

**AN INTRODUCTION TO CONCRETE TECHNOLOGY
(CIVL 4126)**

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) Workability of concrete can be increased by
(a) Increase in maximum size of aggregate
(b) Decrease in temperature
(c) Use of round aggregate which has smooth surface texture
(d) All of the above
- (ii) Strength of concrete increases with
(a) Increases with water-cement ratio (b) Increases in fineness of cement
(c) Reducing the curing time (d) Decrease in size of aggregate
- (iii) The pH value of water for concrete construction is
(a) 3-4 (b) 5-6
(c) 8-9 (d) 6-8.
- (iv) The approximate ratio between the strengths of cement concrete at 7 days and 28 days is
(a) $\frac{3}{4}$ (b) $\frac{2}{3}$ (c) $\frac{1}{2}$ (d) $\frac{1}{3}$.
- (v) A concrete cylinder of size 150 mm diameter and 300 mm long is tested for split tensile strength test. It failed at a load of 100 kN. The split tensile strength in N/mm² is
(a) 0.35 (b) 0.71 (c) 1.42 (d) 2.83.
- (vi) To determine the modulus of rupture, the size of test specimen used is
(a) 150 mm x 150 mm x 150 mm
(b) 100 mm diameter and 200 mm length
(c) 150 mm diameter and 300 mm length
(d) 100 mm x 100 mm x 100 mm
- (vii) Σ (curing period x temperature) is known as
(a) Curing (b) Shrinkage
(c) Maturity (d) None of the above.

- (viii) Lightweight concrete is used
 - (a) for reducing the dead weight of structures
 - (b) in filler wall panels in high-rise buildings
 - (c) for improving thermal insulation
 - (d) any of the above.
- (ix) Concreting in hot weather will result in
 - (a) Increased strength
 - (b) Increased crack
 - (c) Retard setting
 - (d) Unevenness.
- (x) Underwater concreting can be done by
 - (a) Dripping method
 - (b) Tremie method
 - (c) Cofferdam method
 - (d) All of the above

Fill in the blanks with the correct word

- (xi) Minimum w/c ratio required for a workable concrete is _____.
- (xii) Minimum period of mixing of concrete in prestressed concrete construction should be _____.
- (xiii) Ratio of compressive strength to tensile strength of concrete _____ (increases/decreases) with age.
- (xiv) In _____ cement mortar is reinforced with wire meshes.
- (xv) The admixture _____ slow down the process of hydration of concrete to keep it plastic for long period.

Group - B

- 2. (a) What are the ingredients of concrete? What is binder and filler? Brief on the composition of cement. [[CO1](Remember/LOCQ)]
 - (b) Illustrate the requirements and quality of water used in concrete. [[CO1](Understand/IOCQ)]
- 6 + 6 = 12**
- 3. (a) Explain the factors affecting workability of concrete. [[CO2](Remember/LOCQ)]
 - (b) Illustrate any of the workability tests in concrete. [[CO2](Apply/IOCQ)]
- 4 + 8 = 12**

Group - C

- 4. (a) Explain the term “shrinkage” in concrete. Provide relevant diagrams. [[CO4](Remember/LOCQ)]
 - (b) Calculate the gel space ratio and theoretical strength of a sample of concrete made with 500 gm of cement with 0.5 w/c ratio at full hydration and 60% hydration. [[CO4](Apply/IOCQ)]
- 6 + 6 = 12**

5. (a) What is meant by “fineness modulus” of aggregate ? [[CO4](Remember/LOCQ)]
 (b) Determine the fineness modulus of 5kg sample of coarse aggregate having the following sieve analysis.

I.S. sieve no.	63 mm	40 mm	20 mm	12.5 mm	4.75 mm	2.36 mm	600μ	300μ	150 μ	75 μ
Weight retained in kg.	0.0	0.3	1.70	2.1	0.8	0.1	--	--	--	--

Is this aggregate suitable for concrete?

[[CO4](Analyze/HOCQ)]

3 + 9 = 12

Group - D

6. Design a concrete mix of M45 grade pumpable concrete mix having a slump of the order of 100-125 mm using grade OPC 43 conforming to IS: 8112 for a reinforced concrete high rise building subjected to very 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 2.62, moisture content of 2.0 %, absorption of 1.0 %, coarse aggregate crushed (angular) stone chips of 10 mm and 20 mm maximum size conforming to IS 383 code requirements with specific gravity of 2.67, 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 your design: Standard Deviation= 5.0 MPa; air content= 2.0%; Maximum allowable w/c ratio= 0.4; minimum and maximum cement content = 375 kg/m³ and 475 kg/m³ respectively. [[CO3](Remember/LOCQ)]

12

7. (a) What are the effects of air-entraining admixtures in concrete
 For a concrete mix using 100 kg of coarse aggregate with $G_s = 2.65$; 60 kg of fine aggregate with $G_s = 2.61$; 27 kg of cement, and 12 kg of water. Determine the absolute volume of concrete produced. For the same mix proportions, but with 4 per cent air, determine the air content in the mix. [[CO3](Apply/IOCQ)]
 (b) What are the characteristics of aggregates required for mix design and how are they determined. [[CO3](Apply/IOCQ)]

(3 + 4) + 5 = 12

Group - E

8. Write short notes on:
 (i) Fibre Reinforced Concrete (ii) Polymer Concrete. [[CO5](Apply/IOCQ)]
- (6 + 6) = 12**
9. (a) Briefly explain the reasons of cracking in hardened concrete. [[CO6](Evaluate/HOCQ)]

(b) Explain why the evaluation of crack is necessary in damaged concrete structures.

[[CO6](Evaluate/HOCQ)]

8 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	34.37	43.75	21.88