

PARUL UNIVERSITY  
FACULTY OF ENGINEERING & TECHNOLOGY  
B.TECH MID SEM EXAMINATION WINTER 2022-23

SUBJECT NAME (CODE): Advanced Concrete Technology (203104349)      BRANCH: Civil Engg.  
DATE: 03-08-2022      TIME: 10:30 am to 12:00 pm      TOTAL MARKS: 40

Sr. No.		Marks
Q.1	(A) Compulsory Question (5 MCQ)	05
	i) Lightweight concrete cannot be made by using	
	a. Foam      b. Lightweight aggregate	
	c. Lightweight cement      d. No fine aggregate	
	ii) Vacuum concrete helps us to decrease	
	a. Water-cement ratio      b. Workability	
	c. Coarse aggregate      d. Fine aggregate	
	iii) Maximum water content required for complete hydration of cement is	
	a.30%      b.40%	
	c.34%      d.38%	
	iv) The main ingredient of photo-catalytic self-cleaning concrete is	
	a. tungsten-oxide      b. titanium-oxide	
	c. nitrogen-oxide      d. carbon-di-oxide	
	v) The IS code for concrete mix design is	
	a. IS 875      b. IS 456	
	c. IS 1893      d. IS 10262 .	
	(B) Compulsory Question (5 Fill in the Blanks)	05
	i) Shale is a      aggregate.	
	ii) Vacuum concrete helps us increase the      of the concrete.	
	iii) The workability of self-compacting concrete will be      than that of conventional concrete.	
	iv) Self-healing concrete uses      .	
	v) The maximum amount of cement content for making 1 m <sup>3</sup> of concrete as specified in IS 456 is _____	
Q.2	Attempt any four (Short Questions)	12
	(1) Write the advantages of lightweight concrete.	
	(2) Write the advantages of self-compacting concrete.	
	(3) Write the advantages of rapid-hardening concrete.	
	(4) Enlist the data required for concrete mix design.	
	(5) What are the advantages of ready-mixed concrete?	
Q.3	Attempt any two	08
	(1) Explain the process of vacuum concreting with suitable schematic diagram.	
	(2) Write the dis-advantages of rapid hardening concrete.	
	(3) Enlist and explain the different types of fiber reinforced concrete.	
QA	(A) Design the concrete mix of M50 grade with zone II sand.	05

Given Data:

Type of cement: OPC 43 grade

Max. nom. size of aggregate: 20mm

Exposure condition: Severe

Workability: 50mm slump

Type of chemical admixture: Super-plasticizer (1% of cementitious material)

Sp. gr. of cement: 2.88

Sp. gr. of CA: 2.74 (SSD)

Sp. gr. of FA: 2.65 (SSD)

Sp. gr. of chem. admx.: 1.145

Required graphs and tables are given in Annexure

(B) What are the advantages of gap-graded concrete? 05

OR

(B) Write the codal provisions for designing high-performance concrete. 05

Annexure:



CUNe- 1  
CUNe-2  
Curve 3

NOTES

1 In the absence of data on the compressive strength of concrete, the curves 1, 2 and 3 may be used for OPC 43 grade cement concrete.

2 While determining the compressive strength of concrete, the test specimens should be cured in water for 28 days.

FIG. 1. RELATIONSHIP BETWEEN SLUMP AND 28 DAY COMPRESSIVE STRENGTH OF CONCRETE

Table 1 Value of X  
(Clause 4.2)

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

Table 2 Assumed Standard Deviation  
(Clause 4.2.1.3)

SI No.	Grade of Concrete	Standard Deviation
(1)	(2)	(3)
i)	M10 M15	6.0
ii)	M20 M25	
iii)	M30 M35 M40 M45 M50 M55 M60	
iv)		

Table 3 Appropriate Air Content  
(Clause 5.2)

SI 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)

SI No.	Nominal Maximum Size of Aggregate mm
(1)	(2)
i)	10
ii)	20
iii)	40

**Table 5 Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate for Water-Cement/Wilfer-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

**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.

**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 Or. Id. 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	M20
ii)	Moderate	240	0.60	M 15	300	0.50	M25
iii)	Severe	250	0.50	M20	320	0.45	M30
iv)	Very severe	260	0.45	M20	340	0.45	M35
v)	Extreme	280	0.40	M25	360	0.40	M40

**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.