TE Civil – V 16

06.12.23

40+21 (71)

(Time: 3 Hours) (Total Marks: 80)

Note: 1. **Question number 1** is **compulsory**; attempt **any three** out of the remaining questions.
2. Assume suitable **data** if **required** and mention it clearly.
3. Draw neat sketches wherever necessary. Figure to the right indicates full marks.

1. **Attempt any four.**
   (a) What is rheology? Why it is essential? Where is it used? [05]
   (b) Explain the concept behind statistical quality control of the concrete with a sketch. [05]
   (c) Explain the process and significance of hydration of cement. [05]
   (d) What do you understand by destructive, non-destructive, and partial destructive tests on concrete? Give an example in each test. [05]
   (e) What is the relationship between cube strength and cylinder strength? and in which mixture design cube strength and cylinder strength are preferred. [05]
   (f) Explain the mechanism of carbonation with its effect on concrete and the method of determination of carbonation? [05]

2. (a) Design a concrete mix by IS 10262: 2019 for the following data: [12]
   i. Characteristic compressive strength required in the field at 28 days grade designation = M 40
   ii. Standard Deviation = 5.0
   iii. Value of X = 6.5
   iv. For durability criteria, w/c is restricted to 0.45
   v. Nominal maximum size of aggregate = 20 mm
   vi. Shape of C.A aggregate = Angular
   vii. Degree of workability required at site = 100 mm slump
   viii. Type of exposure = mild
   ix. Method of concrete placing = Pumpable concrete
   x. Specific gravity of cement = 3.14
   xi. Specific gravity of C.A = 2.7
   xii. Specific gravity of F.A = 2.6
   xiii. Aggregates are assumed to be in saturated surface dry condition.

   F.A belongs to Zone II
   Refer following tables for the mixture design.

(b) Method of Road Note No. 4 [08]

Design a Concrete Mix to suite the Following Data Using the Method of Road Note No. 4

Specified works cube strength: 30 N/mm^2 at 28 days.

Degree of control: Very good with weigh batching and constant supervision (minimum strength as a 75 percent of average strength)

Degree of workability: Medium

Grading curve number: 03

Type of cement: Ordinary Portland (Specific gravity= 3.15)

Type of fine aggregate: Natural sand (Specific gravity= 2.60)

Type of coarse aggregate: Irregular aggregate of 20 mm size (Specific gravity= 2.60)

Aggregate to cement ratio	
w/c	Medium degree of workability
0.4	3.5
0.45	4.2
0.5	4.8

The aggregates available at the works site have the following grading:

Design the concrete mix & set out field mix proportions for 1 cubic meter of concrete by weigh batching. What is the density of fresh concrete? Also refer following graphs and tables for the mixture design.

IS Sieve Size		20 mm	10 mm	4.75 mm	2.36 mm	1.18 mm	600 µ	300 µ	150 µ
Cumulative Percentage passing	Fine Aggregate	-	-	100	92	76	48	20	3
	Coarse Aggregate	100	31	7	0	-	-	-	-

3. (a) Explain the transport mechanism of fluids and gases in concrete. [04]
   (b) Explain the alkali-aggregate reaction. [04]
   (c) Explain the effects of chemical admixture on the fresh and hardened properties of concrete. [04]
   (d) What is cold weather concreting? What are the harmful effects of cold weather? Explain the various precautionary measures taken during cold weather. [08]

4. (a) Write a short note on infrared thermography. Explain how the result is interpreted to check the quality of concrete. [05]
   (b) You are going to construct concrete sewer pipes under the ground where the soil is rich in sulphate content. Which type of cement you will prefer and why? [03]
   (c) Explain how Maturity method is used for determining the strength of concrete with suitable sketch. [06]
   (d) How is self-compacting concrete distinguished from conventional concrete? And enlist the tests which qualify the self-compacting concrete. [06]

5. (a) What is the purpose of the core test? How do you calculate the compressive strength of concrete by core test? [05]
   (b) Why ITZ is the weakest link in the concrete? What is effect of gel-space ratio on concrete? [05]
   (c) What is Vacuum concrete? What are the advantages of it? [05]
   (d) Write step by step procedure of concrete mix design by American Concrete Institute 211.1 [05]

6. (a) Write following statements are true or false. If false, rewrite the correct statement. [04]

i. Durability of reinforced concrete structures depends primarily on the quality of the cover concrete.

ii. Aerobic bacteria in the slime under flowing sewage convert sulphates in the sewage into sulphides.

iii. When phenolphthalein indicator is used in concrete, the pink colour indicates the acidic nature of the concrete.

iv. The ratio of Ca^{2+}/alkali (Na^{+}, K^{+}) in the ASR gel determines its expansive nature.

(b) Distinguish between stiffening, setting and hardening of concrete. [06]

(c) Explain in detail Corrosion monitoring techniques of reinforcement and preventive measures. [05]

(d) Enlist different waste which will be used in concrete as ingredients, and explain any one in detail with their advantages and disadvantages. [05]

Data for Mix design from IS 10262:2019

Table 1: Maximum Water Content per Cubic metre of Concrete for Nominal Maximum Size of Aggregate

Sr. No	Nominal maximum size of the Aggregate (mm)	Maximum Water Content (kg)
1	10	208
2	20	186
3	40	165

Table 2: Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate

Sr. No.	Nominal maximum size of the Aggregate (mm)	Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
		Zone I	Zone II	Zone III	Zone IV
1	10	0.50	0.48	0.46	0.44
2	20	0.66	0.64	0.62	0.60
3	40	0.75	0.73	0.71	0.69

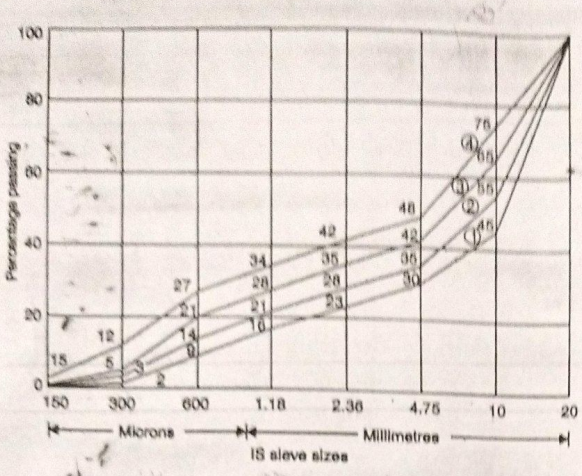

Figure 1 Curves of four gradings of 20mm aggregate

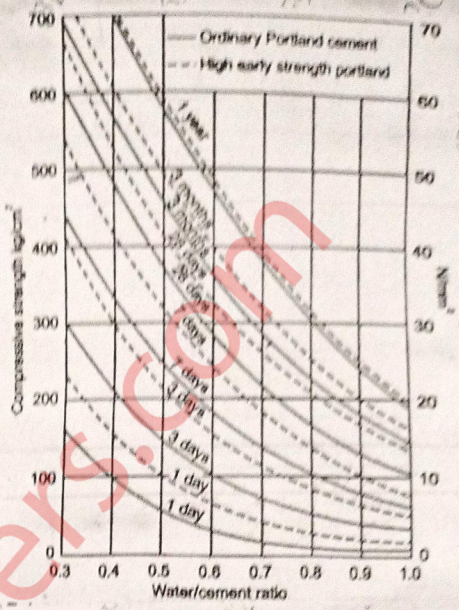

Figure 2 Relationship between compressive strength and w/c ratio

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