25	29	21
C25/30	25	29	21	30	34	26
C30/37	30	34	26	37	41	33
C35/45	35	39	31	45	49	41
C40/50	40	44	36	**50**	54	46

Table 1 will be filled before moisture correction.
Table 2 below will be filled after moisture corrections.

Table 2. Amounts (**considering site conditions** of aggregates).

Material (site condition)	**Amount per m^3**	**Amount per $0.05m^3$**
Cement		
Free-Water		
Coarse aggregate (crushed)		
Fine aggregate (crushed)		

2. From the sieve analysis given below (12%);

a. Draw the grading curve of this aggregate.
b. Calculate fineness modulus: FM=?
   Answer:

c. Check if this aggregate satisfies ASTM C33 limits. Give your answer as “YES” or “NO”.

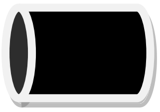
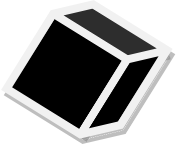
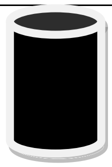
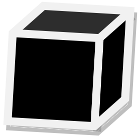
Sieve size (mm)	**Amount Retained (gr)**	**Retained %**	**Cumulative % Retained**	**Cumulative % Passing**
5.00	5			
2.00	200			
2.36	236			
1.18	118			
0.600	600			
0.425	425			
0.300	300			
0.150	150			
0.075	75			

Note: Limit your calculations up to 1 decimal digit.

ASTM C33/C 33M Grading Requirements for Fine Aggregates

Sieve size	**Percent passing**
9.5 mm	100
5.0 mm	95-100
2.36 mm	80-100
1.18 mm	50-85
600 µm	25-60
300 µm	5-30
150 µm	0-10

3. The following concrete samples were tested for splitting tension and compression. Failure loads are as shown in table below. Calculate the splitting tensile strength and compressive strength in MPa for each sample. Related formulas are given below (12%).

Sample	**Size (mm)**	**Test Type**	**Failure load (kN)**	**Loading direction**	**Calculation**	**Result (N/mm^2)**
	150x300 (dxl)	Splitting	465	Normal		
	200	Splitting	887	Diagonal		
	150x300 (dxl)	Compression	1200	Axial		
	150	Compression	1200	Axial		

$f_t = \frac{2P}{\pi l d}$ *cylinder* (splitting tensile strength of cylinder)

$f_t = 0.642\, P/s^2$ Cube (normal direction-splitting tensile strength)
$f_t = 0.519\, P/s^2$ Cube (diagonal direction-splitting tensile strength)

P: Failure load**; l:** length of cylinder**; d:** diameter of cylinder**; s:** one side of cube**.**

CIVL284 – FINAL EXAMINATION, Fall 2012-2013
PART B- (51%)
DURATION: 90 MINUTES

Student Name Surname: Student i.d. number:

4. What are the most important stages of cement production in BEM Cement Factory we visited some weeks ago. (10%)

5. What is the meaning of “uniformly graded aggregates”? Do you suggest a concrete technologist to use this aggregate in structural concrete? (5%)

6. What are two reasons of using clay as a raw material to make “clay bricks”? (6%)

7. What are the two most important engineering properties that should be asked for when selecting a natural stone? (6%)

8. Why copper is of interest to engineers? Give two of them. (4%)

9. Give two methods to protect metals against corrosion. (4%)

10. From which trees can you produce hardwood lumber? Give 4 of them. (4%)

11. Explain production of plywood in four steps. (8%)

12. What are the two advantages of using lightweight aggregates in plasters? (4%)