UPES, Dehradun

End Semester Examination, December 2023

Programme Name: B Tech Civil Engineering
Semester   : **III**
Course Name   : **Concrete Technology**   **Time**   : 3 hrs
Course Code   : **CIVL 2011**   **Max. Marks: 100**
Nos. of page(s)   : **4**

Instructions: Any missing data may be suitable assumed.

SECTION A			
S. No.		**Marks**	**CO**
Q 1	What are the major compounds present in the Ordinary Portland Cement (OPC)? Write their relative amount.	2+2	CO1
Q 2	What do you mean by hydration of cement? What are the major cement hydration products?	2+2	CO2
Q 3	What do you mean by gradation of aggregates? Briefly discuss how to perform gradation test on coarse aggregates.	2+2	CO2
Q 4	What is the workability of concrete? Discuss the different types of slumps typically observed.	2+2	CO1
Q 5	From a given concrete mix, three 150 mm concrete cubes were tested for compressive strength at 28 days. The failure loads of the cubes are 780 kN, 800 kN and 820 kN. Find the compressive strength of the concrete mix.	4	CO1
SECTION B			
Q 6	Discuss different types of moduli of elasticity of concrete with the help of neat and clean diagram.	10	CO1
Q 7	What is fibre reinforced concrete and why is it used? What are the common types of steel fibres used in steel fibre reinforced concrete? What are the factors that affect the properties of steel-fibre reinforced concrete?	3+3+4	CO4

Q 8	(i) What are the sources of sulfates? (ii) What do you mean by sulfate attack on concrete structures? (iii) Outline the factors influencing sulfate attack. (iv) How the sulfate attack on concrete can be prevented? OR What is alkali-aggregate reaction? What are the factors influencing alkali-aggregate reaction? How can you control the alkali-aggregate reaction?	2+2+3 +3 **OR** 2+4+4	CO2
Q 9	Discuss the rebound hammer test on concrete structures.	**10**	CO5

<div align="center">**SECTION-C**</div>

Q 10	Carry out mix proportioning for a M30 grade of concrete for the information given below. The value of the factor 'X' and assumed standard deviation are 6.5 and 5 respectively; Types of cement: OPC43; Maximum size of coarse aggregate: 20 mm; Exposure condition: Severe (Reinforced concrete); Workability: 100 mm (slump); Specific gravity of cement: 3.15; Specific gravity of fine and coarse aggregate are 2.67 and 2.70 respectively; Water absorption of coarse ad fine aggregates are 0.7 and 1.0 percent respectively; Fine aggregates conform to Zone III as per IS 383: 1970; Specific gravity of superplasticizer: 1.1. The figures and tables given below may be used for carrying out the mix proportion.	**20**	CO3

Table 3 Approximate Air Content
(*Clause* 5.2)

SI No. (1)	Nominal Maximum Size of Aggregate mm (2)	Entrapped Air, as Percentage of Volume of Concrete (3)
i)	10	1.5
ii)	20	1.0
iii)	40	0.8

Table 4 Water Content per Cubic Metre of Concrete For Nominal Maximum Size of Aggregate

(Clause 5.3)

Sl No.	Nominal Maximum Size of Aggregate mm	Water Content[1] kg
(1)	(2)	(3)
i)	10	208
ii)	20	186
iii)	40	165

[1]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)

Sl 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
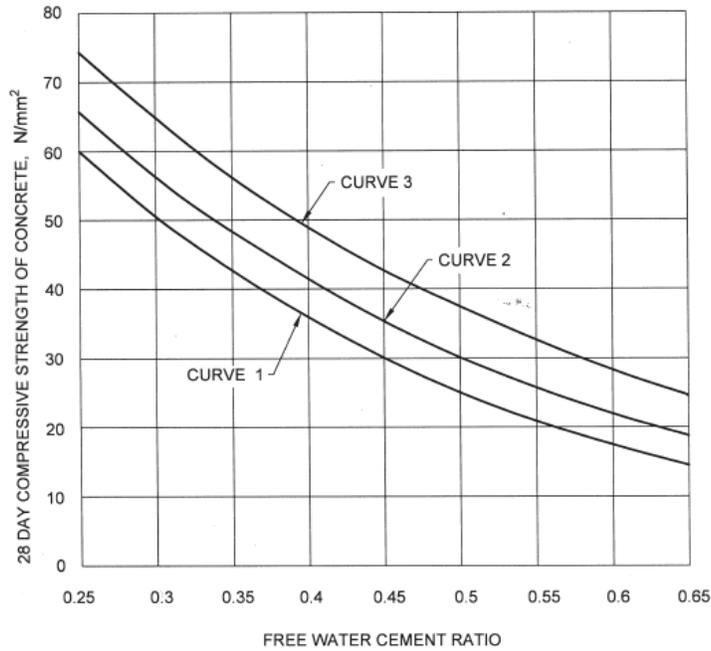
Curve 1 : for expected 28 days compressive strength of 33 and < 43 N/mm².
Curve 2 : for expected 28 days compressive strength of 43 and < 53 N/mm².
Curve 3 : for expected 28 days compressive strength of 53 N/mm² and above.

NOTES

1 In the absence of data on actual 28 days compressive strength of cement, the curves 1, 2 and 3 may be used for OPC 33, OPC 43 and OPC 53, respectively.

2 While using PPC/PSC, the appropriate curve as per the actual strength may be utilized. In the absence of the actual 28 days compressive strength data, curve 2 may be utilized.
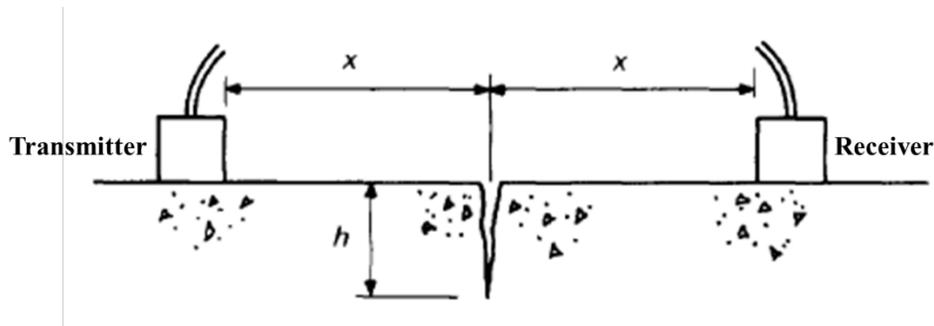
Q 11	(a)What do you mean by non-destructive test methods of concrete structure?		
	(b) List the various non-destructive and partially destructive test methods to assess the quality of concrete in a structure.		
	(c) Discuss the Ultrasonic Pulse Velocity (UPV) technique.	3+5+7 +5	
	(d) For the figure given below, find out the depth of the crack (h) for the following given information. Velocity of pulse, $V = 4500$ m/s, surface travel time of pulse without crack = 10 microsecond and travel time of pulse around the crack = 20 microsecond.		
			CO5
	OR	OR	
	(a) Discuss compressive and tensile strength of hardened concrete.	5+15	
	(b) Discuss self-compacting concrete, light-weight concrete and high-strength concrete.		