

**Code: 1BCHCV202****Credits: 3****L:T:P: 2:2:0****SEE Hours: 3****Course: Applied Chemistry for Civil Engineering****CIE:50 Marks****SEE: 50 Marks****Max. Marks:100**

Prerequisites if any	NA
Learning objectives	To impart a strong foundation in the principles of chemistry with emphasis on application-oriented topics relevant to Civil Engineering

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	To understand and apply the concepts of structural materials for engineering applications.	Understand Apply
CO2	Apply the knowledge of corrosion science and its control to protect structural materials.	Understand Apply
CO3	To understand and apply the concept of water technology, qualitative and quantitative chemical analysis for technological applications.	Understand Apply
CO4	Understand and apply the knowledge of green chemistry in civil engineering.	Understand Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2			2		2					3			
CO2	3	2			2		2					3			
CO3	3	2			2		2					3			
CO4	3	2			2		2					3			

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

	Applied Chemistry for Civil Engineering	No. of Lecture Hours	No. of Tutorial Hours/ Sessions	No. of Practical Hours
Module-1: Conventional and Sustainable Construction Materials				
1.1	Cement: Introduction, raw materials composition, and its properties. Classification and Manufacturing process of cement by wet process (Rotary Kiln process). Special cement: Composition, properties, and applications.	2	0	0
1.2	Properties of Cement, process of setting and hardening of cement. Testing of cement. Estimation of calcium oxide in cement by EDTA method. Additives for cement.	1	0	0
1.3	Types of Portland cement and its derivatives, overall scenario of cement industry and its major problems (Engineering and other problems). Geo polymer concrete: Introduction, synthesis, constituents, properties, and applications.	1	1	0
1.4	Metals and alloys: Introduction, properties and applications of Iron and its alloys and Aluminum and its alloys. Estimation of percentage of Iron in TMT bar by external indicator method.	2	1	0
Module-2: Polymers for Engineering Applications				
2.1	Polymer: Introduction, classifications, synthesis, properties, and engineering applications of polyethylene (PE) and polyvinylchloride (PVC). Properties and industrial applications of carbon - based reinforced composites - graphene/carbon nanotubes as fillers.	2	1	0
2.2	Fibers: Synthesis, properties, and applications of polypropylene and nylon fibers. Adhesives: Introduction, synthesis, properties, and structural applications of Epoxy resin.	2	0	0
2.3	Wood-Polymer Composites: Raw materials, additives, manufacturing technologies, properties, outdoor durability, and construction applications. Biodegradable polymers: Synthesis, properties and applications of polylactic acid (PLA).	1	1	0
2.4	Molecular weight of polymers by number average and weight average method and numerical problems.	0	1	0
Module-3: Corrosion Science and Surface Protection				
3.1	Corrosion: Introduction, electrochemical corrosion of steel in concrete. Factors influencing the corrosion rate: Physical state of the metal, nature of the metal, area effect, pH, temperature, and nature of the corrosion product.	2	1	0
3.2	Types of Corrosion: Differential metal (galvanic corrosion), differential aeration (pitting corrosion), and stress corrosion in civil structures.	2	0	0
3.3	Corrosion Control: Design and selection of materials, Cathodic protection: Sacrificial anode and impressed current method, Corrosion inhibitors (cathodic and anodic). Protective coatings: Introduction, galvanization, and tinning.	1	1	0



3.4	Corrosion penetration rate (CPR) - definition, importance and numerical problems.	0	1	0
Module-4: Techniques in Water Quality Assessment				
4.1	Water Technology: Introduction, water parameters, and hardness of water: Determination of hardness of water by EDTA method and numerical problems.	2	1	0
4.2	Sewage treatment (Primary, secondary and tertiary). Determination of COD and BOD of water effluent and numerical problems.	1	2	0
4.3	Estimation of Dissolved Oxygen (DO) by Winkler's method.	1	0	0
4.4	Desalination of water by electro dialysis and reverse osmosis.	1	0	0
Module – 5: Green Chemistry for Civil Engineering and Analytical Techniques				
5.1	Green Chemistry: Waste management and recycling in civil engineering. Twelve principles of green chemistry. Selection of eco-friendly chemical materials in construction.	1	1	0
5.2	Green binders and admixtures: Composition and benefits, types and sources of construction and demolition waste, and waste minimization techniques. Recycling of concrete, asphalt, steel, and wood.	1	0	0
5.3	Pollution Control: Soil contamination: Types, chemical interactions, and stabilization techniques.	1	1	0
5.4	Analytical Techniques: Introduction, principle, and applications of conductometry: Estimation of acids and acid mixture in wastewater sample and potentiometric estimation of Fe in industrial wastewater.	2	0	0
<i>Total No. of Lecture Hours</i>		26	-	-
<i>Total No. of Tutorial Hours/ Sessions</i>			14	-
<i>Total No. of practical sessions</i>				0
<i>Total No. of Hours/ sessions</i>				40

Self-learning topics identified

1. Case study: 1 Conventional and sustainable construction materials
2. Case study: 2 Application of polymers in structural buildings
3. Case study: 3 Application of corrosion science and its control in civil structures
4. Case study: 4 Application of water chemistry in pollution control
5. Case study: 5 Sustainable and green chemistry in civil engineering

Textbooks:

1. A Textbook of Engineering Chemistry, By S S Dara & S S Umare, Aruna M Sudame, S, Chand and company limited
2. Textbook of Engineering Chemistry by Shashi Chawla, Publisher: Dhanpat Rai, Edition: 6, 2022, Pages: 828.
3. Engineering Chemistry, 3rd edition, by R.V. Gadag, A. Nityananda Shetty, Publisher: Dreamtech Press

Reference Books:

1. Textbook of polymers science by Gowariker and Vishwanathan.
2. Corrosion Engineering by M.G. Fontana, Mc Graw Hill Publication

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_mm17/preview
2. <https://nptel.ac.in/courses/105107207>