

**Daffodil International University**

B. Sc. in Civil Engineering

Final Examination, Spring - 2025

Course Code: CE 201

Course Title: Engineering Materials

Section: BN1 & BN2

Level-Term: 2-1

Teacher's Initial: AU

Full Marks: 40

Date: May 22, 2025

Time: 2.0 Hours

*Note: There are eight questions in total. Answer all of them. Right hand margin indicates full marks.*

1. The combined fineness modulus of fine aggregate (FA) and coarse aggregate (CA), [05]  
having values of 2.85 and 6.77 respectively, was found to be 5.30. If 8.49 cubic feet of  
well-packed combined aggregate is required, Calculate the initial volumes of FA and  
CA to be mixed. Assume a shrinkage factor of 0.75. [CO2, C3]
2. Design a concrete mix for column located above ground where moderate freezing and [10]  
thawing may occur. The required average strength will be 4500psi. The coarse aggregate  
has a nominal maximum size of 25 mm and a dry-rodded mass of 100 lb/ft<sup>3</sup>. The other  
properties of the ingredients are as follows:
  - Cement: Type I with a specific gravity of 3.15.
  - Coarse aggregate: bulk specific gravity = 2.70, absorption = 1.2% and surface  
moisture = 1.5 %.
  - Fine aggregate: bulk specific gravity = 2.60, absorption = 1%, fineness modulus  
= 2.7, and surface moisture = 2 %. [CO3, C5]
3. Briefly demonstrate the causes and control measures of segregation in concrete. [CO2, [04]  
C3]
4. Illustrate the stress-strain curve of mild steel. [CO1, C2] [03]
5. Write short note on the following: [CO1, C1] [08]
  - ① Light weight concrete
  - ② Ingredients of paints
  - ③ FRP
  - IV. Uses of Ferrocement
6. Briefly describe the main objectives of timber seasoning. [CO1, C1] [03]
7. Briefly describe the factors affecting the strength of concrete. [CO1, C2] [04]
8. Briefly describe, with a neat sketch, the relationship between the water-to-cement ratio [03]  
and the compressive strength of concrete. [CO1, C2]

**Table 6.3.1 – Recommended slumps for various types of construction\***

Types of construction	Slump, in.		Temperature, °F	Density, lb./ft. <sup>3</sup>
	Maximum+	Minimum		
Reinforced foundation walls and footings	3	1	60	62.368
Plain footings, caissons, and substructure walls	3	1	65	62.337
Beams and reinforced walls	4	1	70	62.302
Building columns	4	1	75	62.261
Pavements and slabs	3	1	80	62.216
Mass concrete	2	1	85	62.166

**Table 6.3.4(a) – Relationship between water-cement or water-cementitious materials ratio and compressive strength of concrete**

Compressive strength at 28 days, psi*	Water-cement ratio, by weight	
	Non-air-entrained concrete	Air-entrained concrete
6000	0.41	—
5000	0.48	0.40
4000	0.57	0.48
3000	0.68	0.59
2000	0.82	0.74

**Table 6.3.6 – Volume of coarse aggregate per unit of volume of concrete**

Nominal maximum size of aggregate, in.	Volume of oven-dry-rodded coarse aggregate* per unit volume of concrete for different fineness moduli of fine aggregate†			
	2.40	2.60	2.80	3.00
3/8	0.50	0.48	0.46	0.44
1/2	0.59	0.57	0.55	0.53
3/4	0.66	0.64	0.62	0.60
1	0.71	0.69	0.67	0.65
1 1/2	0.75	0.73	0.71	0.69
2	0.78	0.76	0.74	0.72
3	0.82	0.80	0.78	0.76
6	0.87	0.85	0.83	0.81

**Table 6.3.3 – Approximate mixing water and air content requirements for different slumps and nominal maximum sizes of aggregates**

Water, lb/yd <sup>3</sup> of concrete for indicated nominal maximum sizes of aggregate								
Slump, in.	3/8 in.*	1/2 in.*	3/4 in.*	1 in.*	1-1/2 in.*	2 in.*†	3 in.*‡	6 in.*§
<b>Non-air-entrained concrete</b>								
1 to 2	350	335	315	300	275	260	220	190
3 to 4	385	365	340	325	300	285	245	210
6 to 7	410	385	360	340	315	300	270	—
More than 7*	—	—	—	—	—	—	—	—
Approximate amount of entrapped air in non-air-entrained concrete, percent	3	2.5	2	1.5	1	0.5	0.3	0.2
<b>Air-entrained concrete</b>								
1 to 2	305	295	280	270	250	240	205	180
3 to 4	340	325	305	295	275	265	225	200
6 to 7	365	345	325	310	290	280	260	—
More than 7*	—	—	—	—	—	—	—	—
Recommended averages† total air content, percent for level of exposure:								
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***
Severe exposure††	7.5	7.0	6.0	6.0	5.5	5.0	4.5***	4.0***