

KATHMANDU UNIVERSITY

End Semester Examination

July/August 2024

15 JUL 2024

Level : B.E.

Year : II

Time : 2 hrs. 30mins.

Course : CIEG 201

Semester : I

F. M. : 40

SECTION "B"

[ 40 marks]

Attempt *ALL* Questions. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. The mix design table will be provided along with this question paper.

1. Explain the importance of studying the physical and mechanical properties of construction materials in the construction of civil engineering structures. Describe the stress-strain relationship in mild steel, highlighting the differences between the true stress-strain curve and the engineering stress-strain curve. [2+3=5]
2. Write the key differences between cast iron, wrought iron, mild steel, and hard steel. For each material, explain the applications where its properties are most beneficial. Describe the different forms of bitumen and asphalt, and explain how each type is used in construction projects. [2+3=5]
3. What is the purpose of seasoning timber? Describe the various methods used for seasoning. From the standpoint of concrete strength, which of the two options is undesirable, and why? (a) Concrete cast at 5°C and cured at 21°C. (b) Concrete cast at 21°C and cured at 5°C. [3+2 = 5]
4. In brick production, what impurities can negatively impact the quality and performance of the bricks? Explain these detrimental effects in detail. Describe the brick manufacturing process of brick with a clear illustration. [2+3=5]
5. What is the objective of performing a soundness test on cement, and explain the experimental procedures involved? Discuss the significance of the C-S-H interlayer space with respect to properties of the hydrated cement paste [2+3=5]
6. During the mixing, transporting, and placing of concrete, air can become entrapped within it. Describe the various methods to increase the density and strength of concrete to minimize this issue. How do factors such as water content, mix proportion, and the size and shape of aggregates influence the workability and strength of concrete? Explain in detail. [2+3=5]
7. How does the zone where the aggregate meets the cement paste (ITZ) influence the overall strength of concrete. In what ways do the amount of moisture present, the characteristics of the aggregate particles, the properties of the cement paste itself, and the transition zone influence the modulus of elasticity of concrete? [2+3 = 5]

P.T.O.

8. Concrete is required for a bridge column that will be exposed to sea water. The cross section of the column is 500 mm X 500 mm. The smallest spacing between reinforcing steel is 25 mm. Concrete will be casted with a slump of 100 mm and the properties of materials are as follows: [5]
- a. Cement used is 43 grade of Portland cement with a specific gravity of 3.15.
  - b. The available coarse aggregate has a maximum size of 20 mm, a dry-rodded unit weight of  $1600 \text{ kg/m}^3$ , a bulk specific gravity (SSD) of 2.68, absorption capacity of 0.5%, and moisture content of 0.25%.
  - c. The fine aggregate has a bulk specific gravity (SSD) of 2.65, absorption capacity of 1.3%, a moisture content (SSD) of 3%, and a fineness modulus of 2.60. The aggregates conform to the IS requirements for grading. Use chemical admixture with specific gravity of 1.145.

With the given information, recommend the grade of concrete and carried out the mix design in detail, using the sequence of steps outlined.

W4-15-2024  
23 AUG 2024

**MIX DESIGN TABLE (CIEG 201)**

Table 1 Value of X (Clause 4.2)			Table 2 Assumed Standard Deviation (Clause 4.2.1.3)		
SI No.	Grade of Concrete	Value of X	SI No.	Grade of Concrete	Assumed Standard Deviation N/mm <sup>2</sup>
(1)	(2)	(3)	(1)	(2)	(3)
i)	M10	5.0	i)	M10	3.5
	M15			M15	
ii)	M20	5.5	ii)	M20	4.0
	M25			M25	
iii)	M30	6.5	iii)	M30	5.0
	M35			M35	
	M40			M40	
	M45			M45	
	M50			M50	
	M55			M55	
	M60			M60	
iv)	M65 and above	8.0	iv)	M65	6.0
				M70	
				M75	
				M80	

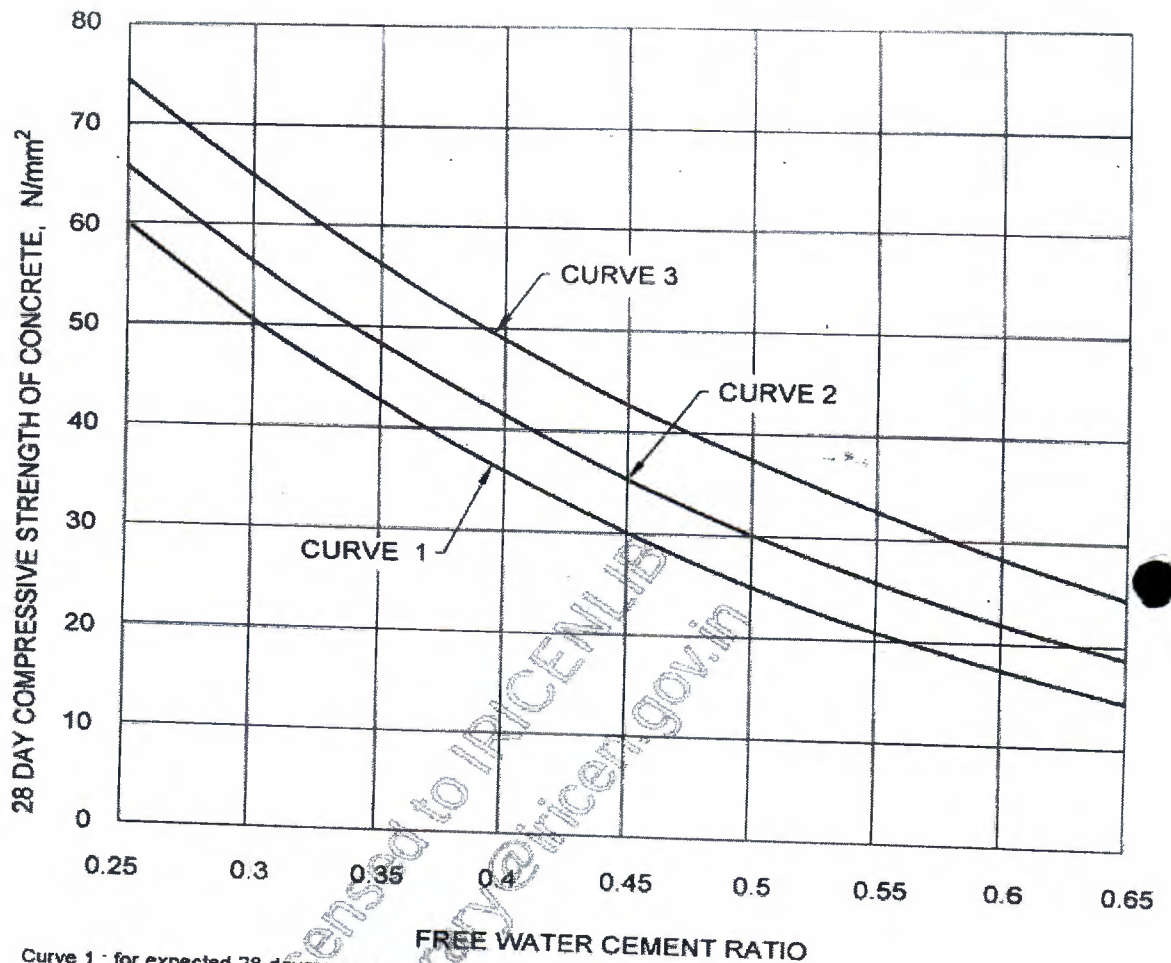
  

Table 3 Approximate Air Content (Clause 5.2)			Table 4 Water Content per Cubic Metre of Concrete For Nominal Maximum Size of Aggregate (Clause 5.3)		
SI No.	Nominal Maximum Size of Aggregate mm	Entrapped Air, as Percentage of Volume of Concrete	SI No.	Nominal Maximum Size of Aggregate mm	Water Content <sup>1)</sup> kg
(1)	(2)	(3)	(1)	(2)	(3)
i)	10	1.5	i)	10	208
ii)	20	1.0	ii)	20	186
iii)	40	0.8	iii)	40	165

<sup>1)</sup>Water content corresponding to saturated surface dry aggregate.

**Table 5 Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate for Water-Cement/Water-Cementitious Materials Ratio of 0.50  
(Clause 5.5)**

SI No.	Nominal Maximum Size of Aggregate mm	Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
		Zone IV	Zone III	Zone II	Zone I
(1)	(2)	(3)	(4)	(5)	(6)
i)	10	0.54	0.52	0.50	0.48
ii)	20	0.66	0.64	0.62	0.60
iii)	40	0.73	0.72	0.71	0.69



Curve 1 : for expected 28 days compressive strength of 33 and < 43 N/mm<sup>2</sup>.  
 Curve 2 : for expected 28 days compressive strength of 43 and < 53 N/mm<sup>2</sup>.  
 Curve 3 : for expected 28 days compressive strength of 53 N/mm<sup>2</sup> and above.

**Table 5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum Size**

(Clauses 6.1.2, 8.2.4.1 and 9.1.2)

Sl No.	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content kg/m <sup>3</sup>	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content kg/m <sup>3</sup>	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mild	220	0.60	-	300	0.55	M 20
iii)	Moderate	240	0.60	M 15	300	0.50	M 25
iii)	Severe	250	0.50	M 20	320	0.45	M 30
iv)	Very severe	260	0.45	M 20	340	0.45	M 35
v)	Extreme	280	0.40	M 25	360	0.40	M 40

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Marks Scored:

Level : B.E.

Year : II

Exam Roll No. :

Time: 30 mins.

Course : CIEG 201

Semester : I

F. M. : 10

Registration No.:

Date **15 JUL 2024**

SECTION "A"

[20Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option from each set of choices.

1. Arrange different structure of trees from center portion of tree to the outer bark moving from center.
  - i. Cambium layer
  - ii. Heart wood
  - iii. Pith
  - iv. Sap wood
  - v. Inner bark

A. i, ii, iii, iv and v  
B. ii, iii, iv, v and i  
C. iii, ii, iv, v and i  
D. iii, ii, iv, i and v
2. The basic purpose of a retarder in concrete is
  - A. To increase the initial setting time of cement paste in concrete
  - B. To decrease the initial setting time of cement paste in concrete
  - C. To render the concrete more water tight
  - D. To improve the workability of concrete mix
3. The stretcher bond in brick masonry can be used only when the thickness of wall is
  - A. 230 mm
  - B. 115 mm
  - C. 190 mm
  - D. 57 mm
4. Which of the following pairs gives a correct combination of the useful and harmful constituents respectively of a good brick earth?
  - A. Lime stone and alumina
  - B. Alumina and iron
  - C. Silica and alkalies
  - D. Alkalies and magnesium
5. If 20 kg of coarse aggregate is sieved through 80 mm, 40 mm, 20 mm, 10 mm, 4.75 mm, 2.36 mm, 1.18 mm, 600 micron, 300 micron, and 150 micron standard sieves and the weights retained are 0 kg, 2 kg, 8 kg, 6 kg, 4 kg respectively, the fineness modulus of the aggregate lies in the range of
  - A. 6.85 - 7.10
  - B. 7.85 - 7.95
  - C. 7.20 - 7.45
  - D. 7.50 - 7.75

6. Pick up the correct statement from the following:
- A. The distinct plane of division along which a stone can easily be split, is called natural bed of stone
  - B. The natural bed of sedimentary rocks is along the planes of stratification
  - C. The natural bed of igneous rocks is defined
  - D. Both A and B are correct
7. Pick up the constituent of good brick earth whose excess causes the raw bricks shrink and warp during drying and burning, from the following:
- A. Alumina
  - B. Lime
  - C. Iron-oxide
  - D. Magnesia
8. Cast iron contains carbon approximately
- A. 1.5% to 5.5%
  - B. 0.05% to 1.75%
  - C. 0.250 %
  - D. None to these
9. A queen closer is a
- A. Brick laid with its length parallel to the face or direction of wall
  - B. Brick laid with its breadth parallel to the face or direction of wall
  - C. Brick having the same length and depth as the other bricks but half the breadth
  - D. Brick with half the width at one end and full width at the other
10. Index number expressing the relative sizes of both coarse and fine aggregates, is called
- A. Proportioning of aggregates
  - B. Fineness modulus
  - C. Grading of aggregates
  - D. None of these
11. Rapid hardening cement attains early strength due to
- A. Larger proportion of lime grounded finer than normal cement
  - B. Lesser proportion of lime grounded coarser than normal cement
  - C. Lesser proportion of lime grounded finer than normal cement
  - D. Excess percentage of gypsum
12. Compared to mild steel, cast iron has
- (i) High compressive strength
  - (ii) High tensile strength
  - (iii) Low compressive strength
  - (iv) Low tensile strength
- The correct answer is
- A. (i) and (ii)
  - B. (ii) and (iii)
  - C. (iii) and (iv)
  - D. (i) and (iv)
13. For the manufacture of Portland cement, the proportions of raw materials used, are
- A. Lime 63% ; silica 22% ; other ingredients 15%
  - B. Lime 22% ; silica 63% ; other ingredients 15%
  - C. Silica 40% ; lime 40% ; other ingredients 20%
  - D. Silica 70% ; lime 20% ; other ingredients 10%

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14. Proper amount of entrained air in concrete results in  
(i) Better workability  
(ii) Better resistance to freezing and thawing  
(iii) Lesser workability  
(iv) Less resistance to freezing and thawing  
The correct answer is  
A. (i) and (ii)      B. (i) and (iv)      C. (ii) and (iii)      D. (iii) and (iv)
15. Which of the following statements is true regarding the gel/space ratio in concrete?  
A. A higher gel/space ratio indicates a higher porosity in concrete.  
B. A lower gel/space ratio results in a stronger and more durable concrete.  
C. The gel/space ratio is unaffected by the water-cement ratio.  
D. An increase in the gel/space ratio generally improves the strength and durability of concrete.
16. In the maturity method, what does the term  $T_o$  (datum temperature) represent?  
A. The temperature above which the concrete gains strength  
B. The temperature below which no strength gain occurs  
C. The average temperature during the curing period  
D. The initial temperature of the concrete mix
17. Sieve analysis is used to determine the particle size distribution of aggregates. What do the symbols  $D_{10}$ ,  $D_{30}$  and  $D_{60}$  represent?  
A. Diameter at 10%, 30%, and 60% passing, respectively  
B. Diameter at 10%, 30%, and 60% retained, respectively  
C. Diameter at which 10%, 30%, and 60% of the total sample weight is retained, respectively  
D. Diameter at which 10%, 30%, and 60% of the total sample weight passes, respectively
18. Pick up the incorrect statement from the following.  
A. The degree of grinding of cement, is called fineness  
B. The phenomenon by virtue of which cement does not allow transmission of sound, is known as soundness of cement  
C. The process of changing cement paste into hard mass, is known as setting of cement  
D. The heat generated during chemical reaction of cement with water is known as heat of hydration
19. Pick up the incorrect statement from the following.  
A. The strength of concrete decreases as the water cement ratio increases  
B. If the water cement ratio is less than 0.45, the concrete is not workable and causes honey-combed structure  
C. A rich mix of concrete possesses higher strength than that a lean mix of desired workability with excessive quantity of water  
D. Good compaction by mechanical vibrations, increases the strength of concrete

20. The approximate value of maturity of identical concrete at 28 days when cured at an average temperature during day time at 23 °C and night time at 13°C.
- A. 16700  $\approx$  16702 °C.hrs.
  - B. 16703  $\approx$  16705 °C.hrs.
  - C. 16706  $\approx$  16708 °C.hrs.
  - D. 16709  $\approx$  16711 °C.hrs.