QP Code :539301

(3 Hours)

(CBSGS)   **80 MARKS**

INSTRUCTIONS: 1. Question number 1 is **COMPULSORY**.   2. Attempt any **THREE** from the remaining. 3. Each full question carries **EQUAL** marks.   4) **ASSUME** any suitable data, if needed.

1. **a)** Design **M25** grade of concrete as per Indian Standard method. The target mean strength to be achieved is **34 MPa,** with the standard deviation of 5.5 MPa. The water-cement ratio for the required target strength is **0.42** (from the graph). Refer the various tables given at the end. The details are as below. Bulk density of Cement = 1450 kg/m³; Bulk density of Fine Aggregates = 1700 kg/m³; Bulk density of Coarse Aggregates = 1800 kg/m³. Report the mix proportions by mass as well as by volume.   **(08 M)**

Design Parameters		Material Properties	
Max. size of coarse aggregates	20 mm.	Cement	43 grade
Shape of coarse aggregates	Crushed (Angular)	Sp. gravity of cement	3.15
Degree of workability (compacting factor)	0.90	Coarse Aggregates	20 mm & 12.5 mm in the (60:40) ratio
Degree of quality control	Fair	Sand	Conforming to Zone II
Degree of exposure	Moderate	Sp. gravity of CA	2.65
		Sp. gravity of sand	2.60

b) Write a note on Slump Test of concrete.   **(04 M)**

c) Explain the properties & uses of High Strength Concrete.   **(04 M)**

d) Write a note on superplasticizers.   **(04M)**

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2. **a)** Write a detailed note on Repair & Rehabilitation of Concrete Structures.   **(06 M)**

b) Write a detailed note on High Performance Concrete.   **(06 M)**

c) What are the factors affecting the Concrete Durability?   **(06 M)**

d) Ultrasonic Pulse Velocity Test is: i) used to measure the strength of wet concrete.

ii) Used to obtain the estimate of concrete strength of finished concrete elements. iii) A non-destructive test.

Which of the above statements are correct?   **(02 M)**

A) i, ii & iii   B) ii & iii   C) i & ii   D) i & iii

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3. **a)** Write a note on Rebound Hammer Test on concrete.   **(06 M)**

b) Write a detailed note on shape, size & texture of aggregates.   **(06 M)**

c) Enlist the types of cement. Explain Rapid Hardening Cement.   **(06 M)**

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d) Examine the two statements carefully:

Assertion (A): The rate of hydration is faster in finer cements.

Reason (R): The surface area is more in case of finer cements.

Select the answer to these items using the codes given below. **(02 M)**

   i) Both **A** & **R** are individually true & **R** is the correct explanation of **A**.

   ii) Both **A** & **R** are individually true but **R** is not the correct explanation of **A**.

   iii) **A** is true but **R** is false.

   iv) **A** is false but **R** is true.

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4) a) Discuss Ready Mixed Concrete, with a neat sketch of typical RMC plant layout. **(06 M)**

b) Explain Fibre Reinforced Concrete. **(06 M)**

c) Write a note on Alkali Aggregate Reaction. **(06 M)**

d) Modulus of elasticity of concrete is: i) Tangent modulus   ii) Secant modulus
iii) proportional to $\sqrt{f_{ck}}$ iv) proportional to $(1/\sqrt{f_{ck}})$
Which of the above statements are correct? **(02 M)**
  A) i & iii   B) i & iv   C) ii & iii   D) ii & iv

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5) a) Write a detailed note on self compacting concrete. **(06 M)**
b) Explain Hot Weather Concreting. **(06 M)**
c) The following data represents the strength of concrete cubes of the same concrete grade, prepared & tested in the same conditions. Find the Average Strength & Standard Deviation. The results are arranged in the ascending order. **(06 M)**

Sample No.	Cube Strength (MPa)	Sample No.	Cube Strength (MPa)	Sample No.	Cube Strength (MPa)	Sample No.	Cube Strength (MPa)
1	22.7	6	25.1	11	26.0	16	27.4
2	23.0	7	25.2	12	26.1	17	27.6
3	24.1	8	25.4	13	26.2	18	27.7
4	24.2	9	25.6	14	26.4	19	27.9
5	24.2	10	25.9	15	26.5	20	28.0

d) If 400 ml (or grams) of water is required to have a cement paste of 1900 grams of normal consistency, the percentage of water is: **(02 M)**

 a) 21.05%   b) 78.94%   c) 26.66%   d) None of these

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6) a) Explain Split Tensile Test with the help of a neat sketch. **(06 M)**

b) Write a detailed note on Roller Compacted Concrete. **(06 M)**

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c) Discuss the segregation & bleeding of concrete. (06 M)

d) In a laboratory trial mix for M30 grade concrete, water cement ratio used is 0.35 & water content = 145 litres/m^3. What is the cement content of the mix/m^3? (02 M) ----

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Data for Concrete Mix Design from Indian Standard Code [Q. 1 (a)]

Table 1: Minimum cement content, maximum water-cement ratio & minimum concrete grade (20 mm nominal max. size of aggregates)

Exposure	Reinforced Concrete		
	Min. cement content (kg/m^3)	Max. free water-cement ratio	Min. concrete grade
Mild	300	0.55	M20
Moderate	300	0.50	M25
Severe	320	0.45	M30
Very Severe	340	0.45	M35
Extreme	360	0.40	M40

Maximum cement content: restricted to 450 kg/m^3.

Table 2: Approximate sand & water content per m^3 of concrete*

Grade	Nominal size of aggregate (mm)	Water content in m^3 of concrete (kg)	Sand as % of aggregate by absolute volume	Remarks
Up to M35	10	208	40	Sand zone II, water-cement ratio = 0.6, Compaction Factor = 0.8
	20	186	35	
	40	163	30	
Beyond M35	10	200	28	
	20	180	25	

* These values apply to the conditions given in the **remarks** column. For other conditions, corrections are to be applied as per **Table 3**.

Table 3: Corrections to the values given in Table 2, to be applied for conditions other than those given in the remarks column of Table 2.

Change in conditions other than those given in Table 2	Correction for water content	Correction for sand content in total aggregates (%)
Sand conforming to zone I, III or IV	0	+1.5 for zone I, - 1.5 for zone III, - 3.0 for zone IV
Increase or decrease in compacting factor value by 0.1 (for workability)	+3%	0
Each 0.05 increase or decrease in water-cement ratio	0	+1%
For rounded aggregates (gravel)	- 15 kg/m^3	- 7%

Table 4: Approximate Air Content

Maximum size of aggregate (mm)	Entrapped air
10	3%
20	2%
40	1%