

CONCRETE TECHNOLOGY
(CIV2204)

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) What happens when the water-cement ratio is too high?
 - (a) Increased strength
 - (b) Increased segregation and bleeding
 - (c) Decreased workability
 - (d) Faster hydration
- (ii) What is the typical size range of fine aggregates?
 - (a) 10 mm to 20 mm
 - (b) 4.75 mm to 10 mm
 - (c) ≤4.75 mm
 - (d) ≥20 mm
- (iii) Which of the following methods is not a curing method?
 - (a) Steam curing
 - (b) Membrane curing
 - (c) Air curing
 - (d) Vibration curing
- (iv) Which hydration product contributes the most to the strength of concrete?
 - (a) Calcium Hydroxide
 - (b) Calcium Silicate Hydrate (C-S-H)
 - (c) Ettringite
 - (d) Gypsum
- (v) The characteristic strength of concrete is
 - (a) Higher than average cube strength
 - (b) Lower than average cube strength
 - (c) Same as average cube strength
 - (d) Higher than 90% of average cube strength
- (vi) The proper size of mould for testing compressive strength of cement is
 - (a) 7.05 cm cube
 - (b) 15 cm cube
 - (c) 10.05 cm cube
 - (d) 12.05 cm cube
- (vii) What is the primary purpose of a superplasticizer in concrete?
 - (a) To increase workability without increasing water content
 - (b) To accelerate setting time
 - (c) To improve air entrainment
 - (d) To reduce concrete shrinkage

- (viii) What is the target strength formula as per I.S. 10262 (2009)?
 (a) $f_{ck}' = f_{ck} + 1.65 \times \sigma$ (b) $f_{ck}' = f_{ck} - 1.65 \times \sigma$
 (c) $f_{ck}' = f_{ck} \times 1.75 \times \sigma$ (d) $f_{ck}' = f_{ck} + 2.5 \times \sigma$
- (ix) Workability of self compacting concrete is measured using the
 (a) Vicat's apparatus (b) Slump flow test
 (c) Slump test (d) Standard Consistency Test
- (x) Air entraining agents are mainly used to improve:
 (a) Strength (b) Workability and freeze-thaw resistance
 (c) Density (d) Shrinkage

Fill in the blanks with the correct word

- (xi) The _____ test is performed to assess the flow ability of concrete.
- (xii) The chemical reaction between cement and water is called _____.
- (xiii) The admixture that delays the setting time of concrete is called a _____.
- (xiv) Super plasticizers increase the workability of concrete without increasing the _____.
- (xv) The maximum size of aggregates allowed for reinforced concrete typically ranges from _____ to _____ mm.

Group - B

2. Describe the hydration process of cement and explain its impact on the heat of hydration and strength development in concrete.

[[CO3](Understand/LOCQ)]

(6 + 6) = 12

3. (a) A sample of coarse aggregate weighing 1000 g was subjected to sieve analysis. The following data were obtained: Determine: 1. Percentage retained on each sieve. 2. Cumulative percentage retained. 3. Percentage passing each sieve. 4. Draw the grading table and determine the Fineness Modulus (FM) of the aggregate.

Sieve Size (mm)	Weight Retained (g)
40	0
20	80
10	300
4.75	420
2.36	150
Pan	50

[[CO2](Evaluate/HOCQ)]

- (b) Write short note on aggregate impact value test.

[[CO2](Understand/LOCQ)]

8 + 4 = 12

Group - C

4. (a) Compare the development of strength in concrete over time.

[[CO4](Analyse/IOCQ)]

- (b) List the methods for improving the strength of concrete. [[C04](Remember/LOCQ)]
6 + 6 = 12
5. (a) State the principle behind the rebound hammer test and ultra sonic pulse velocity test. [[C04](Remember/LOCQ)]
 (b) Mention few limitations of rebound hammer and ultra sonic pulse velocity test. [[C04](Remember/LOCQ)]
6 + 6 = 12

Group - D

6. Define super plasticizers. How do they differ from regular plasticizers, and what are their effects on the workability and strength of concrete? [[C05](Understand/LOCQ)]
(2 + 10) = 12
7. Design a concrete mix of grade M45 grade pumpable concrete mix having a slump of the order of 75 mm using Grade – 43 OPC conforming to IS:8112 for a reinforced concrete high rise building subjected to severe exposure conditions during its service life with the following data as per IS:10262-2009: Fine aggregate is natural river and conforming to grading zone-I (fineness modulus of 2.4), specific gravity of 2.74, moisture content of 2.0%, absorption of 1.0%, coarse aggregate crushed (angular) stone chips of 20 mm maximum nominal size conforming to IS 383 code requirements with specific gravity of 2.74 , moisture content of 1.0% and absorption of 0.5%, specific gravity of cement is 3.15. Degree of quality control at site is good and Super-plasticizer conforming to IS: 9103 may be used. Assume also the following values of other data as may be required for the design. Standard deviation = 5.0 MPa, Air content = 2.0%, Maximum allowable w/c =0.4, Minimum and maximum cement content = 320 kg/m³ and 450kg/m³ respectively. Apply any mix design methodology. [[C05](Evaluate/HOCQ)]
12

Group - E

8. (a) What is the effect of fiber content on the properties of fiber-reinforced concrete? [[C06](Understand/LOCQ)]
 (b) What are the challenges associated with using waste materials in concrete? [[C06](Understand/LOCQ)]
6 + 6 = 12
9. (a) What is the method of crack injection in concrete repair? [[C06](Remember/LOCQ)]
 (b) What is the difference between repair and strengthening of concrete? [[C06](Understand/LOCQ)]
6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	73	6	21

