

**BACHELOR OF ENGINEERING (CIVIL ENGINEERING) FOURTH YEAR SECOND SEMESTER EXAM
2025**

**CONCRETE TECHNOLOGY
PART-I**

Time: Three Hours

Full Marks 100
(50 marks for 1st part)

Use a separate Answer-Script for each part

[No code or handbook is allowed, assume any suitable data]

No. of questions		Marks (50)
1.	Design a mix proportion of following concrete (15) a) Grade designation- M35 b) Type of cement -OPC c) Type of mineral admixture -Fly ash conforming to IS 3812 (Part I) d) Maximum nominal size of aggregate -20mm e) Minimum cement content -320 kg/m³ f) Maximum water-cement ratio -0.45 g) Workability-75 mm (slump) h) Exposure condition -mild (for reinforced concrete) j) Method of concrete placing- Pumping k) Degree of supervision -Good m) Type of aggregate -Crushed angular aggregate n) Maximum cement (OPC) content-450 kg/m³ p) Chemical admixture type- Superplasticizer TEST DATA FOR MATERIALS a) Cement used- OPC 43 grade conforming to IS 8112 b) Specific gravity of cement- 3.15 c) Fly ash Conforming to- IS 3812 (Part I) d) Specific gravity of fly ash - 2.2 e) Chemical admixture- Superplasticizer conforming to IS 9103 f) Specific gravity of: 1) Coarse aggregate-2.74 2) Fine aggregate-2.74 g) Water absorption: 1) Coarse aggregate-0.5% 2) Fine aggregate-1% h) Free (surface) moisture: 1) Coarse aggregate-Nil 2) Fine aggregate- Nil	15

[Turn over

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g) Sieve analysis:

1) Coarse aggregate

IS Sieve Sizes mm	Analysis of Coarse Aggregate Fraction		Percentage of Different Fractions			Remarks
	I	II	I	II	Combined	
			60	40	100	
			percent	percent	percent	
20	100	100	60	40	100	Conforming to Table 2 of IS 383
10	0	71.20	0	28.5	28.5	
4.75		9.40		3.7	3.7	
2.36		0				

2) Fine aggregate

Conforming to grading Zone I of Table 4 of IS 383

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

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.

Free Water Cement Ratio	Curve 1 (N/mm²)	Curve 2 (N/mm²)	Curve 3 (N/mm²)
0.25	75	65	55
0.30	65	55	45
0.35	55	45	35
0.40	45	35	25
0.45	35	25	15
0.50	25	15	10
0.55	15	10	5
0.60	10	5	0
0.65	5	0	0
0.70	0	0	0

Table 1 Value of X (Clause 4.2)

Sl No.	Grade of Concrete	Value of X
(1)	(2)	(3)
i)	M10 M15	5.0
ii)	M20 M25	5.5
iii)	M30 M35 M40 M45 M50 M55 M60	6.5
iv)	M65 and above	8.0

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	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) <table><tr><th rowspan="2">Sl No.</th><th rowspan="2">Nominal Maximum Size of Aggregate mm</th><th colspan="4">Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate</th></tr><tr><th>Zone IV</th><th>Zone III</th><th>Zone II</th><th>Zone I</th></tr><tr><th>(1)</th><th>(2)</th><th>(3)</th><th>(4)</th><th>(5)</th><th>(6)</th></tr><tr><td>i)</td><td>10</td><td>0.54</td><td>0.52</td><td>0.50</td><td>0.48</td></tr><tr><td>ii)</td><td>20</td><td>0.66</td><td>0.64</td><td>0.62</td><td>0.60</td></tr><tr><td>iii)</td><td>40</td><td>0.73</td><td>0.72</td><td>0.71</td><td>0.69</td></tr></table> NOTES 1 Volumes are based on aggregates in saturated surface dry condition. 2 These volumes are for crushed (angular) aggregate and suitable adjustments may be made for other shape of aggregate. 3 Suitable adjustments may also be made for fine aggregate from other than natural sources, normally, crushed sand or mixed sand may need lesser fine aggregate content. In that case, the coarse aggregate volume shall be suitably increased. 4 It is recommended that fine aggregate conforming to Grading Zone IV, as per IS 383 shall not be used in reinforced concrete unless tests have been made to ascertain the suitability of proposed mix proportions.	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	
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2)	The oxide composition of OPC is as follows: CaO (60%), SiO₂ (15%), Al₂O₃ (5%), Fe₂O₃ (2%), SO₃ (1%) Find the percentage of C₃S, C₂S, C₃A and C₄AF. What is lime saturation factor of this cement? On the basis of the result comment on this cement.	10																																		
3)	What is the basic difference between PPC cement and PSC cement?	5																																		
a)																																				
b)	Write a short note on the chemical process when water is added to cement	5																																		
4)	Answer any three of the followings a) Fiber reinforced concrete b) What is the basic difference between plasticizer and super plasticiser c) Write advantage and disadvantages of Fiber reinforced concrete d) Write a short note on retarder.	5X3 = 15																																		

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Use a separate Answer-Script for each part
 Necessary different tables and graphs are allowed in the Exam. Hall

No. of questions	(Answer all questions)	Marks (10x2+15X2=50)
1.	What do you mean by flexural strength of concrete? Describe the procedure of measuring the flexural strength of concrete in the laboratory.	2+8=10
2.	What do you mean by workability of concrete? Describe the factors affecting the workability of concrete.	2+8=10
3.	a. What do you mean by self-compacting concrete and What are the properties of self-compacting concrete? b. Describe J-Ring test for measuring the workability of self-compacting concrete.	5+10=15
4.	Write Short note a. Chloride attack on concrete b. Shrinkage and creep of concrete c. Sulphate attack on concrete	5 x 3 =15