

COURSE NAME : CIVIL ENGINEERING GROUP

COURSE CODE : CE/CS/CR/CV

SEMESTER/YEAR : FIFTH

SUBJECT TITLE : CONCRETE TECHNOLOGY

SUBJECT CODE :

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH (Marks)	PR	OR	TW	TOTAL
03	--	02	03	100	---	---	---	125

- External

@ - Internal

* On Line Examination

NOTE:

- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 100 and to be entered in mark sheet under the head Sessional Work. (SW)

Rationale:

Plain or reinforced cement concrete is extensively used as a construction material in almost all types of Civil engineering structures like buildings, roads flyovers, dams, bridges and watertanks.etc. With advanced construction techniques and use of locally available ingredients of concrete, concrete has become very popular construction material.

The contents on cement and aggregate will be useful in deciding contents and quality of concrete during preparation and placing of concrete in position. Topic on quality control of concrete will be useful in execution of various items of works where concreting is involved. Thus the total contents of the subject will be useful for ensuring the quality of concrete during design preparation, transporting and placing in position for various structures. It will also provide guidelines for effective supervision and quality control of concreting work. With good knowledge of concrete materials namely cement, aggregates, water and admixtures and concreting operation namely selection of materials, mixed design, mixing, placing, compacting and finishing, curing, one can obtain concrete of desired workability and required strength.

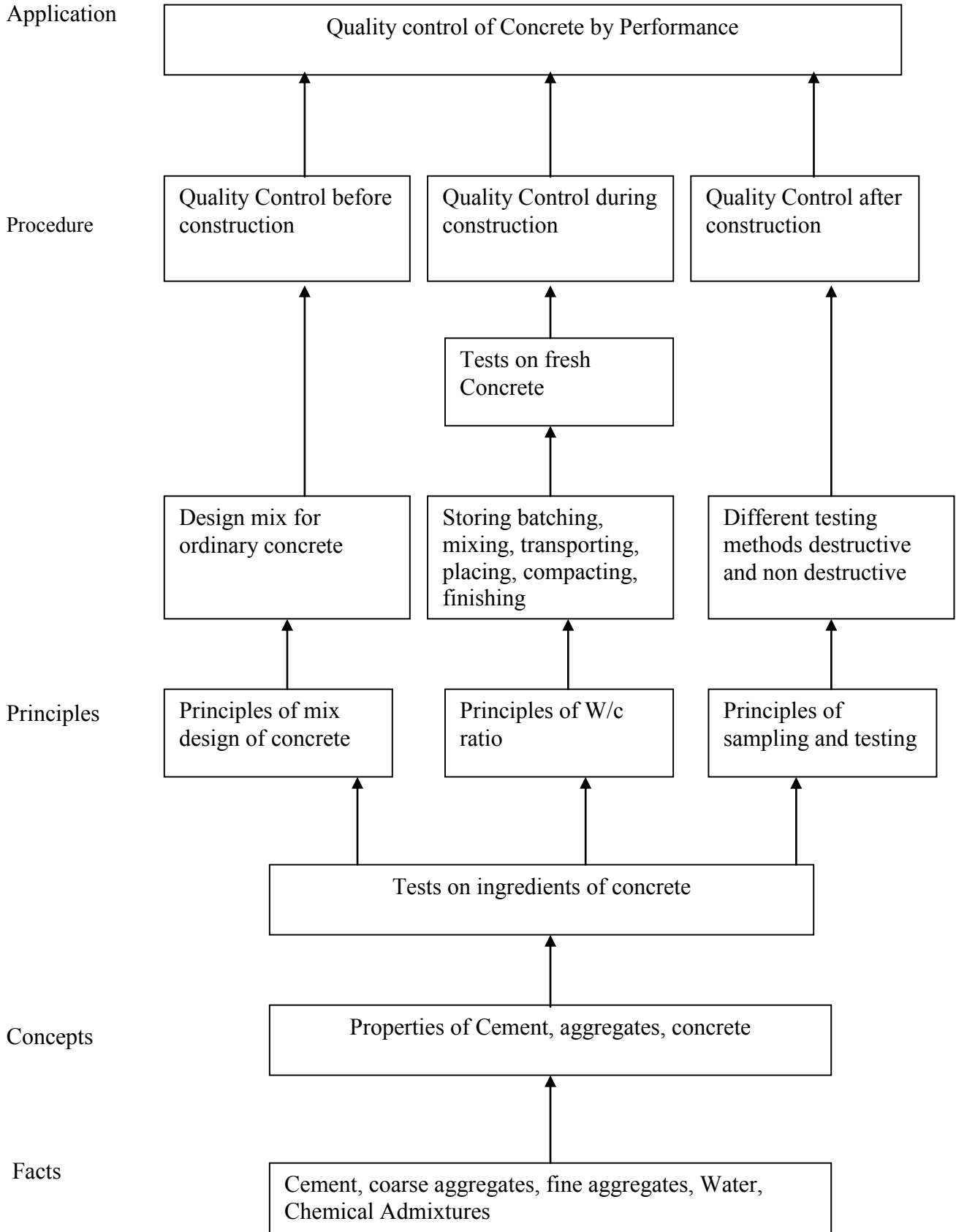
The content of this subject will enable a civil Engineering technician to acquire skills of carrying out various tests on concrete materials and concrete it self along with interpretation of test result.

General Objectives:

Student will be able to -

1. Ensure the quality of ingredients of concrete.
2. Design concrete mix.
3. Understand Techniques of quality control of concrete.

Learning Structure:



Theory:

Topic and Contents	Hours	Marks
<p>Topic 1: CEMENT Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State physical properties and tests of cement. ➤ State use of various types of cement. <p>Contents:</p> <ul style="list-style-type: none"> • Chemical Constituents of OPC and their effects on properties of OPC, Bogue’s compounds and their properties, Hydration of cement. Physical properties of OPC-Fineness, setting, compressive strength and soundness. Different grades of OPC. 33, 43, and 53 with specifications of physical properties as per relevant IS codes. Testing of OPC –field tests and laboratory tests-fineness test, standard consistency test, setting time test, compressive strength test, soundness test. Storage of cement and effect of storage on properties of cement. • Physical properties, I.S. Specifications and field application of following types of cement :- Rapid hardening cement, Low heat cement, Portland pozzolana cement, Sulphate resisting cement, Blast furnace slag cement, White cement. 	06	12
<p>Topics 2: Aggregates Specific Objectives:</p> <ul style="list-style-type: none"> ➤ List and describe different properties of Aggregates. ➤ Carry out various Tests on the Aggregates of concrete. <p>Contents:</p> <p>2.1:- 04 Marks Requirement of Good Aggregate. Classification of Aggregate according to source, Size and Shape.</p> <p>2.2:-Properties of fine aggregates : 08 Marks Concept of size, specific gravity, bulk density , water Absorption and Bulking. Determination of fineness modulus and grading zone of Sand by sieve analysis, determination of silt content in sand and their specification as per IS 383. Determination of Bulking of sand. Concept of crushed Sand.</p> <p>2.3 Properties of coarse aggregates: 08 Marks Concept of size, shape, surface texture, water absorption, soundness, specific gravity and bulk density Determination of fineness modulus of coarse aggregate by sieve analysis, grading of Coarse Aggregates. Determination of crushing value, impact value and abrasion value of coarse aggregate with specification.</p>	10	20

Topic and Contents	Hours	Marks
<p>Topics 3: Concrete</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Describe properties of concrete. ➤ Carry out various tests on concrete. <p>Contents:</p> <p>3.1 Introduction to concrete - 08 Marks Definition of concrete, necessity of supervision for concreting operation, different grades of concrete (ordinary Concrete, standard concrete and high strength concrete as per provisions of IS 456- 2000. Water cement ratio:- Definition of w/c ratio, Duff Abraham w/c law, significance of w/c ratio, selection of w/c ratio for different grades of concrete prepared from different grades of OPC as per graphs specified in IS 10262 -1982, maximum w/c ratio for different grades of concrete for different exposure conditions.</p> <p>3.2 Properties of fresh and Hardened concrete.....08 Marks Definition of workability, factors affecting workability of Concrete. Determination of workability of concrete by slump cone test, compaction factor test. Range values of workability requirement for different types of concrete works. Segregation, bleeding. Definition of compressive strength, durability and Impermeability of concrete. Factor affecting compressive strength, durability and Impermeability of concrete.</p> <p>3.3 Concrete Mix Design and Testing of Concrete...08 Marks Objectives of mix design, list of different method of mix design, study of mix design procedure by I.S. method as per I.S. 10262-1982(Only procedural steps) Testing of concrete:-Significance of testing, determination of compressive strength of concrete cubes at different ages, interpretation and co-relation of test results Non- destructive testing of concrete:- Importance of NDT, methods of NDT - rebound hammer test and ultrasonic pulse velocity test, working principle of rebound hammer and factor affecting the rebound index, specification for deciding the quality of concrete by Ultrasonic pulse velocity as per I.S. 13311 (part 1 and 2). Determination of compressive strength of concrete by rebound hammer test as per I.S. 13311, determination of Quality of concrete by ultrasonic pulse velocity test.</p>	12	24

Topic and Contents	Hours	Marks
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<p>Topics 4: Quality Control of Concrete</p> <p>Specific Objectives:</p> <p>➤ Describe various concrete operations.</p> <p>Contents:</p> <p>4.1 :- Concreting Operation.....16 Marks Batching- Definition and Types of Batching. Mixing- Types of Mixing and Types of mixers. Form work : Form work for concreting, different types of form works for members like beams, slabs, Columns, materials used for form work, requirement of good form work. Stripping time for removal of form works per IS 456-2000 provision for different structural members. Transportation: Modes of transportation of concrete, precautions to be taken during transportation. Placing: placing of concrete in form work, precautions to be taken while placing of concrete. Compaction of concrete: methods of compaction, care to be taken during compaction. Finishing of concrete: purpose of finishing, types of Finishing. Curing of concrete: definition of curing, necessity of curing, different methods of curing and their application</p> <p>4.2 :- Waterproofing and Joints of concrete:.....08 Marks Waterproofing: Importance and need of waterproofing, methods of Waterproofing and materials used for waterproofing. Joints in concrete construction: Types of joints, joining old and new concrete, methods of joining, Materials used for filling joints.</p>	<p>12</p>	<p>24</p>
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Topic and Contents	Hours	Marks
	08	20

<p>Topics 5: Chemical Admixture in concrete, Special Concrete and, Extreme weather concreting</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State the uses of admixture in concrete. ➤ Describe special concrete. <p>Contents:</p> <p>5.1:-Chemical admixture in concrete:..... 08 Marks Purpose of using admixtures, Properties, and application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixture, air entraining admixture and super plasticizers.</p> <p>5.2:-Special Concretes:-..... 08 Marks Properties, Advantages and Limitation of the following types of Special concrete: Ready mix Concrete, Fiber Reinforced Concrete, High performance Concrete, Self compacting concrete, Light weight concrete.</p> <p>5.3:- Extreme weather concreting:.....04 Marks Effect of cold weather and hot weather on Concrete, precautions to be taken while concreting in hot and cold Weather condition.</p>		
Total	48	100

Practicals:
Skills to be developed:

Intellectual Skills:

1. Analyze the given data
2. Select proper method for analysis
3. Interpret the results

Motor Skills:

1. Measure the quantities accurately
2. Handle instruments properly

Term work shall consist of

List of Practicals:

1. Determine fineness of cement preferably by Blaine's air permeability apparatus
Or by sieving.
2. Determine standard consistency, initial and final setting times of OPC.
3. Determine compressive strength of ordinary Portland cement.
4. Determine silt content in sand by volume and bulking of sand.
5. Determine bulk density and water absorption of fine and coarse aggregates.
6. Determine Fineness modulus of fine and coarse aggregate by sieve analysis.
7. Determine aggregate impact value.
8. Determine aggregate abrasion value.

Mini Project:

Determination of design mix proportion by mass for M 20 grade of concrete using I.S. Method for given data (such as grading zone of sand, proportion of 20 mm and 12.5 mm metals, specific gravities of cement, sand and aggregate, water absorption of sand and aggregate, compacting factor and exposure condition).

Learning Resources:**1. Books:**

Sr. No.	Author	Title	Publisher
1	M. S. Shetty	Concrete technology	S. Chand Publication
2	M. L. Gambhir	Concrete technology	Tata Mc-Graw. Hill Publishing Co. Ltd. New Delhi
3	A. M. Neville and J J Brooks	Concrete technology	Pearson Education Pvt. Ltd. New Delhi
4	A.R.Santhakumar	Concrete technology	Oxford University press.
5	A. M. Neville	Properties of Concrete	Pearson Education Pvt. Ltd. New Delhi

2. CDs, PPTs Etc.:

CD or PPT of above experiments developed by NITTTR and NPTEL (if available) shall be shown to the students on T. V. / L.C.D. projector prior to the conductance of above experiments.

3. IS, BIS and International 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 permeability Method.
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 and 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 and 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 cement specification
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 for extreme 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
17. Sp 23 handbook on concrete mixes (based on Indian standards)
18. I.S. 13311 (part-1 and 2)- 1992 methods of non-destructive testing of concrete. part-1 ultrasonic pulse velocity, part-2 rebound hammer.