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(AY:2024-25) May 2025 (ENDSEM) EXAM

TY (SEMESTER - II)

COURSE NAME: **Advanced Concrete Technology** **Branch: CIVIL** **COURSE CODE:** **CVUA32204B**

(T.Y PATTERN 2020R1)

Time: [1Hr 30 Min] **[Max. Marks: 40]**

(*) Instructions to candidates:

1) **Figures to the right indicate full marks. Use of scientific calculator is allowed**
2) **Use suitable data wherever required**
3) **All questions are compulsory. Solve any two sub question each from Questions 1 , 2 ,3 and 4**

Q. No.	Question Description	Max. Marks	CO mapped	BT Level
Q.1	a) Describe the difference between hydraulic and pozzolanic Supplementary Cementitious Materials.	[5]	1	Understand
	b) Explain how XRD helps in identifying hydration products in cement paste.	[5]	1	Understand
	c) Describe how the ITZ influences the mechanical properties of concrete.	[5]	1	Understand
Q2	a) Explain how high-performance concrete differs from conventional concrete	[5]	2	Understand
	b) Explain the behaviour of self-healing concrete under cracked conditions.	[5]	2	Understand
	c) Explain the different workability test for self compacting Concrete in detail with sketch.	[5]	2	Understand
Q3	a) Analyze the effect of increasing water content on concrete workability and strength.	[5]	3	Understand
	b) Using the following data, design a trial SCC mix for M40 grade: • Water-cement ratio: 0.40 • Target slump flow: 650 mm • Cement: 400 kg/m³ • Fly ash (30% replacement of cement) • Coarse aggregate: 760 kg/m³ • Fine aggregate: Balance to make 1 m³ • Superplasticizer: 1% by weight of binder • Assume specific gravity: Cement = 3.15, Fly Ash = 2.2,	[5]	3	Apply

	Fine Agg. = 2.65, Coarse Agg. = 2.7 *Find the quantity of each material in 1 m³ of SCC mix.* Assume suitable data c) Explain all mix design steps with suitable application also explain one case study, Mix Design for Mass Concrete – M20 Grade , As per IS 10262:2019 and IS 456:2000	[5]	3	Understand
Q4	a) Explain the principle of Ultrasonic Pulse Velocity (UPV) testing and its significance in assessing concrete quality. b) Describe how the chloride ion penetration test helps assess the durability of concrete. c) Describe how waterproofing can help maintain the durability of concrete exposed to harsh environmental conditions.	[5] [5] [5]	4 4 4	Understand Understand Understand

Graphs and Tables for SCC

IS Sieve Sizes mm	*Analysis of Coarse Aggregate Fraction*		*Percentage of Different Fractions*			*Remarks*
	I (20-10 mm)	II (10 - 4.75 mm)	I 50 percent	II 50 percent	100 percent	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
20	100	100	50	50	100	Conforming of Table 7 of IS 383
10	2.8	78.3	1.4	39.15	40.55	
4.75	Nil	8.70	Nil	4.35	4.35	

2) Fine aggregate : Conforming to grading Zone II of Table 9 of IS 383

Table 5 : IS 456: 2000

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/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete
i)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
iii)	Mild	220	0.60	–	300	0.55	M 20
iii)	Moderate	240	0.60	M 15	300	0.50	M 25
iv)	Severe	250	0.50	M 20	320	0.45	M 30
v)	Very severe	260	0.45	M 20	340	0.45	M 35
	Extreme	280	0.40	M 25	360	0.40	M 40

NOTES

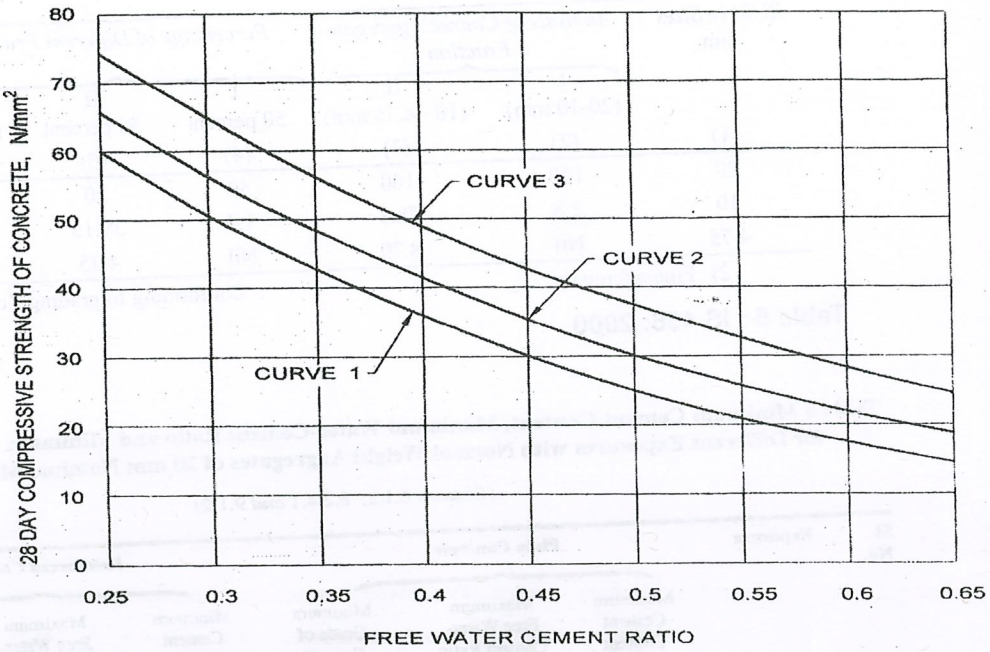
1 Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2. The additions such as fly ash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water-cement ratio if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part 1) and IS 455 respectively.

2 Minimum grade for plain concrete under mild exposure condition is not specified.

Table 3 Approximate Air Content

(*Clause* 5.2)

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



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.

FIG 1. RELATIONSHIP BETWEEN FREE WATER CEMENT RATIO AND 28 DAYS COMPRESSIVE STRENGTHS OF CONCRETE FOR CEMENTS OF VARIOUS EXPECTED 28 DAYS COMPRESSIVE STRENGTHS

Table 1 Value of X
(*Clause* 4.2)

Sl No.	Grade of Concrete	Value of X
(1)	(2)	(3)
i)	*M*10, *M*15	5.0
ii)	*M*20, *M*25	5.5
iii)	*M*30, *M*35, *M*40, *M*45, *M*50, *M*55, *M*60	6.5
iv)	M65 and above	8.0

Table 2 Assumed Standard Deviation
(*Clause* 4.2.1.3)

Sl No.	Grade of Concrete	Assumed Standard Deviation N/mm²
(1)	(2)	(3)
i)	*M*10, *M*15	3.5
ii)	*M*20, *M*25	4.0
iii)	M30, M35, M40, M45, M50, M55, M60	5.0
iv)	*M*65, *M*70, *M*75, *M*80	6.0