

VI Semester -

CONCRETE TECHNOLOGY			
Course Code	21CV62	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+2	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	4	Exam Hours	3
<p>Course objectives:</p> <ol style="list-style-type: none"> 1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete 2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete. 3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures. 			
<p>Teaching-Learning Process (General Instructions) These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"> 1. Blackboard teaching/PowerPoint presentations (if needed) 2. Regular review of students by asking questions based on topics covered in the class. 			
MODULE-1			
<p>CEMENT AND AGGREGATES Cement, Chemical composition, Physical and chemical properties, Other Cementitious materials and composition -GGBS, Fly ash rice Husk ash, Silica fume, Hydration of cement, Factors influencing and affecting Hydration of cement, Types of cement. Fine aggregate - grading, analysis, Specific gravity, bulking, moisture content, deleterious materials. Coarse aggregate – Importance of size, shape and texture. Grading of aggregates - Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests. Codal Provisions.</p>			
Teaching-Learning Process	<ol style="list-style-type: none"> 1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class. 		
MODULE-2			
<p>FRESH PROPERTIES OF CONCRETE Workability - Process of manufactures of concrete: Batching, Mixing, Assessment of Workability of Concrete, Factors affecting workability, Measurement of workability – slump test, flow test, Compaction factor test and Vee-Bee Consistometer tests, Segregation and bleeding, Transporting, Placing, Compaction, Curing, need and Types of curing, accelerated curing.</p>			
Teaching-Learning Process	<ol style="list-style-type: none"> 1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class. 		
MODULE-3			
<p>ADMIXTURES: Classification, effect on fresh and hardened concrete, retention time, Dosage ant their effects, Influence on properties of paste, mortar, and concrete Types of concrete (in brief). MIX DESIGN PROCEDURE: Concept of Concrete Mix design, variables in proportioning, exposure conditions, Procedure of mix design as per IS 10262-2019, Numerical examples of Mix Design. Highlights of Other methods of Mix Design as per other codes.</p>			

Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.
MODULE-4	
HARDENED CONCRETE: Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, Effect of aggregate properties, assessment of compressive strength, flexural strength, tensile strength, bond strength and modulus of elasticity, aggregate - cement bond strength, factors influencing strength and codal provisions, Relation between modulus of elasticity and strength, factors affecting modulus of elasticity, Poisson Ratio.	
Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.
MODULE 5	
Durability - definition, significance, short term and long-term durability. Shrinkage - plastic shrinkage and drying shrinkage, Factors contributing to cracks in concrete - plastic shrinkage, settlement cracks, Factors affecting shrinkage, Effect of creep. Measurement of creep, factors influencing creep. Permeability, Sulphate attack, Chloride attack, carbonation, freezing and thawing, Construction joints and Expansion joints, Thermal effect of concrete. Codal Provisions.	
Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Testing of cement: Consistency, fineness, setting time, Specific Gravity, Soundness and strength.
2	Testing of fine aggregate: Specific Gravity, sieve analysis and zoning, bulking of fine aggregate, bulk density, silt content.
3	Testing of coarse aggregate: Specific Gravity, sieve analysis, bulk density, flakiness index, elongation index, water absorption & moisture content, soundness of aggregate.
4	Concrete Mix design by ACI 211.1-91 method, IS code method as per 10262- 2019 & 456-2000, DOE method
5	Tests on Concrete- Workability tests – Slump cone test, compaction factor test, Vee-bee consistometer test, flow table test, strength tests- compressive strength, flexural strength, split tensile strength
6	Effects of Admixture - Accelerator, Retarder, Super Plasticizer
7	Non-destructive Testing - Rebound Hammer test, Ultrasonic Pulse Velocity test
Course outcomes (Course Skill Set): At the end of the course the student will be able to: 1. Assess and infer various properties of cement, cementitious materials, Fine and coarse aggregate as per codal provision and specifications (L2) 2. Design the concrete mix for the given materials as per IS:10262-2019 provisions (L4) 3. Understand the manufacturing process and asses the quality of green (L2)	

4. Describe the properties of fresh and hardened concrete – Strength and Durability aspects (L3)

5. Examine and Evaluate properties of Cement and Concrete

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour)**

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test (**duration 02/03 hours**) at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from

the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

- 1.M.S.Shetty , "Concrete Technology" - Theory and Practice, , S.Chand and Company, New Delhi, 2002.
2. Concrete Technology (Trade, Technology & Industry), George White, Delmar Pu
- 3.Concrete: Microstructure, Properties, and Materials, P. Kumar Mehta , Paulo J. M. Monteiro, McGraw-Hill Education
- 4.Neville, A.M. , Properties of Concrete": , ELBS, London
- 5.A.R.Santakumar , "Concrete Technology" –. Oxford University Press (2007)'
- 6.Advanced Concrete Technology, Zongjin Li, Wiley; 1 edition
- 7.GambhirDhanpatRai&Sons , "Concrete Manual" -, New Delhi
- 8.N.KrishnaRaju, "Concrete Mix Design" -, Sehgal - publishers
- 9.IS:10262-2016 , "Recommended guidelines for concrete mix design", Bureau of Indian Standards, New Delhi

Web links and Video Lectures (e-Resources):

Cement <https://nptel.ac.in/courses/105102012/1>
Aggregates <https://nptel.ac.in/courses/105102012/6>
Mineral admixtures<https://nptel.ac.in/courses/105102012/11>
Chemical admixtures <https://nptel.ac.in/courses/105102012/9>
<https://nptel.ac.in/courses/105102012/10>
Concrete mix design <https://nptel.ac.in/courses/105102012/14>
Concrete production & fresh concrete <https://nptel.ac.in/courses/105102012/19>
Engineering properties of concrete<https://nptel.ac.in/courses/105102012/23>
Dimensional stability & durability <https://nptel.ac.in/courses/105102012/27>
Durability of concrete <https://nptel.ac.in/courses/105102012/31>
Special concretes <https://nptel.ac.in/courses/105102012/36>

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quizz(To assist in GATE Preparations
- Demonstrations in Lab
- Self Study on simple topics
- Simple problems solving using Excel
- Virtual Lab Experiments