Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore

	Course Title: **CONCRETE TECHNOLOGY**		
	Credits (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15CE43T**
	Type of Course: **Lectures, Self Study & Student activity**	Credit **:04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Pre-requisites: Student should have the knowledge of basics of civil engineering, fundamentals of chemistry and building materials.

Course Objectives:

The student should be able to

1. Adopt the basic knowledge of science and engineering to properties of concrete.
2. Imbibe the culture of professional and ethical responsibilities by following codal provisions in concrete mix design.
3. Identify and solve problems in concrete mix design.
4. Engage in lifelong learning with the advances in concrete technology.

At the end of the course the students should be able to

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Define concrete; understand the functional role of ingredients in concrete and the application of concrete as a building material.	R/U/Ap	1,2,3,5	9
CO2	Explain the significance of water cement ratio, differentiate the behavior of concrete in fresh and hardened states, and know the fundamental characteristics of fresh and hardened concrete.	R/U/Ap	1,2,3,4,5	17
CO3	Design concrete mixes as per codal provisions.	R/U/Ap/Ay	1,2,3,4,5,6,7	7
CO4	Summarize the sequence and procedure of concreting operations and the importance of joints in concrete structures.	R/U	1,2,4,5	12
CO5	Discover the need for sustainability and study the usage of waste/ recycled materials in concrete	R/U/Ap/		7
CO6	Evaluate the effect of the environment on service life performance, properties and failure modes of structural concrete and present it as a case study.	R/U/Ap/ Ay/ C	1,2,3,4,5, 6,7,8,9,10	*
			Total sessions	**52**

Legend- R; Remember U:Understand Ap: Application Ay: Analysis C:Creation E: Evaluation

*** Related to Student activity beyond classroom hours.**

Programme outcome Attainment Matrix

Course	Programme Outcome									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
	Basic knowledge	Discipline knowledge	Experiments and Practice	Engineering Tools	Engineer and society	Environment & Sustainability	Ethics	Individual and Team work	Communication	Life long learning
Concrete technology	3	3	3	3	3	2	2	1	1	1

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

DETAILED COURSE CONTENT

UNIT	COURSE CONTENTS	HOURS
1	**INTRODUCTION: -** Definition of concrete. Advantages of concrete. Uses of concrete in comparison to other building materials. **CONCRETE INGREDIENTS** **Cement** – Chemical composition, grades of cement, Tests on cement-(fineness, normal consistency, setting time, soundness, and compressive strength) **i) Storing Cement**:- (a) Storing of cement in the warehouse., (b) Storing of cement at site., (c) Effect of storage on strength of cement **Water** -Quality of mixing water, Limits on the impurities as per ISI. **Fine aggregate** – specific gravity, density, moisture content, bulking, sieve analysis, grading of aggregates, deleterious materials, emerging trends of fine aggregate-manufactured sand. **Coarse aggregate** – importance of size, shape and texture, grading of aggregates, sieve analysis, specific gravity, flakiness and elongation index, crushing, impact and abrasion tests. . Aggregate:- Storing of aggregate on site for maintaining uniformity of moisture and cleanliness. **Admixtures** **Chemical admixtures**– (uses and effect):- plasticizers, accelerator, retarders and air entraining gents, carboxyclic based admixtures. **Mineral admixtures** –fly ash, blast furnace slag, meta-kaolin, Silica fume, rice husk ash.	**9**
2	**Behavior of concrete** Hydration of cement, Bogue's compounds, gel/space ratio, Calcium silicate hydrate, calcium hydroxide, calcium aluminates hydrates, water requirement for hydration, Water Cement Ratio- water cement ratio law and conditions under which the law is valid, Effect of various W/C ratios on the physical structure of hydrated cement, internal moisture, temperature, age, and size of specimen. Definition of cube strength	**5**

UNIT	COURSE CONTENTS	HOURS
	of concrete. Relations between water cement ratio and strength of concrete, Structure of concrete, transition zone,	
3	**PROPERTIES OF CONCRETE**: **Properties of Fresh concrete**: Workability – definition, factors affecting workability, measurement of workability by slump, compaction factor, vee-bee, flow tests. Segregation and bleeding. **Properties of hardened concrete**:- (a) Strength. Characteristic strength, (b) Durability, (c) Permeability., Factors affecting strength, w/c ratio, maturity concept, effect of aggregate properties, compressive strength, tensile strength, bond strength, modulus of rupture, modulus of elasticity, poisson ratio, the relationship between these parameters., aggregate-cement bond strength. **Shrinkage** – plastic shrinkage and drying shrinkage, factors affecting shrinkage. **Creep** – measurement of creep, factors affecting creep, effect of creep. **Durability** – definition, significance, permeability, Factors contributing to cracks in concrete – plastic shrinkage, settlement cracks, Thermal expansion, and structural design deficiencies. Concrete in Aggressive Environment: Alkali – Aggregate Reaction, Sulphate Attack, Chloride Attack, Acid Attack, Effect of Sea Water, Carbonation, special coating for Water Proofing, Freezing and thawing, Tests on hardened concrete – compressive strength, split tensile strength, flexural strength, non-destructive testing of concrete. (d) Dimensional changes. (iii) Quality Control at site:- Control tests on cement, aggregate water and concrete. Concept of quality control.	**12**
4	**CONCRETE MIX DESIGN**: Concept of mix design, Objectives of mix design, grades of concrete, different methods of mix design, factors affecting mix proportions variables in proportioning, exposure conditions, Design data for moisture, bulkage, absorption and suitable fine aggregate and coarse aggregate ratio, Procedure of mix design as per IS 10262-2009, numerical examples of mix design as per IS 10262- 2009 and IS 456 Adjustment on site for Bulking, water content, Absorption, Workability	**07**
5	**CONCRETE OPERATIONS**:- **(ii)Batching**:- (a) Batching of cement, (b) Batching of aggregate: Batching by volume, using gauge box, selection of proper gauge box, Batching by weight-spring balances and by batching machines., (c) Measurement of water. **(iii)Mixing** (a) Hand mixing (b) Machine mixing-types of mixer, capacities of mixers, choosing appropriate size of mixers, operation of mixers, mixing of water.(c) Maintenance and care of machines. precautions before, during and after concreting **(iv)Transportation of Concrete**:- Transportation with and situations of use of the following- pans, wheel barrows, transit mixers, chutes, belt conveyors, pumps, tower cranes. Ready-mix concrete-manufacturing of ready mix concrete **(v) Placement of Concrete** :(a) Prior preparation before placement; when put on natural soil, rocky base, specially prepared sub-base (brick soling and water bound macadam base), hardened concrete base, checking of form work, checking provision for joints. (b) Placement of concrete-precautions to be taken. **(vi) Compaction** :(a) Hand compaction-pavement, narrow and deep members. (b) Machine compaction-types of vibrators-internal and external-Method of handling-suitability for various situations. **(vii)Finishing concrete slabs**-screeding, floating, and trowelling.	**14**

UNIT	COURSE CONTENTS	HOURS
	Hot Weather Concreting- Cold Weather Concreting-under water concreting **(viii)Curing**:- Object of curing, Method of curing,- conventional and advanced Recommended duration for curing. **(ix)Jointing**:- Importance, types, Location	
6	**Special types of concrete**:- sustainability- application of waste/ recycled materials in concrete. Comparison of the following special concrete with conventional concrete- High strength concrete, fiber reinforced concrete, polymer concrete, ferrocement concrete. Foamed concrete, pervious concrete, high density concrete, self-compacting concrete, high performance concrete, Reinforced Cement concrete pavement quality concrete (Composition advantages and specific applications only) Suggested activity (Case study)	**05**

SUGGESTED ACTIVITIES

The topic should be related to the course in order to enhance his knowledge, practical skill & and lifelong learning, communication, modern tool usage.

1. Prepare a Spread sheet of concrete mix design template which helps to design the concrete mix and prepare practical test report consulting industry.
2. Prepare a detailed search report of Non-destructive test on concrete and present it.
3. Prepare a literature survey on Repairs and rehabilitation of structures.
4. Design a concrete mix as per ACI.
5. Visit your Institute's Library / internet centre and enlist the books available on the topic given by your teacher. Prepare a bibliography consisting name of the author, title of the book, publication and place of publication. Enlist the magazines, periodicals and journals being available in your library.(any one)
    a) Sustainable concrete buildings / Concrete green building
    b) Present scope of Epoxy and Polyurethane in construction industry.
    c) Strength and durability relationship, volume change in concrete
    d) permeability of concrete
    e) Alkali aggregate reaction,
    f) Chloride attack, sulphate attack etc.
    g) Corrosion of steel - causes of corrosion, remedial measure to control
    h) Ultrasonic Pulse Velocity - techniques of measuring and factors affecting measurement of Ultrasonic Pulse Velocity
    i) Cover meter and Corrosion meter
    j) Polymer concrete
    k) Fiber reinforced concrete
    l) No fines concrete
    m) Ferrocement
6. Writing report on (any one)
    a) Latest standards, specification, Test methods of ASTM /AASHTO/NRMCA.
    b) Case study of Concrete and grunting conducted in any project

c) Study on determine physical properties of ingredients of concrete in laboratory
d) Minimum & Maximum cement content on durability of Concrete
e) Schmidt's rebound hammer test concrete with their limitation
f) Vacuum concrete
g) Shortcreting
h) Vacuum Dewatered Concrete
i) Pavement quality concrete
j) RMC

7. Self-Compacting Concrete (SCC) – Mix Design and methods of testing.
8. Concrete Mix Design by DOE Method.
9. Mix design of fly ash concrete by IS 10262 – 2009.
10. Water permeability test on concrete.

NOTE

1. Students should select any one of the above or other topics relevant to the subject approved by the concerned faculty, individually or in a group of 3 to 5. Students should mandatorily submit a written report and make a presentation on the topic. The task should not be repeated among students. Report will be evaluated by the faculty as per rubrics. Weightage for 5 marks Internal Assessment shall be as follows: (Unsatisfactory **1**, Developing **2**, Satisfactory **3**, Good **4**, Exemplary**5**)

2. Reports should be made available along with bluebooks to IA verification officer

Example of model of rubrics / criteria for assessing student activity

Dimension	**Students score (Group of five students)**				
	STUDENT 1	STUDENT 2	STUDENT 3	STUDENT 4	STUDENT 5
Rubric Scale	Unsatisfactory **1**, Developing **2**, Satisfactory **3**, Good **4**, Exemplary5				
1.Literature	5				
2.Fulfill team's roles & duties	2				
3.Conclusion	3				
4.Convensions	4				
Total	13				
Average=(Total /4)	3.25=4				
Note: Concerned faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity for 5 marks One activity to attain last CO (course outcome) may be					

given to a group of FIVE students

Note: Dimension should be chosen related to activity and evaluated by the course faculty

Dimension	Rubric Scale				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary
1.Literature	Has not included relevant info	Has included few relev ant info	Has included some relev ant info	Has included many relev ant info	Has included all relevant info needed
2. Fulfill team's roles & duties	Does not perform any duties assigned	Performs very little duties	Performs partial duties	Performs nearly all duties	Performs all duties of assigned team roles
3.Communication	Poor	Less Effective	Partially effective	Effective	Most Effective
4.Convensions	Frequent Error	More Error	Some Error	Rare Error	No Error

Course Delivery: The course will be delivered through lectures, demonstration, site visits, expert lectures**.**

Course Assessment and Evaluation Scheme:

	What		To whom	When/Where (Frequency in the course)		Max Marks	Evidence collected	Course outcomes
Direct Assessment method	CIE	IA	Students	Thrice test (Average of three tests)	Test 1	20	Blue books	1,2
					Test 2			2,3
					Test3			4,5
				Mini project		05	Report	1,2,3,4,5
	SEE	End Exam		End of the course		100	Answer scripts at BTE	1,2,3,4,5
Indirect Assessment	Student Feedback on course		Students	Middle of the course			Feedback forms	1, 2, Delivery of course
	End of Course Survey			End of the course			Questionnaires	1,2,3,4,5,6 Effectiveness of Delivery of instructions & Assessment Methods

***CIE** – Continuous Internal Evaluation ***SEE** – Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Weightage of Marks and blue print of marks for SEE

Unit	Major Topics	Hours Allotted	Questions to be set for SEE – Cognitive Levels R	U	Ap	Ay	Marks weightage	weightage (%)	A*	B*
1	Introduction to Concrete and Concrete Ingredients	9	40% **10**	20% **5**	40% **10**	0% **0**	25	17	1	2
2	Behavior of concrete	5	70% **10**	30% **5**	0% **0**	0% **0**	15	10	1	1
3	Properties of Concrete	12	50% **15**	50% **15**	0% **0**	0% **0**	30	23	2	2
4	Concrete Mix Design	7	21% **5**	20% **5**	20% **5**	40% **10**	25	13	1	2
5	Concrete Operations	12	50% **15**	33% **10**	17% **5**	0% **0**	30	23	2	2
6	Special types of concrete	7	25% **5**	75% **15**	0% **0**	0% **0**	20	13	2	1
Total		52	**43%** **60**	**38%** **55**	**13%** **20**	**7%** **10**	145	100	9	10

A*-SEE QUESTIONS TO BE SET FOR (05MARKS) in PART – A
B*- SEE QUESTIONS TO BE SET FOR (10MARKS) in PART – B (mix design problem compulsory)

Questions for CIE and SEE will be designed to evaluate the various educational components such as:

Sl. No	Bloom's taxonomy	% in Weightage
1	Remembering and Understanding	**81**
2	Applying the knowledge acquired from the course	**13**
3	Analysis	**7**
4	Synthesis (Creating new knowledge)	**0**
5	Evaluation	**0**

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM		20
	Year:		
Name of Course coordinator : CO's:____			Units:__

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

Model Question Paper for CIE (Tests)

Test/Date and Time	Semester/year		Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 Am	**IV SEM**		Concrete technology	**20**
	Year: 2015-16		**Course code:15CE43T**	

Name of Course coordinator :
Course outcome :CO1, CO2
Note: Answer all questions

	Question	**M**	**CL**	**CO**	**PO**
1	Mention the Chemical composition of cement OR Mention the different test conducted on cement	**5**	**R**	**1**	**1,2,3 ,5**
2	Differentiate between chemical admixtures and mineral admixtures?	**3**	**U**	**1**	**1,2,5**
3	Which test should be conducted to determine the expansion of cement? And how?	**6**	**Ap**	**1**	**1,2,3 4,5**
4	Write the difference between Gel/space ratio and water cement ratio OR Differentiate between hydration of cement and heat of hydration	**6**	**R/ U**	**2**	**1,2,5**

Textbooks:

1. Neville A.M., Concrete Technology, Standard Publishers Distributors, Delhi.
2. IS: 10262 – 2009 recommended guidelines for Concrete Mix design – BIS Publications
3. Shetty MS, Concrete technology, Chand S and Co.
4. Gambhir B L, Concrete Technology, Tata McGraw Hill, New Delhi
5. Concrete Technology - Theory & Practice - R.S. Varshney
6. Concrete Technology - A.R.Santhakumar
7. Concrete Technology R. S. Varshnay New Chand & Brothers,

.

Reference I.S. Codes

1. I.S.4031- (Part 1 to Part 6) Indian standard method of physical tests for hydraulic cement, BIS, New Delhi.

I.S.4031 (Part 1) - 1996 Part 1 – Determination of fineness by dry sieving. I.S.4031(Part 2) -1999 Part 2 – Determination of fineness by air permeabilitymethod.

I.S.4031(part 3) -1988 (reaffirmed 2000) Part 3– Determination of soundness
I.S.4031(part 4) - 1988 (reaffirmed 1995)

Part 4 - Determination of consistency of standard cement paste. I.S.4031 (part 5) – 1988, (reaffirmed 2000) Part 5 - Determination of initial and final setting times

I.S : 4031 (part 6) – 1988, (reaffirmed 2000) Part 6 - Determination of compressive strength of hydraulic cement other than masonry cement

2. I.S : 2386 (part i to part vi) – 1963 Indian standard methods of test for aggregate for concrete. BIS, New Delhi.

Part i - Particle size and shape. (reaffirmed 1997) Part ii - Estimation of deleterious materials and organic impurities. (reaffirmed 2002)

Part iii - Specific gravity, density, voids, absorption & bulking. (reaffirmed 1997) Part iv - Mechanical properties (reaffirmed 1997)

part v - Soundness. (reaffirmed 1997) part vi - Measuring mortar making properties of fine aggregate. (reaffirmed 2002)

3. I.S. : 383 – 1970 Indian standard specification for coarse & fine aggregates from natural sources for concrete. B.I.S.., New Delhi.

4. I.S. : 1911 - 1959 (reaffirmed) Indian Standard methods of sampling and analysis of concrete), B.I.S.., New Delhi.

5 I.S. : 456 - 2000 Indian standard , plain and reinforced concrete – code of practice. (fourth revision), B.I.S.., New Delhi.

6. I.S. : 516 – 1959 Indian standard methods of tests for strength of concrete (xii reprint December 1987), B.I.S.., New Delhi.

7. I.S. : 8112- 1989 Indian standard - 43 grade ordinary portland cement Specification

8. I.S. : 12269 – 1987 (reaffirmed 1999) Indian standard specification for 53 grade O.P.C..

9. I.S. : 9103 – 1999 Indian standard –concrete admixtures specification 10. I.S. : 455- - 1989 (reaffirmed 1995) –Indian standard – Portland slag cementspecification 11. I.S. : 1489 (part 1) 1991 – Portland – Pozzolana Cement – specification

part 1 fly ash based 12. I.S. : 7861 (part 1) 1975 (reaffirmed 1997) – Indian standard of practice forextreme weather concreting part 1 recommended practice for hot weather concreting

13. I.S.: 7861 (part 2) – 1981 (reaffirmed 1997) – Indian standard of practice For extreme weather concreting part 2 – recommended practice for cold weather concreting

13. I.S. : 8041 – 1990 – Indian standard – rapid hardening Portland Cement specification BIS-New Delhi

14. I.S. : 12330 – 1988 (reaffirmed 1995) – Indian standard specification for sulphate resisting Portland cement

15. I.S : 12600 - 1989 (reaffirmed 1995) - Portland cement, low heat Specification

16. I.S : 10262 – 1982 Indian standard recommended guidelines for concrete mix

design

Sp 23 handbook on concrete mixes (based on Indian standards) 18. I.S. 13311 (part-1 & 2)-1992 methods of non-destructive testing of concrete.

part-1 ultrasonic pulse velocity, part-2 rebound hammer.

E-Links

http://ict.concrete.org.uk/links.asp

http://elearning.vtu.ac.in/16/ENotes/ConcreteTechnology/Unit8-MCN.pdf

http://elearning.vtu.ac.in/10CV42.html

http://www.theconcreteinstitute.org.za/

http://www.aboutcivil.org/concrete-technology.html

http://nptel.ac.in/syllabus/syllabus.php?subjectId=105102012

http://nptel.ac.in/courses/105102012/1

www.btechguru.com/courses

http://www.faadooengineers.com/register.php

Model Question Paper

Diploma in Civil Engineering

4th semester

Course title: **CONCRETE TECHNOLOGY**

Time; 3Hrs. Max.marks: 100

Students can carry IS10262-2009

Assume any missing data suitably

Part –A

Answer any six each question carries 5 marks

1.Differentiate between Chemical admixtures and Mineral admixtures ?
2.Write the difference between Gel/space ratio and water cement ratio ?
3. Define workability? What are the factors affecting workability?
4.Explain Sulphate Attack & Chloride Attack ?
5.What are the factors affecting design of concrete mix?
6.Write the situation of use the following equipments wheel barrows, transit mixers, chutes, pumps, tower cranes
7.List the various methods of curing of concrete each with examples?
8.Explain Reinforced Cement concrete?
9. List some of the waste/ recycled materials can be used in concrete?

Part –B

Answer seven (Question No. 10 compulsory and any six) each question carries 10 marks

1. Explain Quality of mixing water in concrete? What are the permissible limits of impurities in water as per ISI?
2. Which test should be conducted to determine the expansion of cement ? And how?
3. Write short note on Calcium silicate hydrate and Calcium aluminates hydrates?
4. What is creep and shrinkage of concrete? List the factors affecting creep and shrinkage of concrete?
5. Differentiate between bleeding and segregation. Explain their effects on Concrete
6. Why is concrete mix design necessary? List the design data required for concrete mix design
7. Explain in details a) Hot weather concreting b) Light weight concrete
8. Why is vibrator required in concreting? Discuss the various types of vibrators used in concreting
9. Difference between High strength concrete and high performance concrete?
10. Design Concrete Mix Proportion for M30 grade by IS 10262 - 2009.

DESIGN STIPULATIONS FOR PROPORTIONING	TEST DATA FOR MATERIALS
Grade designation : M30 Type of cement : OPC 43 grade confirming to IS 8112 Maximum nominal size of aggregates:20mm Minimum cement content : 320 kg/m3 Maximum water cement ratio : 0.4 Workability : 100 mm (slump) Exposure condition: Severe Method of concrete placing : Pumping Degree of supervision : Good Aggregate type: Crushed angular aggregate Maximum cement content : 400 kg/m3 Chemical admixture type : Superplasticizer	Cement: OPC 43 grade confirming to IS 8112 Specific gravity of cement : 3.15 Chemical admixture : Super plasticiser conforming to IS 9103 Specific gravity of coarse aggregate : 2.74 Fine aggregate : 2.74 Water absorption coarse aggregate : 0.5% Fine aggregate : 1.0 % Free (surface) moisture Coarse aggregate : Nil (absorbed moisture also nil) Fine aggregate : Nil Sieve analysis coarse aggregate : Conforming to Table 2 of IS: 383 Fine aggregate Conforming to Zone I of IS383

Model Questions Bank

Unit 1- Introduction to Concrete and Concrete Ingredients
Cognitive level -Remember
1. Define concrete. 2. Mention the Chemical composition, 3. What are the grades of cement? 4. Mention the different test conducted on cement 5. Define fineness, 6. Define normal consistency, 7. What are the impurities limits in water as per ISI? 8. Mention the various test conducted on Fine aggregate 9. List the various test conducted on Coarse aggregate 10. What is manufactured sand or robo sand 11. What are method of storing of aggregate on site for maintaining uniformity of moisture and cleanliness ? 12. Define Admixtures ? 13. Mention the different types of admixtures? 14. Write a note on fly ash

15. Write a note on blast furnace slag
16. Write a note on meta-kaolin
17. Write a note on Silica fume
18. Write a note on rice husk ash
19. Write a note plasticizers
20. Write a note accelerator,
21. Write a note retarders
22. Write a note air entraining gents,
23. Write a note carboxyclic based admixtures.
24. What are different types of admixture used in concrete?
25. What are different types of admixture used in concrete?

Cognitive level -Understand

1. What are the advantages of concrete?
2. What are the uses of concrete in comparison to other building materials?
3. Explain the setting time of cement,
4. Explain the test conducted on normal consistency of cement?
5. Explain the test conducted on fineness of cement?
6. Explain the test conducted on setting time of cement?
7. Explain the test conducted on soundness of cement?
8. Explain the Storing of cement in the warehouse?
9. Explain the test conducted on specific gravity of fine aggregate?
10. Explain the test conducted on density of fine aggregate?
11. Explain the test conducted on moisture content of fine aggregate?
12. Explain the test conducted on bulking of fine aggregate?
13. Explain the test conducted on sieve analysis of fine aggregate?
14. Explain the test conducted on sieve analysis of Coarse aggregate?
15. Explain the test conducted on specific gravity of Coarse aggregate?
16. Explain the test conducted determine flakiness and elongation index of Coarse aggregate?
17. Explain the crushing tests on Coarse aggregate?
18. Explain the impact test conducted on Coarse aggregate?
19. Explain the abrasion tests on Coarse aggregate?
20. Explain the test conducted on specific gravity of coarse aggregate?
21. What do you mean by grading of aggregates
22. Differentiate between Chemical admixtures and Mineral admixtures ?
23. Mention any one uses and effect of each different types of Chemical admixtures
24. Mention any one uses and effect of each different types of Mineral admixtures
25. How does the carboxyclic based admixtures works?
26. Enlist the physical properties of cement. Explain setting time of cement with neat sketch.
27. Define fineness modulus of sand. Explain test procedure to calculate the Also state value as per IS standard.
28. Enlist mechanical properties of coarse aggregate. Explain any two in detail.
29. What is significance of fineness modulus of sand? Explain test procedure to calculate the F. M.
30. Explain detailed procedure to determine Aggregate Crushing Value?
31. Explain in detail effect of air entraining agents on concrete?
32. Explain the effects of different chemical admixture on fresh concrete.
33. Explain the advantages in using Pozzuoli admixture in concrete.
34. Explain in detaileffect of super-plasticizer on concrete?
35. What do you mean by Pozzuoli admixture? Explain in detail Fly Ash?
36. Explain Air-entraining Admixture and the effect of Air Entrainment on the Properties of

Concrete.

Cognitive level –Application

1. How do you arrive at compressive strength of cement?
2. How do you store cement at site?
3. What are the effects of long storage of cement and suggest how to overcome it?
4. What are the features/properties/quality of fine aggregate should look for while preparing concrete?
5. What are the features/properties/quality of coarse aggregate should look for while preparing concrete?
6. How size, shape and texture of Coarse aggregate is important in concrete
7. What are admixtures that can be added to minimize the heat of hydration of cement?
8. How do you use rice husk ash as a building material?
9. How do you ensure grading of aggregates at site
10. Which test should be conducted to determine the expansion of cement ? And how?
11. List the permissible Limits of impurities in water as per IS code
12. why use of fly ash and met kaolin in fresh concrete

Unit 2- Behavior of concrete

Cognitive level -Remember

1. What are the Bogue's compounds,
2. Define Gel/space ratio,
3. Briefly note on Calcium silicate hydrate?
4. Write a short note on Calcium aluminates hydrates,
5. What is the minimum water requirement for hydration of cement?
6. Define Water Cement Ratio
7. Define water cement ratio law?
8. What are the effect of various W/C ratios on the physical structure of hydrated cement?
9. Definition of cube strength of concrete?
10. Write the Relations between water cement ratio and strength of concrete?
11. Brief about structure of hydrated cement paste?
12. Explain transition zone in concrete?
13. Explain the effect of w/c ratio and gel space ratio on strength of concrete

Cognitive level -Understand

1. Explain Hydration of cement and heat of hydration
2. What is the role of Calcium hydroxide in cement ?
3. Write the difference between Gel/space ratio and water cement ratio
4. Differentiate between hydration of cement and heat of hydration
5. Differentiate between Calcium silicate hydrate, Calcium hydroxide & Calcium aluminates hydrates,
6. How are Calcium silicate hydrate, Calcium hydroxide &Calcium aluminates hydrates formed in concrete?
7. Write a note on water requirement for hydration of cement?
8. State the conditions under which the water cement ratio law is valid?
9. What are the effect of internal moisture on the physical structure of hydrated cement?
10. What are the effect of various temperature on the physical structure of hydrated cement?
11. What are the effect of age, and size of specimen on the physical structure of hydrated cement?

12. Explain the phenomenon of hydration of cement and its effect on Strength of cement.
13. Explain Heat of Hydration and Water Requirements for Hydration?
14. Explain how shape and texture of aggregate affected strength of concrete?
15. Write detail procedure of measuring slump of fresh concrete? Explain different types of slump failure.
16. Explain how gel/space ratio affecting strength of concrete?

Unit 3- Properties of Concrete
Cognitive level -Remember
1. What are the properties of Fresh concrete 2. Define Workability 3. What are the factors affecting workability 4. What are the Properties of hardened concrete 5. What are the factors affecting shrinkage. 6. Define Creep Explain measurement of creep? 7. Define Durability ? 8. Define permeability, 9. Write a short note on Carbonation, 10. Mention some of the special coating for Water Proofing of concrete 11. Mention the different tests conducted on hardened concrete 12. Define Segregation 13. Define bleeding 14. What are the different non-destructive test conducted on concrete. 15. Define compressive strength of concrete 16. Define tensile strength of concrete 17. Define bond strength of concrete 18. Define modulus of rupture of concrete 19. What are the values of modulus of elasticity, poisson ratio of concrete 20. Write the relation between compressive strength and modulus of elasticity 21. Write a note on aggregate-cement bond strength. 22. Write the relation between compressive & tensile strength of concrete 23. Define Shrinkage 24. What is modulus of elasticity and explain its relation with strength. 25. Enlist different tests on Hardened Concrete? Explain any one in detail? 26. Explain characteristic strength, compressive strength and flexural strength on concrete. 27. Explain creep of concrete and how determine the creep of concrete in laboratory. 28. What is modulus of elasticity and explain its relation with strength. 29. Explain Freezing and thawingphenomena of concrete. 30. Explain in details factors contributing to Cracks in Concrete. 31. Explain in details the methods for controlling the sulphate attack on Concrete 32. What you mean by NDT? Explain any one method in detailed
Cognitive level -Understand
1. Explain the properties of Fresh concrete: 2. Explain the factors depending upon workability 3. Explain the test conducted on measurement of workability by slump test 4. Explain the test conducted on measurement of workability by compaction factor test 5. Explain the test conducted on measurement of workability by vee-bee test 6. Explain the test conducted on measurement of workability by flow test 7. Differentiate between Segregation and bleeding?

8. Explain the Properties of hardened concrete
9. Differentiate between plastic shrinkage and drying shrinkage,
10. What are the factors affecting creep? Explain effect of creep.
11. What are the factors contributing to cracks in concrete
12. Write a short note on Alkali – Aggregate Reaction,
13. Write a short note on Sulphate Attack,
14. Write a short note on Chloride Attack,
15. Write a short note on Acid Attack,
16. What are the effect of Sea Water on concrete,
17. Explain how to determine compressive strength of concrete
18. Explain how to determine split tensile strength of concrete
19. Explain how to determine flexural strength,
20. Write short note on rebound hammer test
21. Write short note on Ultrasonic pulse velocity test
22. What are the factors affecting strength of concrete?
23. Explain maturity concept?
24. Explain effect of aggregate properties strength of concrete?
25. How do you ensure concrete quality Control at site
26. Differentiate between bleeding and segregation. Explain their effects on Concrete
27. Explain in detail factors affecting strength of concrete?
28. Explain in details types of concrete shrinkage?
29. Explain how to determine dynamic modulus of elasticity and its relation with static modulus of elasticity
30. Explain effect of w/c ratio on durability and permeability of concrete.
31. Explain the importance on minimum & maximum cement content on durability?
32. Explain the techniques of measuring and factors affecting measurement of Ultrasonic Pulse Velocity.
33. Explain in detail Schmidt's rebound hammer to test concrete with their limitation (with figure)
34. Explain the techniques of measuring and factors affecting measurement of Ultrasonic Pulse Velocity.
35. Explain in detail Schmidt's rebound hammer to test concrete with their limitation (with figure)

Unit 4- Concrete Mix Design
Cognitive level -Remember
1. Define Grades of concrete, 2. Mention the different methods of mix design, 3. List the design data required for concrete mix design 4. What are the factors affecting mix proportions 5. Provide the details of exposure conditions provided in the code 6. Explain the procedure of mix design as per IS 10262-2009, 7. What are the factors affecting design of concrete mix? 8. Enlist varies method of mix design? Write data to be collected for a mix design?
Cognitive level -Understand
1. Why concrete mix design necessary? 2. Explain the concept of mix design? 3. What are the objectives of mix design? 4. Write a note on adjustment on site for Bulking while preparing concrete?

5. Explain adjustment on site for water absorption of materials while preparing concrete during rainy season?
6. Write a note on adjustment on site for Workability while preparing concrete ?
7. What are methods of compaction of concrete used for making good quality concrete? Explain in brief
8. Explain different exposure condition as per IS 456 – 2000 provision.
9. Explain the importance on minimum & maximum cement content on durability?
10. Explain detail procedure of concrete mix design by IS 10262 - 2009
11. Explain method of expressing proportions and also what do you mean by acceptances criteria?

Cognitive level : application & analysis

1. Design concrete mix design for proportioning

m) Grade designation: M40
n) Type of cement: OPC 43 grade confirming to IS 8112
o) Type of mineral admixture: Fly ash confirming to IS 3812 (Part-1)
p) Maximum nominal size of aggregates: 20 mm
q) Minimum cement content: 320 kg/m3
r) Maximum water cement ratio: 0.45
s) Workability: 100 mm (slump)
t) Exposure condition: Severe (for reinforced concrete)
u) Method of concrete placing: Pumping
v) Degree of supervision: Good
w) Type of aggregate: Crushed angular aggregate
x) Maximum cement content: 450 kg/m3
y) Chemical admixture type:Superplsticizer

A-2 TEST DATA FOR MATERIALS

h) Cement used: OPC 43 grade confirming to IS 8112
i) Specific gravity of cement: 3.15
z) Fly ash used: Fly ash confirming to IS 3812 (Part-1)
j) Specific gravity of fly ash: 2.2
k) Chemical admixture: Super plasticiser conforming to IS 9103
l) Specific gravity of Coarse aggregate: 2.74 Fine aggregate: 2.74
m) Water absorption Coarse aggregate: 0.5 percent Fine aggregate: 1.0 percent
n) Free (surface) moisture coarse aggregate: Nil (absorbed moisture also nil) Fine aggregate: Nil
o) Sieve analysis coarse aggregate: Conforming to Table 2 of IS: 383 Fine aggregate: Conforming to Zone I of IS: 383

Unit 5- Concrete Operations

Cognitive level -Remember

1. Explain in details a) Hot weather concreting b) Light weight concrete c)Cold weather concreting d) High Density Concrete
2. What do you know about Batching ?
3. Explain different types of Transportation of Concrete
4. What is Ready-mix concrete-
5. Explain different Methods of curing?
6. Mention different types of joints and its location?

Cognitive level -Understand

1. Describe the various methods of mixing of concrete

2. Why is vibrator required in concreting? Discuss the various types of vibrators used in concreting
3. What are precautions is to be taken during hot and cold weather concreting?
4. Differentiate between Hand mixing & Machine mixing ?
5. What are the precautions taken before, during and after concreting in concrete mixing machines?
6. Write the situation of use the following equipments pans, wheel barrows, transit mixers, chutes, belt conveyors, pumps, tower cranes.
7. Explain manufacturing of ready mix concrete
8. Explain Finishing concrete slabs-screeding, floating, and trowelling.
9. Why curing is necessary?
10. Why water is used in curing the concrete?
11. what is the recommended duration for curing of concrete?

Unit 5- Special types of concrete
Cognitive level -Remember
1. Explain in details a) Polymer concrete b) Fiber reinforced concrete c) Nofines concrete d) Ferrocement 2. Explain in details a) Self Compacting Concrete (SCC) b) High performance concrete 3. Explain different types of fiber used in concrete? 4. What is fiber reinforced concrete, mention any two advantages and its specific application ? 5. What is polymer concrete mention any two advantages and its specific application ? 6. What is ferrocement concrete mention any two advantages and its specific application ? 7. What is Foamed concrete mention any two advantages and its specific application ? 8. What is pervious concrete mention any two advantages and its specific application ? 9. What is high density concrete mention any two advantages and its specific application ? 10. What is self-compacting concrete mention any two advantages and its specific application ? 11. What is high performance concrete mention any two advantages and its specific application ? 12. What is pavement quality concrete mention any two advantages and its specific application ? 13. List some of the waste/ recycled materials can be used in concrete?
Cognitive level -Understand
1. Compare conventional concrete and self-compacting concrete 2. Compare conventional conventional concrete & High strength concrete, 3. Mention advantages of application of waste/ recycled materials in concrete? 4. Difference between High strength concrete and high performance concrete?

Some of the suggested activities

1. Flyash – building blocks for the future
2. Flyash -cement stabilized soil blocks
3. Pollution studies in silk industry experimental investigations on replacement of sand by quarry dust in concrete

4. Experimental investigation on recycled aggregate concrete
5. To find the influence of the size of the aggregate of the compressive strength of concrete
6. Ferro cement composite with no-fines concrete
7. Lime -fly ash - soil blocks
8. A study on effects of light weight aggregates on compressive and flexural strength of concrete
9. Studies on partial replacement of cement by red mud in motor
10. A study on low cost housing material bricks made up of building waste
11. Experimental investigations on replacement of sand by graded quarry dust in concrete
12. Development of traditional water proofing agents (using natural resins) for economy in construction
13. Compressive strength of stabilised blocks and masonary prisms
14. Preliminary investigations on red soil cement stabilised coconut shell blocks
15. Laboratory study on cement- stabilised iron-ore rejections
16. Variations in strength of concrete and masonary units
17. Crushed stone dust cement blocks
18. Stabilized manganese-ore tailings blocks
19. Mangalore tile waste as coarse aggregate in concrete
20. Effect of blast furnace sl*g on soil-cement stabilization
21. Stabilized haalu mannu blocks
22. Portable low cost ferrocement water tank
23. Flyash concrete door shutters
24. Development of masonry mortar using limestone polished slurry and cement
25. Utilization of man made waste in man-made structures
26. Flyash laterite bricks
27. Properties and suitability of fine quarry dut for the final coat plastering and impervious layer
28. Suitability of beach sand as fine aggregate for concrete
29. Characteristics properties of concrete with mixed fibres using waste plastic and waste coiled steel fibres
30. Waste plastic fibre reinforced concrete with polymers-turning pollution to solution
31. Investigation on coiled fibre reinforced concrete with tile waste as coarse aggregate
32. Effect of microsilica-600 on the properties of waste plastic fibre reinforced concrete
33. Concreting practices in belgaum - a case study
34. Comparative study of strength of welded mesh and expanded metal in ferrocement
35. Behaviour of filler slab in low cost housing
36. Study of geo-technical and strength parameters of laterite blocks in and around karkal talaq
37. Design and construction of folded ferrocement boat
38. Experimental study on utilization of silica fume in concrete
39. The strengths of recron 3s fibrous concrete with and without super plasticizers
40. Experimental study on utilization of blast furnace sl*g in concrete
41. Determination of aggregate shape factors using universal thickness-length guage
42. An experimental study on enhancement of strength of concrete embers using wrapping technology
43. A study on the use of rice husk ash in concrete from sustainability consideration
44. Mix design for self compacting concrete
45. Utilization of pozzolanic wastes in the production of wastes coiled fibre reinforced concrete
46. Use of recycled aggregates,waste plastic fibres and flyash in the production of bituminous mix for flexible pavements
47. Effective utilization of bauxite residue(red mud) in brick making
48. Fibre reinforced concrete and cocktail fibre reinforced concrete as repair materials

49. Experimental studies on mix proportioning and strength properties of pavement quality and lean concrete with high volume flyash
50. Study on blending of quarry dust in large volume for structural component available in udupi and d k
51. Study on utilisation of building materials from demolished structures
52. An experimental study on effect of ratio of different sized coarse aggregates on compressive strength of self compacting concrete
53. Sustanable and cost effective building material technology through partial replacement of cement by granite cutting slurry waste powder and partial replacement of coarse aggregates by mangalore tile bats for arch lintels
54. Design and evaluation of high volume flyash concrete for rigid pavement overlays
55. Geopolymer mortar
56. Geopolymer concrete
57. Study on strength behaviour of concerte using foundry dust in fine aggregate
58. Enhancing the strength properties of recycled aggregate concrete through the use of supplimentary cementing materials
59. Experimental studies on air entrained ferrocement panels with high volume fly ash and compatibility of its connection
60. Rice husk ash concrete blocks
61. Mix design and strength characteristics of reactive powder concrete
62. Experimental study on resistance of self compacting concrete to elevated temperature and verification of ratio of compressive strengths of cube to that of cylinder for scces
63. Waste of material in the construction industry

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