# B.E. (Civil) Part II 4th Semester Final Examination, April 2013

Concrete and CE Materials (CE 403)

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

*2 (Two) marks are reserved for neatness in each half*
*Assume any reasonable data if necessary.*

## First Half

*Answer any **THREE (3)** questions*

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

Design stipulations
a) Characteristic compressive strength of concrete = 25 MPa
b) Maximum size of aggregate =20mm (angular)
c) Degree of workability required at site = 0.85 (C.F.)

Test data for materials
a) cement used : OPC as per IS:8112
b) specific gravity of i) coarse aggregate=2.7, ii) fine aggregate=2.6, iii) cement=3.15
c) Water absorption for i) coarse aggregate=0.5%, ii) fine aggregate=1.2%
d) Free (surface) moisture in i) coarse aggregate : nil, ii) fine aggregate : 2%
e) Fine aggregates conform to Zone III as per IS : 383

Data supplied
a) standard deviation = 5 MPa (degree of quality control : very good)
b) water cement ratio = 0.45 (for required target strength)
c) minimum cement content = 300 Kg/$m^3$, maximum free w/c = 0.50, type of exposure : moderate.
d) 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) 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%.

b) If 10 Kg of aggregate is analyzed and the weight retained in the various sieves are as follows: 3 Kg in 20mm sieve, 2.5 Kg in 10mm sieve, 1.5 Kg in 4.75mm sieve, 2 Kg in 2.36mm sieve, 1 Kg in 1.18mm sieve. Compute the Fineness Modulus. (5+6 = **11**)

3. (a) What do you mean by 'hydration' of cement?
(b) Find out the volume of solid product of hydration, gel water, capillary water and empty capillary pores produces on hydration of 500 gm of dry OPC. Take specific gravity of cement as 3.15, degree of hydration 75% and water-cement ratio as 0.50. (4+7 = **11**)

4. (a) Describe the quality of a good timber.
(b) State different types of limes.
(c) Mention about classification of rocks. (4+3+4=**11**)

5. (a) What are the functions of different ingredients of brick?
(b) State the specification of first class brick.
(c) Discuss about the different uses of tiles. (4+4+3=**11**)

## Second Half

*Answer any **THREE (3)** questions*

6. (a) What do you mean by segregation in concrete ?
(b) Discuss the effects of different factors which influence the workability of concrete.
(c) Name different methods for measuring the workability. State the salient features of slump test with sketches.

(2+4+5=11)

7. (a) What is shrinkage in concrete?
(b) Describe different modulus of elasticity of concrete with the diagram. Which one of them is more commonly used in practice?
(c) Why does creep occur in concrete? Discuss the effects of creep.

(2+5+4=11)

8. (a) State the limitations of Abrams water-cement ratio law in context of compressive strength of concrete. How gel-space ratio is related to the compressive strength of concrete. Calculate the theoretical strength of sample of concrete made with 500 gm of cement with 0.45 water/cement ratio, on full hydration and at 60 percent hydration.

(b) Discuss about the 'maturity of concrete'.

(c) Laboratory experiments conducted at Kolkata on a particular mix showed 30 MPa for fully matured concrete. Find whether formwork of slab can be removed for an identical concrete placed at Gangtok at the age of 21 days (when cured at an average temperature during day time 10°C and night time 3°C) if the concrete is likely to be subjected to a stripping stress of 25 MPa. (Given: for 30 MPa, A=21 and B=61).

(5+2+4=11)

9. (a) What is paint and varnish?
(b) Discuss about the ingredients and their functions of paints.
(c) Discuss about different forms of the steel used in construction work.

(2+4+5=11)

10. Write short notes on the following (*any three*)
(a) Durability of concrete
(b) Chemical admixtures
(c) Special concrete
(d) Bitumen, Tar and Asphalt.
(e) Pigment Volume Concentration
(f) White Wash and Colour Wash

(11)

## 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 Metreof Concrete Kg | Sand as Percent of Total Aggreant 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 gradeing 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 Conditios Stipulayed for Tables 4 and 5 | Adjustment Required In Water Content | Adjustment Required In 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<br>— 1.5 percent for Zone III<br>—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 ration | 0 | ± 1 percent |
| For rounded aggregate | —15kg/m³ | — 7 percent |

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