

CONSTRUCTION MATERIALS AND MANAGEMENT TEST I

Number of Questions: 25

Time: 60 min.

Directions for questions 1 to 25: Select the correct alternative from the given choices.

1. The bearing strength of M25 grade concrete in limit state method of design as per IS 456:2000 is
(A) 25 MPa (B) 11.25 MPa
(C) 15 MPa (D) None
2. Modulus of Elasticity of M30 grade concrete is
(A) 25000 N/mm² (B) 27386 N/mm²
(C) 30000 N/mm² (D) None
3. Flexural tensile strength of M25 grade concrete as per IS 456-2000 is
(A) 12.5 N/mm² (B) 25 N/mm²
(C) 22.5 N/mm² (D) 3.5 N/mm²
4. Minimum grade of concrete used for pretensioned and post tensioned prestressed concrete are
(A) M40 and M30 (B) M40 and M20
(C) M30 and M40 (D) None
5. The 7-days strength of M30 grade concrete should be at least
(A) 30 MPa (B) 20 MPa
(C) 25 MPa (D) none
6. The target mean strength (f_m) for concrete mix design obtained from the characteristic strength (f_{ck}) and standard deviation (σ) as defined in IS456-2000 is:
(A) $f_{ck} + 1.35\sigma$
(B) $f_{ck} + 1.65\sigma$
(C) $f_{ck} + 1.45\sigma$
(D) $f_{ck} + 1.55\sigma$
7. Minimum cement content to be used in Reinforced cement concrete for mild exposure is
(A) 300 kg/m³ (B) 320 kg/m³
(C) 340 kg/m³ (D) 450 kg/m³
8. Nominal cover to main reinforcement in case of slabs with mild exposure should be
(A) 30 mm (B) 25 mm
(C) 20 mm (D) 40 mm
9. The individual variation in compressive strength of three cubes in the sample should not exceed
(A) $\pm 10\%$ (B) $\pm 15\%$
(C) $\pm 20\%$ (D) $\pm 25\%$
10. The pozzolanas added to improve the properties of concrete are
(A) Fly ash (B) Silica fume
(C) Slag (D) All the above
11. Which of the following statements regarding the cube strength of concrete are correct?
(i) Strength increases with decrease in cube size
(ii) Strength decreases with increase in slenderness ratio

- (iii) Strength increases with increase in slenderness ratio
- (iv) Strength decreases with decreases in cube size
(A) (i) and (ii) are correct
(B) (i), (ii), (iii) are correct
(C) (i) and (iii) are correct
(D) All the above
12. Which of the following statements regarding properties of concrete are correct?
(p) Modulus of elasticity of M25 grade of concrete is 25000 MPa.
(q) Approximate value of shrinkage strain of concrete is 0.0003
(r) pH value of water used in concrete construction should not be less than 6.
(A) p and q are correct
(B) p and r are correct
(C) q and r are correct
(D) all the above are correct
13. The long term modulus of elasticity of M25 grade concrete with θ value at 7 days to be 2.2 is
(A) 25000 MPa (B) 7812.5 MPa
(C) 3500 MPa (D) None
14. The probability of failure of a structure as per IS456-2000 (according to the concept of limit state design) is ____
(A) 0.0975 (B) 0.95
(C) 0.975 (D) 0.20
15. Group – I contains some properties of concrete / cement and Group II contains list of some tests on concrete / cement.
Match the property with corresponding test.

	Group – I		Group – II
P.	Direct tensile strength of conc rete	1.	Cylinder splitting test
Q.	Workability of concrete	2.	Surface area test
R.	Bond between steel and concrete	3.	Vee – bee tests
S.	Fineness of cement	4.	Fineness modulus test
		5.	Pullout test

Codes:

- | | |
|-------------|-------------|
| P Q R S | P Q R S |
| (A) 1 3 5 4 | (B) 5 2 1 3 |
| (C) 2 3 1 4 | (D) 2 1 5 3 |
16. Consider the following statements regarding the air entrained concrete?
(1) Increased resistance to freezing and thawing
(2) Improvement in workability.
(3) Increase in strength.

- (4) Permits reduction in water content of these,
 (A) 1, 2, 4 are correct
 (B) 2, 3, 4 are correct
 (C) 1, 3, 4 are correct
 (D) All the above are correct
17. Which of the following statements regarding admixtures are correct?
 (A) Retards the setting of cement
 (B) Accelerates the setting of cement
 (C) Improves the workability of concrete
 (D) All the above
18. Consider the following statements:
 I. The compressive strength of concrete decreases with increase in water cement ratio of the concrete mix.
 II. Water is added to the concrete mix for hydration of cement and workability.
 III. Creep and shrinkage of concrete are independent of the water cement ratio in the concrete mix.
 The true statements are
 (A) I and III (B) I, II, III
 (C) II and III (D) I and II
19. Consider the following statements:
 I. Modulus of elasticity of concrete increases with increase in compressive strength of concrete
 II. Brittleness of concrete increases with decrease in compressive strength of concrete.
 III. Shear strength of concrete increases with increase in compressive strength of concrete.
 The true statements are
 (A) I and III (B) I, II, III
 (C) II and III (D) I and II
20. Consider the following statements:
 (p) Nominal mix proportions for M20 grade concrete is 1 : 1.5 : 3
 (q) Weight batching is preferred compared to nominal (volume) batching
 (r) Maximum cement content as per IS456-2000 is 450 kg/m³
 (A) p, q are correct (B) p, r are correct
 (C) q, r are correct (D) p, q and r are correct
21. Which of the following statements given below are correct.
 (p) Nominal cover to reinforcement is based on serviceability or durability requirements
 (q) Factors affecting the durability of concrete are w/c and maximum cement content
 (r) Minimum cement content is not based on exposure conditions.
 (A) p, q, r are correct (B) p and q are correct
 (C) p and r are correct (D) only p is correct
22. Consider the following statements regarding the addition of pozzolanas to cement causes
 (p) Increase in strength
 (q) Less heat of hydration
 (r) Decrease in workability
 The true statements are
 (A) p, q, r are correct (B) p and q are correct
 (C) p and r are correct (D) q only is correct
23. The composition of air entrained concrete is given below:
 Water : 180 kg/m³
 Ordinary Portland cement: 360 kg/m³
 Sand : 601 kg/m³
 Coarse aggregate: 1160 kg/m³
 Assume the specific gravity of OPC, sand and coarse aggregate to be 3.10, 2.65 and 2.74 respectively, the air content in liters/m³ is _____
 (A) 53 liters/m³ (B) 50 liters/m³
 (C) 45 liters/m³ (D) None
24. Consider the following statements
 (p) Nominal maximum size of coarse aggregate to be used in R.C.C is 20 mm
 (q) As per IS456-2000; fine sand to be used in R.C.C should confirm to zone II and medium sand.
 (r) Minimum grade of concrete to be used in R.C.C is M30
 The true statements are
 (A) p and q are true (B) p and r are true
 (C) p, q and r are true (D) q and r are true
25. Which of the following statements given below are correct?
 (p) In mild environment, surface crack width should not exceed 0.3 mm as per IS456-2000.
 (q) Crack width increases with increase in stress in reinforcement bar.
 (r) Concrete and steel exhibit high strength after being subjected to high temperature.
 (A) p and r are correct
 (B) p, q and r are correct
 (C) p and q are correct
 (D) None

ANSWER KEYS

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|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. B | 2. B | 3. D | 4. A | 5. B | 6. B | 7. A | 8. C | 9. B | 10. D |
| 11. A | 12. D | 13. B | 14. A | 15. A | 16. A | 17. D | 18. D | 19. B | 20. D |
| 21. B | 22. D | 23. A | 24. A | 25. C | | | | | |

HINTS AND EXPLANATIONS

1. Bearing strength of concrete = $0.45 f_{ck}$
 $= 0.45 (25)$
 $= 11.25 \text{ MPa}$ Choice (B)
2. $E_c = 5000 \sqrt{f_{ck}}$
 $= 5000 \sqrt{30}$
 $= 27386 \text{ N/mm}^2$ Choice (B)
3. Flexural tensile strength of concrete = $0.7 \sqrt{f_{ck}}$
 $= 0.7 \sqrt{25} = 3.5 \text{ MPa}$ Choice (D)
5. 7 days strength = $\frac{2}{3}$ cube strength
 $= \frac{2}{3} \times 30 = 20 \text{ N/mm}^2$ Choice (B)
6. $f_{ck} = f_m - 1.65 \sigma$
 $\Rightarrow f_m = f_{ck} + 1.65 \sigma$ Choice (B)
7. Minimum cement content to be used in reinforced concrete for mild exposure is 300 kg/m^3 Choice (A)
8. Minimum cover to Reinforcement for slabs = 20 mm Choice (C)
9. Individual variation in compressive strength of 3 cubes should not exceed $\pm 15\%$. Choice (B)
10. Fly ash, silica fume and slag are the three types of pozzolanas used in concrete to improve the properties of concrete. Choice (D)
11. Statements (i) and (ii) are correct
 Strength increases with decrease in cube size because of better homogeneity and strength decreases with increase in slenderness ratio. Choice (A)
12. All statements are correct.
 Modulus of elasticity of concrete of M25 grade is
 $E_c = 5000 \sqrt{25} = 5000 \sqrt{f_{ck}} = 25000 \text{ MPa}$ and approximate value of shrinkage strain of concrete is 0.0003 . and pH value of water used in construction should not be less than 6. Choice (D)
13. $E_{ce} = \frac{E_c}{1 + \theta} = \frac{5000 \times \sqrt{25}}{1 + 2.2}$
 $= 7812.5 \text{ N/mm}^2$ Choice (B)
14. The structure may fail when
 (i) The load exceeds the design load.
 (ii) The strength is less than the characteristic strength
 (iii) Both load exceeds design load and strength less than characteristic strength.
 The probability of load exceeding design load $p_1 = 5\%$
 The probability of strength less than characteristic strength $p_2 = 5\%$
 The probability of failure = $1 - q_1 q_2 = 1 - (0.95)^2$
 $= 0.0975$ Choice (A)
15. Group I correctly matches with Group II for Choice (A). Choice (A)
16. There is an increased resistance to freezing and thawing & improvement in workability and also permits reduction in water content in case of air entrained concrete. Choice (A)
17. All the above statements regarding admixtures are correct. Choice (D)
18. I and II statements are correct. Choice (D)
19. I, II, III statements are correct. Choice (B)
20. Statements p, q and r are correct. Choice (D)
21. p and q statements are correct. Choice (B)
22. Statement 'q' only is correct. Choice (D)
23. $\frac{M_c}{\rho_c} + \frac{M_s}{\rho_s} + \frac{M_{cA}}{\rho_{cA}} + V_w + V_a = 1$
 $\frac{360}{3.10 \times 1000} + \frac{601}{2.65 \times 1000} + \frac{1160}{2.74 \times 1000} + \frac{180}{1000} + V_a = 1$
 $V_a = 0.053 \text{ m}^3/\text{m}^3$
 $= 0.053 \times 1000 \text{ litres/m}^3$ [$\because 1 \text{ m}^3 = 1000 \text{ litres}$]
 $= 53 \text{ litres/m}^3$ Choice (A)
24. Statements (p) and (q) are true. Choice (A)
25. Statements (p) and (q) are correct. Choice (C)