

B. £. (Civil) 4th Semester Final Examination, 2010

Concrete Technology (CE - 403)

Full Marks: 70

Time: 3 hours

FIRST HALF

(Answer question no.5 and any TWO from the rest)

1. a) State the differences between wet process and dry process of cement manufacturing.
b) What is the importance of gypsum addition in manufacturing of cement?
c) The composition of Bogue's compounds for a certain brand of cement is as follows:
 $C_3S = 54.1\%$, $C_2S = 16.6\%$, $C_3A = 10.8\%$ and **C4AF** - 9.1%.
Find the content of CaO in the raw material if **SO₃** content is 2% .

3 + 2 + 5 = 10

2. a) What is Lime Saturation Factor ?
b) Discuss about the heat of hydration.
c) Calculate the total heat of hydration at the age of 3 days from 100 gms of cement having same Bogue's compounds in Q. 1(c) considering heat of hydration per gm of **C₃S**, **C₂S**, **C3A** & **C4AF** as 58, 12, 212 & 69 calories respectively.

2 + 4 + 4 = 10

3. a) Discuss about the differences in hydration of **C3S** and **C₂S**.
b) Find the volume of hydration products, capillary water and volume of capillary pores from the following data:

Weight of cement = 500 gm, w/c = 0.6, Degree of hydration = 80%,

Specific gravity of cement = 3.12

Assume any other suitable data if required. 3 + 7 = 10

4. a) What do you understand about maturity of concrete?
b) The strength of a sample of fully matured concrete is found to be 30 MPa. Find the strength of identical concrete at the age of 14 days when cured at an average temperature during day time at 30°C and night time at 15°C. Assume Plowman's coefficients A & B are 32 & 54 respectively.

4 + 6 = 10

5. Write short notes on any three:

3 × 5 = 15

- Types of cement
- Admixtures in concrete
- Modulus of elasticity of concrete
- Shrinkage of concrete
- Creep in concrete
- Special Concrete

SECOND HALF

(Answer question no.6 and any TWO from the rest)

6. Design a concrete mix for M25 as per IS: 10262.

Design stipulations

- a) Characteristic compressive strength of concrete = 25 N/mm²
- b) Maximum size of aggregate - 20mm (angular)
- c) Degree of workability required at site = 0.85 (C.F.)

Test data for materials

- d) cement used : OPC (43 grade as per IS:8112).
- e) specific gravity of i) coarse aggregate=2.75, ii) fine aggregate=2.60, iii)cement=3.15
- 1) Water absorption for coarse aggregate=0.6% & fine aggregated .0%
- m) Free (surface) moisture in coarse aggregate = Nil & fine aggregate = 2%
- n) Fine aggregates conform to Zone III as per IS : 383

Data supplied

- i) standard deviation = 5.3 N/mm² (degree of quality control: Good)
- j) water cement ratio - 0.45 (for required target strength) & 0.50 (for Durability)
- k) Entrapped air = 2% by volume of concrete.

Design the mix proportion and calculate actual quantities of ingredients required for the mix, per bag of cement. (Use tables 4 & 6 of IS: 10262) **15**

7. a) Discuss about the properties of aggregates influencing the properties of concrete.
- b) If 10 Kg of aggregate is analyzed and the weight retained in the various sieves are as follows: 4 Kg in 20mm sieve, 3 Kg in 10mm sieve, 1.5 Kg in 4.75mm sieve, 1.0 Kg in 2.36mm sieve, 0.5 Kg in 1.18mm sieve. Compute the Fineness Modulus. **4+6 =10**
8. What are the important properties of concrete in the fresh state? What are the various factors affecting the workability of concrete? Discuss about slump test for measuring workability of concrete. **3+3+4=10**
9. a) What is the relation between compressive and tensile strength of concrete?
- b) Predict theoretical compressive strength of concrete having cement content = 300 gm, w/c = 0.6 and degree of hydration = 80%. Use both Abrams' Law and Power's Equation. Assume values of A& B as 98.5 MPa & 7 respectively. **2+8= 10**
10. What are internal and external factors affecting durability of concrete. Discuss on chloride & sulphate attack on concrete. What is carbonation in concrete?

4+4+2=10

TABLE 4

APPROXIMATE SAND AND WATER CONTENTS PER CUBIC
METRE OF CONCRETE FOR GRADES UPTO M35

Nominal Maximum Size of Aggregate mm	Water content*. Per Cubic Metre of Concrete Kg	Sand as Percent of Total Aggregate by Absolute Volume
10	208	40
20	186	35
40	165	30

* water content corresponding to saturated surface dry aggregate.

IS : 10262 - 1082

3.3.2 Table 4 is to be used for concretes grade up to M 35 and is based on the following conditions :

- Crushed (angular) coarse aggregate, conforming to IS :363-1970*
- Fine aggregate consisting of natural sand conforming to grading zone II of Table 4 of IS:383-1970*
- Water-cement ratio of 0.6 (by mass), and
- Workability corresponding to compacting factor of 0.80.

TABLE 6

ADJUSTMENT OF VALUES IN WATER CONTENT AND
SAND PERCENTAGE FOR OTHER CONDITIONS

(Clauses 3.3.4 and 4.1)

Change in Condition	Adjustment Required In										
for Tables 4 and 5											
(D)											
For sand conforming to grading Zone I, Zone III or Zone IV of Table 4 of IS : 383-1970*	<table> <thead> <tr> <th>Water Content</th> <th>Percent, Sand in Total Aggregate</th> </tr> </thead> <tbody> <tr> <td>(2)</td> <td>(3)</td> </tr> <tr> <td>+ 0</td> <td>+ 1.5 percent for Zone I</td> </tr> <tr> <td></td> <td>- 1.5 percent for Zone III</td> </tr> <tr> <td></td> <td>-3.0 percent for Zone IV</td> </tr> </tbody> </table>	Water Content	Percent, Sand in Total Aggregate	(2)	(3)	+ 0	+ 1.5 percent for Zone I		- 1.5 percent for Zone III		-3.0 percent for Zone IV
Water Content	Percent, Sand in Total Aggregate										
(2)	(3)										
+ 0	+ 1.5 percent for Zone I										
	- 1.5 percent for Zone III										
	-3.0 percent for Zone IV										
Increase or decrease* in the value of compacting factor by 0.1	+3-percent										
Each 0.05 Increase or decrease in the water-cement ratio	0 1.1 percent										
For rounded aggregate	- 1 kg/m ³ - 1 percent										

Specification for coarse and fine aggregate from natural sources for concrete (second revision).