আন্তর্জাতিক ইসলামী বিশ্ববিদ্যালয় চট্টগ্রাম
International Islamic University Chittagong
Faculty of Science and Engineering (FSE)
Department of Civil Engineering (CE)

END-OF-SEMESTER EXAMINATION
SEMESTER AUTUMN, 2022 SESSION

Programme	**: Bachelor of Science in Civil Engineering**	**Level of Study**	**: UG 1**
Time	**: 1.30 pm**	**Date**	**: December 10, 2022 Saturday**
Duration	**: 2 hour 30 minutes**		
Course Code	**: CE-1205**	**Section(s)**	**: 2AM**
Course Title	**: Engineering Materials**		

This Question Paper Consists of **Six (06)** Printed Pages (Including Cover Page and Appendix) with **Five (05)** Questions.

Course Learning Outcome(CLO)	
CLO-1	Understanding of concepts, theories and computational methodologies.
CLO-2	Describe Imperfections in Solids: What are the solidification of mechanisms? What types of defects arise in solids? How do defects affect material properties?
CLO-3	Derive and describe, formulate, and solve diffusion problems: How does diffusion occur? How does diffusion depend on structure and temperature?
CLO-4	Describe the mechanical properties of materials: What and why Stress-strain are used instead of load and deformation? Elastic and Plastic behaviour of materials. Materials are most resistant to permanent deformation, toughness and ductility.

Bloom's Levels of the Questions						
Letter Symbol	**R**	**U**	**A**	**ANA**	**E**	**C**
	Remember (10)	**Understand (10)**	**Apply (10)**	**Analysis (30)**	**Evaluation (30)**	**Create (10)**

INSTRUCTION(S) TO CANDIDATES

DO NOT OPEN UNTIL YOU ARE ASKED TO DO SO

- This is a Closed Book, Closed Notes Examination.
- Do not open until You Are Asked to Do So.
- Total mark of this examination is 100 for two sections A &B and is worth 50% of the total course.
- Attempt All Questions.
- Mobile Phones and Other Electronic Devices are Prohibited in the Exam Hall.
- **Workout Can Be Done Using Pencil Or Pen.**

Note: Any form of cheating or attempt to cheat is a serious offence, which may lead to dismissal

PART –A

(There are THREE questions, answer all THREE Questions)

			CO	BL
QUESTION 1 (20 marks)_				
a)	What is the difference between destructive and non-destructive tests on hardened concrete?	(5 marks)	4	AN
b)	Write the standard test performed on fresh concrete.	(5 marks)	1	R
c)	Describe any two important standard tests that you will perform at construction/project site to ascertain the consistency of concrete to be used for structural purpose.	(10 marks)	3	A
QUESTION 2 (20 marks)_				
a)	List the different types of special concrete and Differentiate between the special concrete and ordinary concrete.	(5 marks)	1	AN
b)	Design a concrete mix Using ACI method for a multi-Storied building for the following data: A mix with a mean 28-day compressive strength of 35 MPa with a 2.5% defective rate (k=1.96) and a slump of 75 mm is required, using OPC. The maximum size of well-shaped, angular aggregate is 20mm, its bulk density is 1600 kg/m3 and its specific gravity is 2.64. The available fine aggregate has a fineness modulus of 2.60 and a specific gravity of 2.58. No air-entrainment is required. CA absorbed 3% moisture and sand contains 2% free surface moisture. Standard deviation from past records = 4 MPa. Assume any other essential data.	(15 marks)	3	E
QUESTION 3 (20 marks)_				
a)	What are the various popular methods of proportioning a good concrete mix? State the quality of water for mixing of concrete.	(5 marks)	1	R
b)	Explain the properties and specific uses of Ferro-cement.	(5 marks)	4	AN
c)	State types of chemical attack affecting the durability of concrete.	(5 marks)		E
d)	To get a durable concrete, what measures you will take?	(5 marks)	1	E

PART –B

(There are TWO questions, answer all TWO Questions)

QUESTION 4 (20 marks)_				
a)	What are the important reasons for seasoning timber?	(5 marks)	1	R
b)	What are the factors you will consider to select any preservative for timber preservation?	(5 marks)	1	A
c)	What do you understand by artificial wood? Mention the advantages of plywood and its uses.	(5 marks)	1	U
d)	What are the different types of additives used in paint production?	(5 marks)	2	R
QUESTION 5 (20 marks)_				
a)	Distinguish between water based and oil based paint.	(5 marks)	1	U
b)	What are the purposes in using paint? Write a short note on efflorescence.	(5 marks)	1	C
c)	What is the major difference between thermoplastic and thermo-setting plastics?	(5 marks)	2	U
d)	Define plastics. Write down the uses of plastics in building construction.	(5 marks)	1	U

Appendix

Table 11.5. Relation between water/cement ratio and average compressive strength of concrete, according to ACI 211.1-91

Average compressive strength at 28 days	Effective water/cement ratio (by mass)	
MPa	Non-air entrained concrete	Air-entrained concrete
45	0.38	-
40	0.43	-
35	0.48	0.40
30	0.55	0.46
25	0.62	0.53
20	0.70	0.61
15	0.80	0.71

Note: Measured on standard cylinders. The values given are for a maximum size of aggregate of 20 to 25 mm and for ordinary portland cement and for recommended percent of air entrainment shown in Table 11.8

Table 11.6. Requirements of ACI 318-89 for W/C ratio and Strength for Special Exposure Conditions

Exposure Condition	Maximum W/C ratio, normal density aggregate concrete	Minimum design strength low density aggregate concrete MPa
i. Concrete intended to be Watertight		
(a) Exposed to fresh water	0.5	25
(b) exposed to brackish or sea water	0.45	30
ii Concrete exposed to freezing and thawing in a moist condition		
(a) Jetties, gutters, guard rails or thin sections	0.45	30
(b) other elements	0.50	25
(c) in presence of de-icing chemicals	0.45	30
iii For corrosion protection of reinforced concrete exposed to de-icing salts, brackish water, sea water or spray from these sources	0.40	33

. First estimate of density (unit weight) of fresh concrete as given by ACI 211.1-91

Maximum size of	First estimate of density (unit weight) of fresh concrete	
aggregate mm	Non-air-entrained kg/m³	Air-entrained kg/m³
10	2285	2190
12.5	2315	2235
20	2355	2280
25	2375	2315
40	2420	2355
50	2445	2375
70	2465	2400
150	2505	2435

Table 11.4. Dry Bulk Volume of Coarse Aggregate per Unit Volume of Concrete as given by ACI 211.1—91

Maximum Size of Aggregate	Bulk volume of dry rodded coarse aggregate per unit volume of concrete for fineness modulus of sand of			
F.M	2.40	2.60	2.80	3.00
10	0.50	0.48	0.46	0.44
12.5	0.59	0.57	0.55	0.53
20	0.66	0.64	0.62	0.60
25	0.71	0.69	0.67	0.65
40	0.75	0.73	0.71	0.69
50	0.78	0.76	0.74	0.72
70	0.82	0.80	0.78	0.76
150	0.87	0.85	0.83	0.81

Note: The values given will produce a mix that is suitable for reinforced concrete construction. For less workable concrete the values may be increased by about 10 percent. For more workable concrete such as pumpable concrete the values may be reduced by up to 10 per cent

Table 11.8. Approximate requirements for mixing water and air content for different workabilities and nominal maximum size of Aggregates according to ACI 211.1-91

Workability or Air content	Water Content, kg/m³ of concrete for indicated maximum aggregate size							
	10 mm	12.5 mm	20mm	25 mm	40 mm	50 mm	70 mm	150 mm
	Non-air-entrained concrete							
Slump								
30-50 mm	205	200	185	180	160	155	145	125
80-100 mm	225	215	200	195	175	170	160	140
150-180 mm	240	230	210	205	185	180	170	
Approximate entrapped air content per cent	3	2.5	2	1.5	1	0.5	0.3	0.2
	Air-entrained Concrete							
Slump								
30-50 mm	180	175	165	160	145	140	135	120
80-100 mm	200	190	180	175	160	155	150	135
150-180 mm	215	205	190	185	170	165	160	
Recommended average total air content percent								
Mild exposure	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0
Moderate exposure	6.0	5.5	5.0	4.5	4.5	4.0	3.5	3.0
Extreme exposure'	7.5	7.0	6.0	6.0	5.5	5.0	4.5	4.0

End of Questions Paper