Concrete Technology (CE - 403)

Full Marks: 70   **Time: 3 hours**

<u>Answer THREE questions from each half</u>
<u>Two marks are reserved for neatness in each half.</u>
<u>Assume any suitable data, if necessary.</u>

FIRST HALF

1. Design a concrete mix for M20 as per IS:10262.
   <u>Design stipulations</u>
   a) Characteristic compressive strength of concrete = 20 N/mm^2
   b) Maximum size of aggregate =20mm (angular)
   c) Degree of workability required at site = 0.80 (C.F.)

   <u>Test data for materials</u>
   d) cement used : OPC (43 grade as per IS:8112).
   e) specific gravity of i) coarse aggregate=2.65, ii) fine aggregate=2.60,
      iii) cement=3.15
   f) Water absorption for i) coarse aggregate=0.6%, ii) fine aggregate=1.5%
   g) Free (surface) moisture in i) coarse aggregate : nil, ii) fine aggregate : 2%
   h) Fine aggregates conform to Zone II as per IS : 383

   <u>Data supplied</u>
   i) standard deviation = 4 N/mm^2 (degree of quality control : Good)
   j) water cement ratio = 0.50 (for required target strength)
   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)   **11**

2.   a) Why dry process of cement manufacturing is advantageous than wet process?

      b) What is the importance of Bogue's compounds?

      c) Estimate the Bogue's compounds from the oxide compositions of cement:

      CaO = 63%, SiO_2 = 20%, Al_2O_3 = 6%, Fe_2O_3 = 3%, SO_3 = 2% others = 6%.

                                                                    3 +3+5 = 11

3. a) Discuss about the heat of hydration for cement.

   b) Find the volume of hydration products, capillary water and volume of capillary

pores from the following data:

   Weight of cement = 300 gm, w/c = 0.5, Degree of hydration = 80%,

   Specific gravity of cement = 3.12

   Assume any other suitable data if required.   **3+8 = 11**

4. a) What are the factors affecting the strength of concrete?

   b) What is the relation between compressive and tensile strength of concrete?

   c) Predict theoretical compressive strength of concrete, having w/c = 0.6, cement
content = 100 gm, and degree of hydration = 90%. Use both Abrams' Law and Power's
Equation. Assume values of A and B as 98.5 MPa and 7 respectively.   **3+2+ 6= 11**

5. a) What do you understand about maturity concept 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 20^0C and night time at 10^0C.   **4+7= 11**

SECOND HALF

6. a) Discuss about the relevant properties of aggregates used for making of concrete.

   b) What is bulking of aggregates?

c) If 20 Kg of aggregate is analyzed and the weight retained in the various sieves are as follows: 6 Kg in 20mm sieve, 5 Kg in 10mm sieve, 3 Kg in 4.75mm sieve, 4 Kg in 2.36mm sieve, 2 Kg in 1.18mm sieve. Compute the Fineness Modulus.   4+2+5=11

7. What are admixtures in concrete? Mention the classification of admixtures. Discuss the advantages for using admixtures.   2+5+4=11

8. What do you understand about workability of concrete? What are the various factors affecting the workability of concrete? Discuss about slump test and compacting factor test for measuring workability of concrete.   2+3+6=11

9. a) Discuss about the internal and external factors affecting durability of concrete.

   b) Write about the effect of chloride and sulphate attack on concrete.

   c) What is carbonation in concrete?   4+5+2=11

10. Write short notes on <u>any three</u> of the followings: 11

   a) Portland slag cement

   b) Curing in concrete

   c) Modulus of elasticity of concrete

   d) Shrinkage of concrete

   e) Creep in concrete

   f) Special Concrete

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/m³	−7 percent

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