



### Course description:

This course introduces the students to the concrete material. It allows the student the opportunity to understand the reasons that make concrete the most widely used construction material in the world. To provide the students with an understanding of the advantages and disadvantages of concrete. This Concrete Technology course covers cement production, properties and types of cement, hydration of cement, aggregate properties, mixing water, mixing and placement of concrete, compaction, fresh concrete properties, types and applications of admixtures and additives, strength and durability of hardened concrete, and concrete mix design.

### Aims of the course:

This course has the following aims:

1. To understand the behavior of concrete under varying circumstances.
2. To learn the different applications of concrete in a varied environment.
3. To learn the appropriate techniques for handling the concrete in site.
4. To introduce the student to the large variety of concretes that are used and their properties.
5. To provide the student with the knowledge and skills necessary for designing concrete mixes.

### Intended Learning Outcomes (ILOs):

Successful completion of this course should lead to the following learning outcomes:

1. Describe the historic development of concrete and the advantages and disadvantages of its use.
2. To be able distinguish between different types of cement and their chemical compositions.
3. To be able to apply the different methods used for testing cement.
4. To distinguish between the utility of different types of aggregates based on their gradation, texture, and their mechanical properties.
5. To choose between the different admixtures for the required effect on concrete.
6. To determine whether the available water can be used in mixing and curing concrete.
7. To understand the properties of fresh concrete and understand its methods of testing.
8. To understand the factors that are important in determining the strength of concrete.
9. To learn the appropriate techniques for mixing, handling, and placing the concrete.
10. To understand the temperature problems in concreting and the techniques used to mitigate these problems.
11. To describe the development of strength in concrete with time.
12. Explain and predict important strength properties of concrete such as creep, elasticity, fatigue, and the relationship between tensile and compressive strengths.
13. Describe non-load related deformation in concrete such as shrinkage and swelling, and carbonation.
14. Describe the relationship between permeability and durability.
15. Differentiate between the different types of tests used to find concrete tensile and compressive strengths.
16. Distinguish the different types of lightweight concrete and to understand the properties of each type.

17. Based on the knowledge learned during this course the student should be able to design a mix of concrete appropriate for the required task.

### Course Structure:

Week	C. Hrs	ILOs	Topics	Teaching Procedure	Assessment methods
1	2	1	Historic development, Composition of concrete, Advantages of concrete over other materials, advances, and future trends in concrete.	Lectures and Tutorials	H.W, Quizzes & Exams
1 & 2	4	2&3	Cement: manufacturing methods of cement, cement chemistry, setting of cement and testing, types of cement, heat and hydration and strength	Lectures and Tutorials	H.W, Quizzes & Exams
3	3	4	Physical properties of aggregates, shape and texture, classification and gradation, bond strength, toughness and strength, and unsoundness due to impurities.	Lectures and Tutorials	H.W, Quizzes & Exams
4	2	5	Admixtures: Accelerators, Set-retarders, Plasticizers, Super plasticizer and additives	Lectures and Tutorials	H.W, Quizzes & Exams
4	1	6	Mixing water, curing water, tests of water	Lectures and Tutorials	H.W, Quizzes & Exams
5	2	7	Fresh concrete: workability, cohesion, and segregation, bleeding of concrete, workability test, slump test, compacting factor test, Vebe test and ball penetration test.	Lectures and Tutorials	H.W, Quizzes & Exams
5 & 6	2	8	Strength of concrete: total voids in concrete, micro cracking and stress strain behavior, water cement ratio, aggregate cement ratio	Lectures and Tutorials	H.W, Quizzes & Exams
6	2	7	Mixing, handling, placing, and compacting concrete.	Lectures and Tutorials	H.W, Quizzes & Exams
7	2	8	Temperature problems in concreting	Lectures and Tutorials	H.W, Quizzes & Exams
7 & 8	2	9	Development of strength	Lectures and Tutorials	H.W, Quizzes & Exams
9	2	10	Other strength properties	Lectures and Tutorials	H.W, Quizzes & Exams
10	2	10	Elasticity and Creep	Lectures and Tutorials	H.W, Quizzes & Exams
10 & 11	2	11	Deformation and cracking independent of load	Lectures and Tutorials	H.W, Quizzes & Exams
11	2	12	Permeability and durability	Lectures and Tutorials	H.W, Quizzes & Exams
12	3	13	Testing of hardened concrete: compressive strength, tensile strength, pull-out strength.	Lectures and Tutorials	H.W, Quizzes & Exams
13	3	14	Light weight concrete	Lectures and Tutorials	H.W, Quizzes & Exams
14	3	15	Mix design: water cement ratio, types of cement workability and water content, American method, trial mixes.	Lectures and Tutorials	H.W, Quizzes & Exams



## References:

- 1) Concrete Technology by A.M. Neville and J.J.Brooks, Revised edition 2008

## Assessment Methods:

Methods	Grade	Date
1 <sup>st</sup> Exam	20	
2 <sup>nd</sup> Exam	20	
Quiz 1 + Quiz 2 + Homeworks	15	
Final Exam	50	

