B. Sc. Engg. (CEE)/ 4th Sem. 11 March, 2024.

(Monday, Afternoon : 2:30 PM – 4:00 PM)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION
COURSE NO. : CEE 4411
COURSE TITLE: Engineering Materials and Concrete Technology

SUMMER SEMESTER: 2022-2023
TIME : 1.5 Hours
FULL MARKS: 100

There are 4 (Four) questions. Answer ALL questions. Programmable calculators are not allowed. Do not write on this question paper. CO-PO mapping and marks are shown accordingly. The Symbols have their usual meaning.

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1. The sieve analysis data of a sand sample and a stone aggregate sample for a bridge construction project are summarized below: CO2-PO2 (36)

ASTM Sieve	Sand Sample Material Retained (g)	Stone Aggregate Material Retained (g)
3 inch	0	0
1.5 inch	0	0
¾ inch	0	100
½ inch	0	1000
3/8 inch	0	1600
#4	0	1800
#8	90	0
#12	92	0
#16	2	0
#30	2	0
#40	44	0
#50	45	0
#100	65	0
#200	50	400
Pan	100	100

(i) Calculate the FM of the sand and stone aggregate samples, (18)
(ii) Draw the grading curves of the samples (in one graph), (6)
(iii) Make a brief discussion on the FM, sieve analysis data, and grading curves, (3)
(iv) What measures are necessary to improve the grading of the samples? (3)
(v) If the required FM of the sand is 2.65, in what ratio the sand sample is to be mixed with another sand sample of FM = 3.0 to maintain the required FM. (3)
(vi) For a sand sample, all materials are passed through the #12 sieve and retained on #16 sieve; calculate FM of the sand sample? (3)

2. Mixture proportion of mortar is to be designed for the plaster work of a brick wall of 40 ft long and 10 ft height based on the following data: CO3-PO3 (32)

Sand to cement ratio (weight ratio) = 3; W/C=0.45; Specific gravity of cement = 3.1; Specific gravity of sand = 2.65; Air content = 1%; Mortar thickness = 1 inch.

(i) Design a mixture proportion for mortar (the unit contents of sand, cement, and water), (15)
(ii) Calculate the cost of materials for 1 cubic meter of mortar (assume cost for 1 cft of sand = 40 TK, cost for 1 bag of cement = 500 TK, cost for 100 liter of water = 20 TK), (3)
(iii) Calculate the unit weight of mortar, (2)
(iv) Estimate the amount of each ingredients of mortar necessary for the plaster work of the both surfaces of the wall. Assume 15% extra volume of material is necessary due to the loss of mortar during application on the wall, (3)
(v) If there is 3% (by weight) surplus amount of water (in addition to SSD) in sand, how will it be adjusted with the mixing water of mortar? (3)
(vi) Calculate the volumetric ratio of cement to sand. Assume unit weight of cement = 1400 kg/m^3 and unit weight of sand = 1450 kg/m^3. (2)
(vii) "Map cracks are commonly observed on the plaster surface" – Explain the reasons with remedial actions to avoid such cracks. (2)
(viii) Explain the influence of sand to cement ratio on the compressive strength of mortar. (2)

3. **(a)** List some properties of good quality bricks. CO1-PO1 (4)

(b) "We need to look for the alternative construction materials to brick" – Why? CO1-PO1 (4)

(c) Explain the methods that can be used to determine the yield strength of steel from stress-strain curve. CO1-PO1 (4)

4. **(a)** "Civil Engineers need to focus on Sustainability of Construction Materials"- Justify. CO1-PO1 (5)

(b) List the mineral admixtures that are specified in BDS EN 197-1-2010. Explain the method of storing cement at a project site. CO1-PO1 (4+3)

(c) Explain hydration of cement with reactions. CO1-PO1 (8)

Traditional American and British Sieve Sizes

Aperture mm or μm	Approximate Imperial equivalent in.	Previous designation of nearest size	
		BS	ASTM
125 mm	5	—	5 in.
106 mm	4.24	4 in.	4.24 in.
90 mm	3.5	$3\frac{1}{2}$ in.	$3\frac{1}{2}$ in.
75 mm	3	3 in.	3 in.
63 mm	2.5	$2\frac{1}{2}$ in.	$2\frac{1}{2}$ in.
53 mm	2.12	2 in.	2.12
45 mm	1.75	$1\frac{3}{4}$ in.	$1\frac{3}{4}$ in.
37.5 mm	1.50	$1\frac{1}{2}$ in.	$1\frac{1}{2}$ in.
31.5 mm	1.25	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.
26.5 mm	1.06	1 in.	1.06
22.4 mm	0.875	$\frac{7}{8}$ in.	$\frac{7}{8}$ in.
19.0 mm	0.750	$\frac{3}{4}$ in.	$\frac{3}{4}$ in.
16.0 mm	0.625	$\frac{5}{8}$ in.	$\frac{5}{8}$ in.
13.2 mm	0.530	$\frac{1}{2}$ in.	0.530 in.
11.2 mm	0.438	—	$\frac{7}{16}$ in.
9.5 mm	0.375	$\frac{3}{8}$ in.	$\frac{3}{8}$ in.
8.0 mm	0.312	$\frac{5}{16}$ in.	$\frac{5}{16}$ in.
6.7 mm	0.265	$\frac{1}{4}$ in.	0.265 in.
5.6 mm	0.223	—	No. $3\frac{1}{2}$
4.75 mm	0.187	$\frac{3}{16}$ in.	No. 4
4.00 mm	0.157	—	No. 5
3.35 mm	0.132	No. 5	No. 6
2.80 mm	0.111	No. 6	No. 7
2.36 mm	0.0937	No. 7	No. 8
2.00 mm	0.0787	No. 8	No. 10
1.70 mm	0.0661	No. 10	No. 12
1.40 mm	0.0555	No. 12	No. 14
1.18 mm	0.0469	No. 14	No. 16
1.00 mm	0.0394	No. 16	No. 18
850 μm	0.0331	No. 18	No. 20
710 μm	0.0278	No. 22	No. 25
600 μm	0.0234	No. 25	No. 30
500 μm	0.0197	No. 30	No. 35
425 μm	0.0165	No. 36	No. 40
355 μm	0.0139	No. 44	No. 45
300 μm	0.0117	No. 52	No. 50
250 μm	0.0098	No. 60	No. 60
212 μm	0.0083	No. 72	No. 70
180 μm	0.0070	No. 85	No. 80
150 μm	0.0059	No. 100	No. 100
125 μm	0.0049	No. 120	No. 120
106 μm	0.0041	No. 150	No. 140
90 μm	0.0035	No. 170	No. 170
75 μm	0.0029	No. 200	No. 200
63 μm	0.0025	No. 240	No. 230
53 μm	0.0021	No. 300	No. 270
45 μm	0.0017	No. 350	No. 325
38 μm	0.0015	—	No. 400
32 μm	0.0012	—	No. 450