

13.607

Ex/BESUS/CE-403/07

B.E. (CE) Part-II 4th Semester Examination, 2007

**Concrete Technology**

(CE-403)

Time : 3 hours

Full Marks : 70

Use separate answerscript for each half.

Assume reasonable values of data, if not supplied.

**FIRST HALF**

(Answer Q.No.1 and TWO from the rest.)

1. Design a concrete mix as per IS:10262,
  - i) Design stipulations :
    - a) Characteristic compressive strength of concrete = 25 MPa
    - b) Maximum size of aggregate = 20 mm (angular)
    - c) Degree of workability required at site = 0.9 (C.F.)
  - ii) Test data for materials :
    - a) Cement used – OPC as per IS:269
    - b) Specific gravity of
      - i) Cement – 3.15
      - ii) Coarse aggregate – 2.75
      - iii) Fine aggregate – 2.65
    - c) Water absorption
      - i) Coarse aggregate – 0.5%
      - ii) Fine aggregate – 1.2%
    - d) Free (surface) moisture
      - i) Coarse aggregate – NIL (absorbed moisture also nil)
      - ii) Fine aggregate – 2.0%
    - e) Fine aggregates conform to zone-I as per IS:383.
  - III) Data supplied :
    - a) Standard deviation = 4 MPa (Degree of quality control : Good)
    - b) Minimum cement content = 240 kg/m<sup>3</sup> (as per IS 456)
    - c) Maximum w/c = 0.6 (For durability requirement as per IS 456)
    - d) Type of exposure = Mild
    - e) Entrapped air = 2% by volume of concrete
    - f) Required w/c = 0.5 (For target strength as per IS 10262)
    - g) Table-4 for sand & water content and Table-6 for necessary adjustments as per IS 10262 are supplied.

Design the above mix proportion and calculate actual quantities of ingredients required for the mix, per bag of cement. [15]



(CE-403)

2. a) How does w/c affect the strength of concrete?  
b) What are the limitations of Abram's law?  
c) Predict theoretical compressive strength of concrete having w/c=0.5, cement content = 300 gm and degree of hydration = 100% using (i) Abram's law (assuming values of A & B are 98 MPa and 7 respectively), (ii) Power's Equation. [2+2+6]
3. a) What is the necessity of curing of concrete?  
b) Mention different methods for curing of concrete.  
c) Discuss about the fresh properties of concrete. (including Bleeding and Segregation). [2+2+6]
4. a) Briefly focus on different internal and external factors that affect durability.  
b) How use of admixtures can improve the properties of concrete, in general? [6+4]

### SECOND HALF

(Answer Q.No.5 and TWO from the rest.)

5. Write short notes on any three of the followings: 5×3=15
- Modulus of Elasticity of concrete
  - Shrinkage in concrete
  - Creep of concrete
  - Different types of cement
  - Special Concrete
  - Bogue's compound
6. a) Aggregate of 10 Kg weight is analysed and the weight retained in the various sieves are as follows:
- 20 mm – 2.5 Kg
  - 10 mm – 3.5 Kg
  - 4.75 mm – 1.75 Kg
  - 2.36 mm – 1.25 Kg
  - 1.13 mm – 1.0 Kg
- Compute fineness modulus of the aggregate.
- b) What do you mean by 'grading of aggregates'?
- c) Discuss about bulking of sand. 4+2+3=10

7. a) Find out the following parameters of cement after hydration.  
i) Volume of hydrated paste ii) volume of capillary water iii) volume of empty capillary pores iv) volume of total pores.

Data given:

Weight of cement = 100 gm, degree of hydration = 100%, w/c ratio = 0.5,  
Sp. Gravity of cement = 3.15.

- b) What is the difference between capillary water and gel water? 7+3=10

8. a) The composition of a certain brand of OPC is as follows:

$C_3S = 51\%$ ,  $C_2S = 19.0\%$ ,  $C_3A = 10.0\%$  and  $C_4AF = 9.0\%$

If  $SO_3$  content is 3%, find the contents of  $CaO$ ,  $SiO_2$ ,  $Al_2O_3$  and  $Fe_2O_3$ .

- b) Highlight the roles of  $C_3S$  in cement hydration.

- c) What is the role of gypsum in cement manufacturing? 5+3+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 - 1982

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

- a) Crushed (angular) coarse aggregate, conforming to IS :383-1970\*
- b) Fine aggregate consisting of natural sand conforming to grading zone II of Table 4 of IS:383-1970\*
- c) Water-cement ratio of 0.6 (by mass), and
- d) 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 Conditions Stipulated for Tables 4 and 5	Adjustment Required In	
	Water Content	Percent, Sand in Total Aggregate
(1)	(2)	(3)
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 value 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	-15kg/m <sup>3</sup>	- 7 percent

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