B.E. (CE) Part-II 4th Semester Examination, 2006

Concrete Technology

(CE-402)

Time : 3 hours **Full Marks : 100**

Use separate answerscript for each half.

FIRST HALF

Answer any Q.1 and any two from the rest
Assume reasonable values of data not supplied.

1. Design a concrete mix as per IS:10262

I. Design stipulations
   a) Characteristic compressive strength of concrete = 30 MPa
   b) Maximum size of aggregates – 20mm (angular)
   c) Degree of workability required at site = 0.7 CF

II. Test data for materials
   a) Cement used : OPC as per IS:269
   b) Specific gravity of
      i) Coarse aggregates – 2.75
      ii) Fine aggregates – 2.63
      iii) Cement – 3.14
   c) Water absorption
      i) Coarse aggregates – 0.55%
      ii) Fine aggregates – 1%
   d) Free (surface) moisture
      i) Coarse aggregates – Nil (absorbed moisture also nil)
      ii) Fine aggregates – 1.9%
   e) Fine aggregates conform to Zone I as per IS : 383

III. Data supplied
   a) Standard deviation – 5.0 MPa (Degree of control: Very Good)
   b) Free w/c ratio = 0.45 for the type of cement used
   c) As per IS 456, minimum cement content and maximum free w/c ratio are 240 kg/m^3 and 0.6 respectively (Type of exposure : Moderate)
   d) Entrapped air = 2% of volume of concrete

Design the mix proportions of Trial Mix 1 and calculate the actual quantities required for the mix per bag of cement.

Tables 4 & 6 of IS:10262 are supplied. (18)

2. a) Explain with sketches the different moisture conditions of aggregates

b) What are the main factors governing the desired aggregate grading for a concrete mix?

c) 10 kg of aggregate is analysed and the weight retained in the various sieves are as follows:

20mm – 3 kg
10mm – 5 kg
4.75 mm – 5 kg
2.3 mm – 4 kg
1.18 mm – 3 kg

Compute the fineness modulus. (5+5+6 = 16)

3. a) How does "Rapid Hardening Cement" have a rapid rate of strength development ? Discuss the situation in which the use of this cement is not recommended and why.

b) Which type of slag is used for the manufacture of Blast Furnace Slag cement – Glassy granulated slag or air-cooled crystallined slag ?

c) What is pozzolana ? Give some examples of natural and artificial pozzolanas. Why is Portland Pozzolana cement specially useful in (i) marine and hydraulic structures (ii) mass concrete construction (4+2+10 = 16)

4. a) Explain the action of gypsum in the manufacture of cement.

b)What is the importance of the 'alkalis' in cement ?

c) The composition of a certain brand of O.P.C. is given below :

$C_3S = 53.0\%$
$C_2S = 18.0\%$
$C_3A = 12.0\%$
$C_4AF = 8.0\%$

If the SiO_2 content of the raw material is 20.0% and the SO_3 content is 2%, find the content of CaO in the raw material. (5+4+7 = 16)

5. a) Explain with a sketch the structure of hydrated cement.

b)"Fineness is a vital property of cement". Discuss.

c) If 100g of anhydrous cement is mixed with 35 gm of water, find how much cement will be hydrated. Also determine the volume of the hydrated cement, the volume of unhydrated cement and the volume of empty capillaries. (4+4+8 =16)

SECOND HALF

(Answer Q.No.10 and TWO from the rest.)

6. Define workability of concrete. What are the various factors affecting the workability of concrete? Discuss about the different methods of measuring workability of concrete. (2+5+8)

7. What is admixture in concrete? Mention the classification of chemical admixture. Discuss the application of some special admixtures. (3+5+7)

8. Define Abram's law and state its limitations. What is the advantage of gel/space ratio law over the Abram's law? What is creep in concrete? (5+5+5)

9. Define durability of concrete? What are the factors affecting durability of concrete structures? Discuss the chloride and sulphate attack on concrete. (4+5+6)

10. Write short notes on (any four) : (4x5)
    a) Different types of cement
    b) Bulking of sand
    c) Setting time of cement
    d) Non-destructive testing of concrete
    e) Modulus of elasticity of concrete
    f) Shrinkage in concrete.

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TABLE 4. APPROXIMATE SAND AND WATER CONTENTS PER CUBIC METER OF CONCRETE FOR GRADES UPTO M35

Nominal Maximum Size of Aggregate (mm)	Water Content*, Per Cubic Meter 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.

TABLE 6. ADJUSTMENT OF VALUES IN WATER CONTENT AND SAND PERCENTAGE FOR OTHER CONDITIONS

Change in condition Stipulated for Table 4	Adjustment Required in	
	Water Content	Percent, Sand in Total aggregate
For sand conforming to grading Zone I, Zone III or Zone IV of Table 4 of IS : 383-1970*	0	+1.5 percent for Zone I -1.5 percent for Zone III -3.0 percent for Zone IV
Increase or decrease in the values of compacting factor by 0.1	±3 percent	0
Each 0.05 increase or decrease in free water-cement ratio	0	±1 percent
For rounded aggregate	-15 Kg/m^3	-7 percent

* Specification for coarse and fine aggregates from natural sources for concrete (Second revision).