B.E. CIVIL ENGG. 3rd YEAR 1ST SEM. EXAM. 2019

Subject: CONCRETE TECHNOLOGY. TIME: 3 Hours **Full Marks: 100**

Use a separate Answer-Script for each part
Assume any data if required

No. of questions	Part I Full Marks = 60	Marks 20x3=60
1.	**Answer question a or b**	**20**
	a. i. What do you mean by workability of concrete and write down the factors affecting workability of concrete. Describe each factor briefly. ii. Write short on bleeding and segregation of concrete.	(3+12)+5= 20
	or	
	b. i. How can you measure workability of concrete in the laboratory? Describe with neat sketch (any one test). ii. What do you know about flexural strength of concrete and how can you measure flexural strength of concrete in the laboratory?	10+10=20

2.	Make a mix design proportion as per IS 10262:2009 for M 25 grade of concrete with calculations for the necessary data given below. **Basic Data for mix design** a. Grade designation : M25 b. Type of cement : OPC 43 grade, IS 8112 c. Max. Nominal size of aggregate. : 20 mm d. Workability : 75 mm (slump) e. Type of aggregate. : Crushed angular aggregate. f. Maximum cement content : 450 kg/m^3 g. Chemical admixture : Not used **Test data for materials** i. Specific gravity of cement : 3.15 ii. Specific gravity of a. Coarse aggregate : 2.65 b. Fine aggregate : 2.65 iii. Water absorption a. Coarse aggregate : Nil b. Fine aggregate : Nil iv. Free (surface) moisture a. Coarse aggregate : Nil b. Fine aggregate : Nil v. Sieve analysis a. Coarse aggregate : Conforming to Table 2 of IS 383 b. Fine aggregate : Conforming to Zone II of IS 383 You can use table 5. of IS 456:200 given in the Annexure. You can also use table 1, table 2, table 3 of IS 10262:2009 and clause No. 4.2 and 4.4 of IS 10262:2009 given in the Annexure.	**20**

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No. of questions	Part I Full Marks = 60	Marks 20x3=60
3.		20
	a. write short note on Fly ash concrete	5
	b.	5+10 =15
	i. What do you mean by self-compacting concrete and write down the advantages of self-compacting concrete	
	ii. Describe J-ring test for measuring the workability of self-compacting concrete.	

ANNEXURE

Table 5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum Size

(Clauses 6.1.2, 8.2.4.1 *and* 9.1.2*)*

Sl No.	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete
1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mild	220	0.60	–	300	0.55	M 20
ii)	Moderate	240	0.60	M 15	300	0.50	M 25
iii)	Severe	250	0.50	M 20	320	0.45	M 30
iv)	Very severe	260	0.45	M 20	340	0.45	M 35
v)	Extreme	280	0.40	M 25	360	0.40	M 40

NOTES

1 Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2. The additions such as fly ash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water-cement ratio if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part 1) and IS 455 respectively.

2 Minimum grade for plain concrete under mild exposure condition is not specified.

Table 5. of IS 456:2000

Table 1 Assumed Standard Deviation

(Clauses 3.2.1.2, A-3 *and* B-3*)*

Sl No. (1)	Grade of Concrete (2)	Assumed Standard Deviation N/mm² (3)
i)	M 10	3.5
ii)	M 15	
iii)	M 20	4.0
iv)	M 25	
v)	M 30	5.0
vi)	M 35	
vii)	M 40	
viii)	M 45	
ix)	M 50	
x)	M 55	

NOTE — The above values correspond to the site control having proper storage of cement; weigh batching of all materials; controlled addition of water; regular checking of all materials, aggregate grading and moisture content; and periodical checking of workability and strength. Where there is deviation from the above, values given in the above table shall be increased by 1 N/mm².

Table 1.0 of IS10262:2009

Table 2 Maximum Water Content per Cubic Metre of Concrete for Nominal Maximum Size of Aggregate

(*Clauses* 4.2, A-5 *and* B-5)

Sl No.	Nominal Maximum Size of Aggregate	Maximum Water Content [1]
	mm	kg
(1)	(2)	(3)
i)	10	208
ii)	20	186
iii)	40	165

NOTE — These quantities of mixing water are for use in computing cementitious material contents for trial batches.

[1] Water content corresponding to saturated surface dry aggregate.

Table2. Of IS 10262:2009

Table 3 Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate

(*Clauses* 4.4, A-7 *and* B-7)

Sl No.	Nominal Maximum Size of Aggregate	Volume of Coarse Aggregate[1] per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
	mm	Zone IV	Zone III	Zone II	Zone I
(1)	(2)	(3)	(4)	(5)	(6)
i)	10	0.50	0.48	0.46	0.44
ii)	20	0.66	0.64	0.62	0.60
iii)	40	0.75	0.73	0.71	0.69

[1] Volumes are based on aggregates in saturated surface dry condition.

Table 3. Of IS 10262:2009

4.2 Selection of Water Content

The water content of concrete is influenced by a number of factors, such as aggregate size, aggregate shape, aggregate texture, workability, water-cement ratio, cement and other supplementary cementitious material type and content, chemical admixture and environmental conditions. An increase in aggregates size, a reduction in water-cement ratio and slump, and use of rounded aggregate and water reducing admixtures will reduce the water demand. On the other hand increased temperature, cement content, slump, water-cement ratio, aggregate angularity and a decrease in the proportion of the coarse aggregate to fine aggregate will increase water demand.

The quantity of maximum mixing water per unit volume of concrete may be determined from Table 2. The water content in Table 2 is for angular coarse aggregate and for 25 to 50 mm slump range. The water estimate in Table 2 can be reduced by approximately 10 kg for sub-angular aggregates, 20 kg for gravel with some crushed particles and 25 kg for rounded gravel to produce same workability. For the desired workability (other than 25 to 50 mm slump range), the required water content may be established by trial or an increase by about 3 percent for every additional 25 mm slump or alternatively by use of chemical admixtures conforming to IS 9103. This illustrates the need for trial batch testing of local materials as each aggregate source is different and can influence concrete properties differently. Water reducing admixtures or superplasticizing admixtures usually decrease water content by 5 to 10 percent and 20 percent and above respectively at appropriate dosages.

4.4 Estimation of Coarse Aggregate Proportion

Aggregates of essentially the same nominal maximum size, type and grading will produce concrete of satisfactory workability when a given volume of coarse aggregate per unit volume of total aggregate is used. Approximate values for this aggregate volume are given in Table 3 for a water-cement ratio of 0.5, which may be suitably adjusted for other water-cement ratios. It can be seen that for equal workability, the volume of coarse aggregate in a unit volume of concrete is dependent only on its nominal maximum size and grading zone of fine aggregate. Differences in the amount of mortar required for workability with different aggregates, due to differences in particle shape and grading, are compensated for automatically by differences in rodded void content.

Clause 4.2 and Clause 4.4 of IS 10262:2009

B.E. Civil Engineering - Third Year - First Semester

Concrete Technology

(part- II)

Time: Three Hours

Full Marks: 40

[Assume reasonable values of any data not given but required.]

No. of questions	Answer any two questions from question no 1, 2 1nd 3. Answer other two questions from question no 4,5 and 6.	Marks (4X10=40)
1)	The oxide composition of OPC is as follows: CaO (55%), SiO_2 (17%), Al_2O_3 (6%), Fe_2O_3 (3%), SO_3 (2%) Find the percentage of C_3S, C_2S, C_3A and C_4AF. What is lime saturation factor of this cement? On the basis of the result comment on this cement.	5+5
2)	i) Briefly discuss about the soundness test of cement. ii) Write the basic differences between quick setting cement and rapid hardening cement. What are the uses of these cements? What are the relevant IS codes?	5 5
3)	i) Write the basic differences between wet process and dry process of manufacturing of cement. ii) Write s short note on hydration of cement.	5 5
4)	i) Briefly explain different types of mixing process in Ready Mix Concrete. ii) Briefly describe about air entraining admixture. iii) Write a short note on metakaolin.	3 4 3
5	i) Write the functions of super plasticiser. What is the basic difference between super plasticiser and plasticiser? ii) What is the role of fiber in fiber reinforced concrete?	5 5
6)	i) Briefly explain wet and dry process of shortcrete. ii) What is admixture? Mention different type of admixtures.	5 5