Roll No.														

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST – 1

Semester: III
Course Code: CIV 219
Course Name: Building material & Concrete Technology
Program & Sem: B'Tech & 3rd sem

Date: 01-10-2019
Time: 2:30 PM to 3:30 PM
Max Marks: 40
Weightage: 20%

Instructions:

(i) ***Read the questions carefully and answer accordingly.***
(ii) ***All questions are compulsory***
(iii) ***Write appropriate diagrams if it is required.***

Part A

Answer All the Questions. **(3Qx4M=12M)**

Q.1 What is curing of concrete? What are different types of curing? [4M]
(C.O.1) [Bloom's level: Knowledge]

Q.2. Define Segregation and Bleeding of concrete. How is it caused? [4M]
(C.O.3) [Bloom's level: Knowledge]

Q.3. What are the functions of aggregates in concrete? [4M]
(C.O.1) [Bloom's level: Knowledge]

Part B

Answer both the Questions. Each question carries SIX marks. **(2Qx6M=12M)**

Q.4. What are admixtures in concrete? Name few chemical & mineral admixtures.
[(2+2+2)=6M] (C.O. No.2) [Bloom's level : Knowledge]

Q.5. Write the order of different stages of concreting. From fresh to hardened concrete

Curing, Mixing, Placing, Batching, Transportation, Compaction [6M]

(C.O.3) [Bloom's level: Application]

Part C

Answer both the Questions. Each question no carries EIGHT marks.(2Qx8M=16M)

Q.6. Which are the various types of tests on workability? Name and explain types different of slump results. [(2+6)=8M](C.O. No.3) [Bloom's level: Comprehension]

Q.7. Name the various steps involved in manufacture of cement with the help of **flow chart** {Wet process}. 08 [M](C.O. No: 1) [Bloom's level: Knowledge]

SCHOOL OF ENGINEERING

Semester: III

Course Code: CIV 219

Course Name: Building materials & Concrete Technology

Date: 01-10-2019

Time: 2:30PM to 3:30PM

Max Marks: 40

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
			K			C			A			
Q1	1	Module 1	4									4
Q2	3	Module 2	4									4
Q3	1	Module 1	4									4
Q4	2	Module 1	6									6
Q5	3	Module 2							6			6
Q6	3	Module 2				8						8
Q7	1	Module 1	8									8
	Total Marks		26			8			6			40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

Annexure- II: Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Date: 01-10-2019

Semester: III

Time: 2:30PM to 3:30PM

Course Code: CIV 219

Max Marks: 40

Course Name: Building materials & Concrete Technology

Weightage: 20%

Part A (3Qx 4M = 12Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
Q1	Curing may be defined as the operation of maintaining humidity and temperature of freshly placed concrete during some definite period following placing ,casting or finishing to assure satisfactory hydration of cement and proper hardening of the concrete Types of curing • Water Curing • Membrane Curing • Steam Curing • Accelerated Curing • Self Curing	**(2+2=4) marks**	**5min**

Q2	➢ Segregation is when the coarse and fine aggregate, and cement paste, **become separated**. Segregation may happen when the concrete is mixed, transported, placed or compacted ➢ Bleeding It is form of segregation in which water present in concrete mix is pushed upwards due to this water tends to move upwards. Bleeding ordinarily occurs in the wet mix of concrete.	**(2+2=4) marks**	**5min**
Q3	➢ Gives Body to concrete ➢ Provides Economy (cost of aggregates-1/4 to 1/8 of cement) ➢ Reduces Shrinkage – 10% reduction in aggregate can double the shrinkage in concrete ➢ Reduces thermal cracking ➢ Improves durability and strength ➢ Imparts unit weight to concrete	**4 marks**	**5min**

(2Q x6M = 12 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
Q4	Admixtures are the material, other than • Cement • Water • Aggregates • fiber reinforcement Which are used as an ingredient of concrete and is added to batch immediately before or during mixing to enhance certain properties • Types of Chemical Admixture • Plasticizers • Super plasticizers • Retarders and Retarding Plasticizers • Accelerators and Accelerating Plasticizers • Damp-proofing and Waterproofing Admixtures Few Mineral Admixtures Fly Ash Silica Fume Ground Granulated Blast Furnace Slag Surkhi Rice Husk Ash Metakaoline	(2+2+2=6Marks)	7Min
Q5	Batching→ Mixing→ Transportation→Placing→ Compaction→ Curing	6Marks	5min

Part C (2Q x 8M =16Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
Q6	Measurement of workabilty 1. Slump test 2. Compaction Factor test 3. Vee Bee Consistence test 4. Flow test Types Of Slump Collapse Slump 1. In a collapse slump the concrete collapses completely.	2M 4.5M 1.5M(fig)	10M

2. A collapse slump will generally mean that the mix is too wet or that it is a high workability mix, for which slump test is not appropriate.

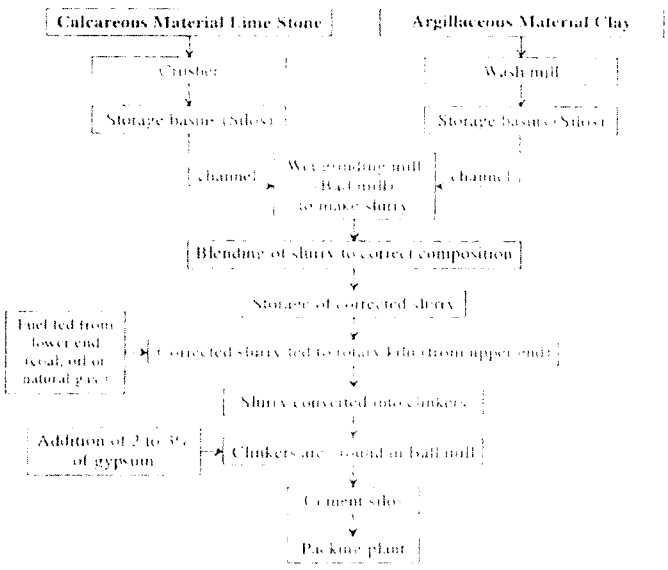
Shear Slump

1. In a shear slump the top portion of the concrete shears off and slips sideways. OR If one-half of the cone slides down an inclined plane, the slump is said to be a shear slump.
2. If a shear or collapse slump is achieved, a fresh sample should be taken and the test is repeated.
3. If the shear slump persists, as may the case with harsh mixes, this is an indication of lack of cohesion of the mix.

True Slump

1.In a true slump the concrete simply subsides, keeping more or less to shape
2.This is the only slump which is used in various tests.
3.Mixes of stiff consistence have a Zero slump, so that in the rather dry range no variation can be detected between mixes of different workability.
4.However , in a lean mix with a tendency to harshness, a true slump can easily change to the shear slump type or even to collapse, and widely different values of slump can be obtained in different samples from the same mix; thus, the slump test is unreliable for lean mixes

Fig.

Q7		8M	10 min

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GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem 2019-20 | **Date**: 19.11.2019

Course Code: CIV 219 | **Time**: 2:30 PM to 3:30 PM

Course Name: BUILDING MATERIAL & CONCRETE TECHNOLOGY | **Max Marks**: 40

Program & Sem: B.Tech (CIV) & III | **Weightage**: 20%

Instructions:

(i) Read the questions carefully and answer accordingly.
(ii) All questions are compulsory
(iii) IS codes IS 456 2000 & IS 10262 2009 are allowed

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries four marks. (3Qx4M=12M)

Q.1 Name the types of concrete strength to be considered for determining the quality of Hardened Concrete.

(C.O.NO.1) [Knowledge]

Q.2 Name the different tensile strength testing methods in concrete.

(C.O.NO.3) [Knowledge]

Q.3.List the factors affecting strength of concrete.

(C.O.NO.1) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries four marks. (2Qx4M=8M)

Q.4.a) Concrete is strong in_____, weak in _____.
(TENSION/COMPRESSION) choose the correct answer and fill the space.

b) What is creep in concrete. [(2+2)=4M]

(C.O.NO.2) [Knowledge]

Q.5. Match the following with very appropriate Options in the list [4M]
(C.O.NO.3) [Application]

List A	List B
a) Ultra sonic pulse velocity	Reduce durability
b) Shrinkage due to Water lost in gel pore	Plastic shrinkage
c) Reduction volume of fresh concrete due to Evaporation	Drying shrinkage
d) Cube Test	Non Destructive Test
e) Leaching phenomenon	Destructive Test

Part C [Problem Solving Questions]

Answer the Question. The Question carry twenty marks. (1Qx20M=20M)

Q.6. Propose a Mix design as per IS 10262-2009 and IS 456-2000 for the following data

- Grade Designation – M40
- Type of cement – OPC 43 Grade
- Type of Mineral Admixture – Fly Ash
- Maximum Nominal size of aggregates – 20mm
- Minimum Cement Content – 320kg/m^3
- Maximum w/c – 0.45
- Workability – 100mm (slump)
- Exposure Condition – Severe
- Method of concrete placing – Pumping
- Degree of Supervision – Good
- Type of aggregate – Crushed Angular Aggregate, Zone I fine aggregate
- Maximum Cement content – 450kg/m^3
- Chemical Admixture – Super plasticizer
- Specific Gravity of Admixture – 1.14
- Specific Gravity of Cement – 3.15
- Specific Gravity of Fly Ash – 2.2
- Specific Gravity of Coarse Aggregate – 2.74
- Specific Gravity of Fine Aggregate – 2.74

NOTE: Chemical Admixture – 2% by weight of cement is to be added – due to which 29% water demand can be reduced.

Fly Ash – 30% by weight of total cementitious material is to be added.

[(1x20=20M](C.O. NO.3) [Comprehension]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: III

Course Code: CIV 219

Course Name: Building material & Construction Technology

Date: 19-11-2019

Time: 2:30PM to 3:30PM

Max Marks: 40

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
			K			C			A			
Q1	1	Module 2	4									4
Q2	3	Module 2	4									4
Q3	1	Module 2	4									4
Q4	2	Module 2				4						4
Q5	3	Module 2				4						4
Q6	3	Module 3							20			20
	Total Marks		12			8			20			40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

Annexure- II: Format of Answer Scheme

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

SOLUTION

Semester: III

Course Code: CIV 219

Course Name: : BMCT

Date: 19-11-2019

Time: 2:30PM to 3:30PM

Max Marks: 40

Weightage: 20%

Part A (3Qx 4M = 12Marks)

Q No	• • **Solution**	**Scheme of Marking**	**Max. Time required for each Question**
Q1	• Compressive strength • Tensile strength • Bond strength • Shear strength • Impact strength • Fatigue strength	**(4) marks**	**5min**
Q2	• Modulus of rupture Test • Split tensile test • Direct tension test	**(4) marks**	**5min**
Q3	1. Influence of constitutional materials • Cement • Water • Aggregate • Admixture 2. Degree of compaction 3. Influence of curing 4. Influence of test conditions	**(4) marks**	**7min**

Part B (2Q x6M = 12 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
Q4 **a)**	a)Compression & Tension	(2+2=4marks)	5min
b)	**Creep is defined as the increase in strain (deformation) under a sustained stress (load).** When loaded, concrete experiences an instantaneous elastic strain, which is recoverable. **In addition, an inelastic creep strain takes place that is only partially recoverable**		
Q5 **a)**	Non Destructive Test Drying shrinkage Plastic shrinkage Destructive Test Reduce durability	4Marks	5min

Part C (2Q x 8M =16Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
Q6	SOLUTION: STEP 1: TARGET STRENGTH FOR MIX PROPORTIONING f'ck =fck + 1.65 s From Table I of IS 10262:2009, Standard Deviation, s = 5 N/mm2. Therefore, target strength = 35 + 1.65 x 5 = 43.25 N/mm2. STEP 2: SELECTION OF WATER•CEMENT RATIO Adopted maximum water-cement ratio = 0.40 From the Table 5 of IS 456 for Very severe Exposure maximum Water Cement Ratio is 0.45 STEP 3: SELECTION OF WATER CONTENT from Table 2 of IS 10262:2009, Maximum water content for 20 mm aggregate = 186 litre (for 25 to 50 mm slump range) Estimated water content for 100 mm slump = 186+ (6/186) = 197 litre. (Note: If Super plasticizer is used, the water content can be reduced upto 20% and above.) Based on trials with Super	20 marks	25 min

plasticizer water content reduction of 20% has been achieved, Hence the arrived water content = 197-[197 x (20/100)] = 158 litre.

STEP 4:

CALCULATION OF CEMENTITOUS CONTENT Adopted w/c Ratio = 0.40 Cement Content = 158/0.40 = 395 kg/m3 From Table 5 of IS 456, Minimum cement content for 'Very severe' exposure conditions 340kg/m3 = 395 kg/m3 > 340 kg/m3 hence ok. Now, to proportion a mix containing fly ash the following steps are suggested: NOTE - This illustrative example is with increase of 10 percent cementitious material content WHEN FLY ASH OR ANY OTHER MINERLA ADMIXTURE IS USED Cementitious material content = 395x1.10 = 434.5 kg/m3 Fly ash @ 30% of total cementitious material content = 130.35 kg/m3 Cement content = 434.5 – 130.35 = 304.15 kg/m3

STEP 5: PROPORTION OF VOLUME OF COARSE AGGREGATE AND FINE AGGREGATE CONTENT From Table 3 of (IS 10262:2009) Volume of coarse aggregate corresponding to 20 mm size aggregate and fine aggregate (Zone II) for water-cement ratio of 0.50 =0.62 . In the present case water-cement ratio is 0.40. Therefore, volume of coarse aggregate is required to be increased to decrease the fine aggregate content. As the water-cement ratio is lower by 0.1. The proportion of volume of coarse aggregate is increased by 0.02 (at the rate of -/+ 0.01 for every ± 0.05 change in water-cement ratio). Therefore, corrected proportion of volume of coarse aggregate for the water-cement ratio of 0.40 = 0.62+0.02 = 0.64
For pumpable concrete these values should be reduced up to 10%. Therefore, volume of coarse aggregate =0.64 x 0.9 =0.576. Volume of fine aggregate content = 1 – 0.576= 0.424.

STEP 6: MIX CALCULATIONS The mix calculations per unit volume of concrete shall be as follows:
a) Volume of concrete = 1 m3
b) Volume of cement = [Mass of cement] / {[Specific Gravity of Cement] x 1000} = 385/{3.15 x 1000} = 0.122 m3
c) Volume of fly ash = [Mass of fly ash] / {[Specific Gravity of fly ash] x 1000} = 130.35/{2.2x1000} = 0.0593 m3
d) Volume of water = [Mass of water] / {[Specific Gravity of water] x 1000} = 158/ {1 x 1000} = 0.158m3
e) Volume of chemical admixture = 1.54 litres/ m3 (By Trial and Error Method used 0.4% by the weight cement) = 1.54/{1.145 x 1000} =0.00134 m3
f) Volume of all in aggregate = [a-(b+c+d+e)] = [1-(0.122+0.0593+0.158 + 0.00134)] = 0.659 m3
f) Mass of coarse aggregate= e x Volume of Coarse Aggregate x Specific Gravity of Fine Aggregate x 1000 = 0.659 x 0.576 x 2.67 x 1000 = 1013.48 kg/m3

	g) Mass of fine aggregate= e x Volume of Fine Aggregate x Specific Gravity of Fine Aggregate x 1000 = 0.659 x 0.424 x 2.60 x 1000 = 726 kg/m3 STEP 7: MIX PROPORTIONS Cement = 304 kg/m3 FLY ASH = 130.35 kg/m3 (30% By Total weight of Cement) Water = 158 kg/m3 Fine aggregate = 726 kg/m3 Coarse aggregate 20mm = 1013.48 kg/m3 12mm = 202.69 kg/m3 (20% By Total weight of Coarse Aggregate) Chemical admixture = 1.54 kg/m3 (0.4% by the weight of cement) Water-cement ratio = 0.40 Mix Proportion By weight = 1 : 2.38 : 3.33		

Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20 | **Date**: 28 December 2019

Course Code: CIV 219 | **Time**: 1.00 PM to 4.00 PM

Course Name: BUILDING MATERIALS AND CONCRETE TECHNOLOGY | **Max Marks**: 80

Program & Sem: B.Tech (CIV) & III | **Weightage**: 40%

Instructions:

(i) Read the all questions carefully and answer accordingly.
(ii) Use of IS 456-2000 and IS 10262-2009 is permitted
(iii) Draw neat sketches wherever necessary

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 4 marks. (5Qx4M=20M)

1. Define initial setting time and final setting time of cement (C.O.No.1) [Knowledge]
2. List the different non-destructive testing methods used to estimate the strength of hardened concrete (C.O.No.3) [Knowledge]
3. Name the different Natural and Artificial Timber seasoning methods (C.O.No.5) [Knowledge]
4. List the advantages of light weight concrete (C.O.No.4) [Knowledge]
5. Write the difference between Chemical Admixture and Mineral Admixture (C.O.No.2) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries 10 marks. (2Qx10M=20M)

6. Give the classification of timber and draw the cross-section of exogenous growth of timber with all the parts (C.O.No.5) [Comprehension]
7. What are the three main steps involved in the manufacture of ordinary Portland cement. Draw the schematic representation of wet process of manufacture of Ordinary Portland Cement. (C.O.No.1) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries 20 marks (2Qx20M=40M)

8. Propose a Mix design as per IS 10262-2009 and IS 456-2000 for the following data
   - Grade Designation – M40
   - Type of cement – OPC 43 Grade
   - Maximum Nominal size of aggregates – 20mm
   - Minimum Cement Content – 320kg/m^3

- Maximum w/c – 0.45
- Workability – 100mm (slump)
- Exposure Condition – Severe (for reinforced concrete)
- Method of concrete placing – Pumping
- Degree of Supervision – Good
- Type of aggregate – Crushed Angular Aggregate
- Maximum Cement content – 450kg/m^3
- Chemical Admixture – Super plasticizer
- Specific Gravity of Admixture – 1.145
- Specific Gravity of Cement – 3.15
- Specific Gravity of Coarse Aggregate – 2.74
- Specific Gravity of Fine Aggregate – 2.74
- Fine aggregates confirming to zone-I (C.O.No.4) [Application]

9. Propose a mix design for the following data:

a) Grade designation: M35
b) Type of cement: OPC 53 Grade conforming IS 12269
c) Maximum nominal size of aggregate: 20mm
d) Minimum cement content: 340 kg/m3 (IS 456:2000)
e) Maximum water-cement ratio: 0.40 (Table 5 of IS 456:2000)
f) Workability: 100-120mm slump
g) Exposure condition: Moderate (For Reinforced Concrete)
h) Method of concrete placing: Pumping
j) Degree of supervision: Good
k) Type of aggregate: Crushed Angular Aggregates
m) Maximum cement content: 390 kg/m3
n) Chemical admixture type: Super Plasticizer ECMAS HP 890
o) Fly ash = 30% by weight of cement and specific gravity of 2.2

A-2 TEST DATA FOR MATERIALS

a) Cement used: OPC 53 Grade conforming IS 12269
b) Specific gravity of cement: 3.15
c) Chemical admixture: Super Plasticizer (specific gravity =1.145)
d) Specific gravity of
1) Coarse aggregate 20mm: 2.67 2) Fine aggregate: 2.65 3) FLY ASH: 2.2 (JSW)
e) Water absorption:
1) Coarse aggregate: 0.5 %
2) Fine aggregate (M.Sand): 2.5 %
f) Sieve analysis:
1) Coarse aggregate: Conforming to all in aggregates of Table 2 of IS 383
2) Fine aggregate: Conforming to Grading Zone II of Table 4 of IS 383

(C.O.No.4) [Application]

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1	1	1	4			4
2	3	2	4			4
3	5	4	4			4
4	4	3	4			4
5	2	1	4			4
6	5	4		10		10
7	1	1		10		10
8	4	3			20	20
9	4	3			20	20
	Total Marks		20	20	40	80

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60% of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem. 2019-20
Course Code: CIV 219
Course Name: Building Materials and Concrete Technology
Program & Sem: B.Tech (Civil) & Third

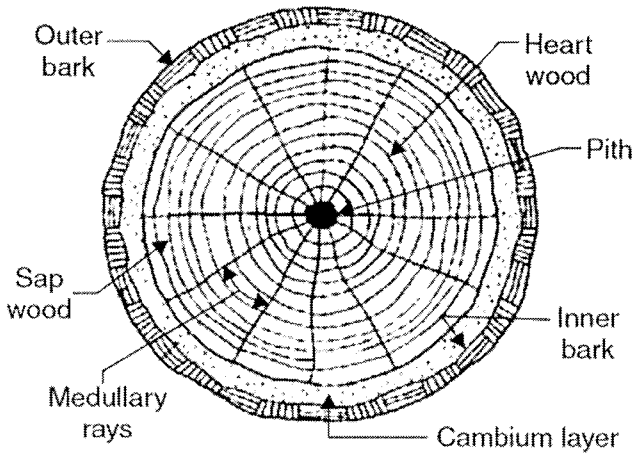
Date: 28.12.2019
Time: 3 HRS
Max Marks: 80
Weightage: 40%

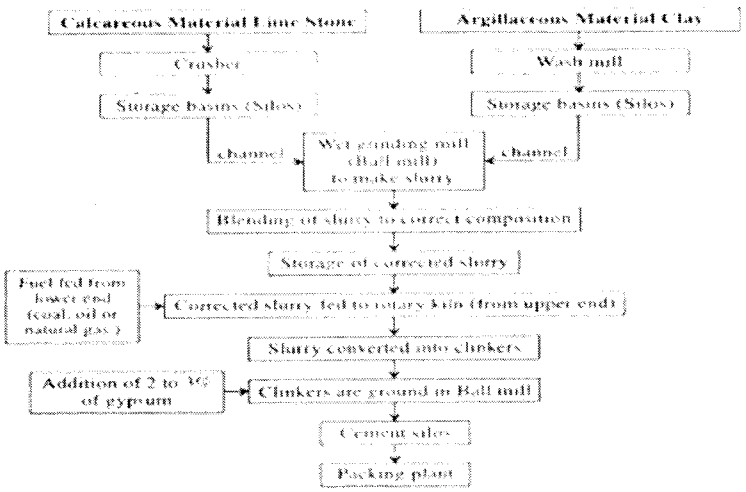
Part A (5Q x 4M = 20Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	• **Initial set:** Occurs when the paste begins to stiffen considerably. • **Final set:** Occurs when the cement has hardened to the point at which it can sustain some load. The initial setting time should not be less than 30 minutes Final Setting time should be less 10 hours	Each definition 2 Marks each	10 Minutes
2	-Rebound Hammer Test -Ultrasonic Pulse Velocity Test -Pull out Test -Penetration Test -Core Extraction Principles and Application	Each point 1 Mark. Any 4 – 4 Marks	10 Minutes
3	Natural Seasoning Methods - Air Seasoning - Water Seasoning Artificial Seasoning Methods - Boiling - Electrical Seasoning - Chemical Seasoning - Kiln Seasoning	All methods have to be written – 4 Marks Reduce 0.5 each for missing methods	10 Minutes
4	➢ Reduction of Dead load due to less density. ➢ Increases progress of work due to less weight. ➢ Lowers Haulage and Handling charges. ➢ In extreme climatic conditions, use of LWC is advisable because of high thermal insulation (due to porousness). ➢ More sound and heat insulation. ➢ Its volume per unit weight is more than that of conventional concrete, because of low density, results in economical construction. ➢ Due to low density, it reduces the size and the cost of structural members such as beams, columns, foundations etc.	Any 4 points – 4 Marks	10 Minutes

	➢ This is advantageous in the case of tall structures which are to be constructed on soils of low bearing capacity. ➢ It is eco-friendly because it gives an outlet for industrial waste such as clinker, fly ash, slag etc. which otherwise create pollution.		
5	<table><tr><th>Mineral Admixtures</th><th>Chemical Admixtures</th></tr><tr><td>Finely ground pozzolanic materials which can replace cement to a certain extend</td><td>Chemical compounds added to concrete to improve specific functions of concrete</td></tr><tr><td>Types – GGBS, Silica Fume, Fly Ash, Rice Husk Ash</td><td>Types – Accelerators, Retarders, Plasticizers, Super plasticizers</td></tr></table>	2 Points in each mineral and chemical admixture – 4 Marks. Apart from these points any relevant points with respect to mineral and chemical admixture can be considered at the discretion of evaluator.	10 Minutes

Part B (2Q x 10M = 20 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	Classification of Timber (a) Based on Mode of Growth – Endogenous, Exogenous (b) Based on Availability (c) Based on Durability (d) Based on Modulus of Elasticity (e) Based on Grading 	Classification of Timber – 5 Marks Cross-section of Timber with correct markings – 5 Marks	20 Minutes

7	Three main steps in the manufacture of cement – Mixing of Raw materials Burning Grinding 	Steps in Manufacturing of cement – 2 Marks Flow chart – 8 Marks	20 Minutes

Part C (2Q x 20M = 40Marks)

Q No	Solution	Scheme of Marking	Ma Tin requ for e Ques
8	The Steps for Mix Design are given below **A-3 TARGET STRENGTH FOR MIX PROPORTIONING** $f'_{ck} = f_{ck} + 1.65\,s$ where f'_{ck} = target average compressive strength at 28 days, f_{ck} = characteristic compressive strength at 28 days, and s = standard deviation. From Table 1, standard deviation, s = 5 N/mm^2. Therefore, target strength = 40 + 1.65 × 5 = 48.25 N/mm^2. **A-4 SELECTION OF WATER-CEMENT RATIO** From Table 5 of IS 456, maximum water-cement ratio = 0.45. Based on experience, adopt water-cement ratio as 0.40. 0.40 < 0.45, hence O.K. **A-5 SELECTION OF WATER CONTENT** From Table 2, maximum water content for 20 mm aggregate = 186 litre (for 25 to 50 mm slump range) Estimated water content for 100 mm slump = $186 + \frac{6}{100} \times 186$ = 197 litre As superplasticizer is used, the water content can be reduced up 20 percent and above. Based on trials with superplasticizer water content reduction of 29 percent has been achieved. Hence, the arrived water content = 197 × 0.71 = 140 litre **A-6 CALCULATION OF CEMENT CONTENT** Water-cement ratio = 0.40 Cement content = $\frac{140}{0.40}$ = 350 kg/m^3 From Table 5 of IS 456, minimum cement content for 'severe' exposure condition = 320 kg/m^3 350 kg/m^3 > 320 kg/m^3, hence, O.K	Each Step of Mix design – 2 Marks (5*2 – 10 Marks) Proportioning- 8 Marks Writing the quantity of materials – 1 Mark Writing the mix proportion by weight – 1 Marks Total – 20 Marks	4 Minu

A-7 PROPORTION OF VOLUME OF COARSE AGGREGATE AND FINE AGGREGATE CONTENT

From Table 3, volume of coarse aggregate corresponding to 20 mm size aggregate and fine aggregate (Zone I) for water-cement ratio of 0.50 = 0.60

In the present case water-cement ratio is 0.40. Therefore, volume of coarse aggregate is required to be increased to decrease the fine aggregate content. As the water-cement ratio is lower by 0.10, the proportion of volume of coarse aggregate is increased by 0.02 (at the rate of +/- 0.01 for every ± 0.05 change in water-cement ratio). Therefore, corrected proportion of volume of coarse aggregate for the water-cement ratio of 0.40 = 0.62.

NOTE — In case the coarse aggregate is not angular one, then also volume of coarse aggregate may be required to be increased suitably, based on experience.

For pumpable concrete these values should be reduced by 10 percent.

Therefore, volume of coarse aggregate = 0.62 × 0.9 = 0.56.

Volume of fine aggregate content = 1 – 0.56 = 0.44.

A-8 MIX CALCULATIONS

The mix calculations per unit volume of concrete shall be as follows:

a) Volume of concrete = **1 m³**

b) Volume of cement $= \frac{\text{Mass of cement}}{\text{Specific gravity of cement}} \times \frac{1}{1\,000}$

$= \frac{350}{3.15} \times \frac{1}{1\,000}$

$= \mathbf{0.111\ m^3}$

c) Volume of water $= \frac{\text{Mass of water}}{\text{Specific gravity of water}} \times \frac{1}{1\,000}$

Quantity of Materials required for mix Proportion

Cement	=	350 kg/m³
Water	=	140 kg/m³
Fine aggregate	=	896 kg/m³
Coarse aggregate	=	1 140 kg/m³
Chemical admixture	=	7 kg/m³
Water-cement ratio	=	0.4

Mix Proportion by weight of cement

Cement: Fine Aggregate: Coarse Aggregate
1:2.56:3.26

9	STEP 1: TARGET STRENGTH FOR MIX PROPORTIONING f'ck =fck + 1.65 s where f'ck = target average compressive strength at 28 days, fck = characteristics compressive strength at 28 days, and s = standard deviation. From Table I of IS 10262:2009, Standard Deviation, s = 5 N/mm2. Therefore, target strength = 35 + 1.65 x 5 = 43.25 N/mm2. STEP 2: SELECTION OF WATER•CEMENT RATIO Adopted maximum water-cement ratio = 0.40 From the Table 5 of IS 456 for Very severe Exposure maximum Water Cement Ratio is 0.45 STEP 3: SELECTION OF WATER CONTENT from Table 2 of IS 10262:2009, Maximum water content for 20 mm aggregate = 186 litre (for 25 to 50 mm slump range) Estimated water content for 100 mm slump = 186+ (6/186) = 197 litre. (Note: If Super plasticizer is used, the water content can be reduced upto 20%	Each Step of Mix design – 2 Marks (5*2 – 10 Marks) Proportioning- 8 Marks Writing the quantity of materials – 1 Mark Writing the mix proportion by weight – 1 Marks	45 Minu

	and above.) Based on trials with Super plasticizer water content reduction of 20% has been achieved, Hence the arrived water content = 197-[197 x (20/100)] = 158 litre. STEP 4: CALCULATION OF CEMENTITOUS CONTENT Adopted w/c Ratio = 0.40 Cement Content = 158/0.40 = 395 kg/m3 From Table 5 of IS 456, Minimum cement content for 'Very severe' exposure conditions 340kg/m3 = 395 kg/m3 > 340 kg/m3 hence ok. Now, to proportion a mix containing fly ash the following steps are suggested: NOTE - This illustrative example is with increase of 10 percent cementitious material content WHEN FLY ASH OR ANY OTHER MINERLA ADMIXTURE IS USED Cementitious material content = 395x1.10 = 434.5 kg/m3 Fly ash @ 30% of total cementitious material content = 130.35 kg/m3 Cement content = 434.5 – 130.35 = 304.15 kg/m3 STEP 5: PROPORTION OF VOLUME OF COARSE AGGREGATE AND FINE AGGREGATE CONTENT From Table 3 of (IS 10262:2009) Volume of coarse aggregate corresponding to 20 mm size aggregate and fine aggregate (Zone II) for water-cement ratio of 0.50 =0.62 . In the present case water-cement ratio is 0.40. Therefore, volume of coarse aggregate is required to be increased to decrease the fine aggregate content. As the water-cement ratio is lower by 0.1. The proportion of volume of coarse aggregate is increased by 0.02 (at the rate of -/+ 0.01 for every ± 0.05 change in water-cement ratio). Therefore, corrected proportion of volume of coarse aggregate for the water-cement ratio of 0.40 = 0.62+0.02 = 0.64 For pumpable concrete these values should be reduced up to 10%. Therefore, volume of coarse aggregate =0.64 x 0.9 =0.576. Volume of fine aggregate content = 1 – 0.576= 0.424. STEP 6: MIX CALCULATIONS The mix calculations per unit volume of concrete shall be as follows: a) Volume of concrete = 1 m3 b) Volume of cement = [Mass of cement] / {[Specific Gravity of Cement] x 1000} = 385/{3.15 x 1000} = 0.122 m3 c) Volume of fly ash = [Mass of fly ash] / {[Specific Gravity of fly ash] x 1000} = 130.35/{2.2x1000} = 0.0593 m3 d) Volume of water = [Mass of water] / {[Specific Gravity of water] x 1000} = 158/ {1 x 1000} = 0.158m3 e) Volume of chemical admixture = 1.54 litres/ m3 (By Trial and Error Method used 0.4% by the weight cement) = 1.54/{1.145 x 1000} =0.00134 m3 f) Volume of all in aggregate = [a-(b+c+d+e)] = [1-(0.122+0.0593+0.158 + 0.00134)] = 0.659 m3 f) Mass of coarse aggregate= e x Volume of Coarse Aggregate x Specific	Total – 20 Marks	

	Gravity of Fine Aggregate x 1000 = 0.659 x 0.576 x 2.67 x 1000 = 1013.48 kg/m3 g) Mass of fine aggregate= e x Volume of Fine Aggregate x Specific Gravity of Fine Aggregate x 1000 = 0.659 x 0.424 x 2.60 x 1000 = 726 kg/m3 STEP 7: MIX PROPORTIONS Cement = 304 kg/m3 FLY ASH = 130.35 kg/m3 (30% By Total weight of Cement) Water = 158 kg/m3 Fine aggregate = 726 kg/m3 Coarse aggregate 20mm = 1013.48 kg/m3 12mm = 202.69 kg/m3 (20% By Total weight of Coarse Aggregate) Chemical admixture = 1.54 kg/m3 (0.4% by the weight of cement) Water-cement ratio = 0.40 Mix Proportion By weight = 1 : 2.38 : 3.33		