

Code: BCHEC102/202**Course:** Applied Chemistry for Civil Engineering Stream**Credits:** 4**L:T:P** 2:2:2**SEE:** 100 Marks**CIE:** 100 Marks**SEE Hours:** 3**Max. Marks:**100

Prerequisites if any	
Learning objectives	<p>1. To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for relevant engineering branches.</p> <p>2. To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.</p>

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 polymers, structural and nano materials for engineering applications.	Understand Apply
CO2	Apply the knowledge of corrosion science to control corrosion problems.	Understand Apply
CO3	Understand and apply the principles of water technology for quantitative and qualitative analysis.	Understand Apply
CO4	To understand and apply the concept of analytical techniques and quantitative chemical analysis in various technological applications	Understand Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2					2					2	To be identified for each branch by Course Instructor			
CO2	3	2					2					2				
CO3	3	2					2					2				
CO4	3	2					2					2				

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

ESTD : 1946

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module-1: Structural Materials for Engineering Applications				
1.1	Metals and alloys: Introduction, properties and applications of Iron and its alloys, Aluminum and its alloys.	2	-	-
1.2	Cement: Introduction, composition, properties, classification & manufacturing process of cement. Process of setting and hardening of cement, additives for cement and testing of cement.	2	2	-
1.3	Glass: Introduction, composition, types of glass. Preparation, properties, and applications of soda-lime glass.	2	-	-
Module-2: Polymer Science and Technology				
2.1	Polymer: Introduction, methods of polymerization (Bulk, solution, suspension, and emulsion). Determination of molecular weight of polymers by number average and weight average method. Synthesis, properties, and engineering applications of polyethylene (PE) and polyvinylchloride (PVC).	2	2	-
2.2	Fibers: Synthesis, properties and applications of polypropylene and nylon fibers. Adhesives: Introduction, synthesis, properties, and applications of Epoxy resin.	2	-	-
2.3	Geo polymer concrete: Introduction, synthesis, constituents, properties, and applications. Biodegradable polymers: Synthesis, properties and applications of polylactic acid (PLA).	2	-	-
Module-3: Corrosion Science and Engineering				
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, over voltage, pH, temperature and nature of the corrosion product.	2	-	-
3.2	Types: differential metal corrosion (galvanic corrosion) and differential aeration corrosion (pitting corrosion), stress corrosion in civil structures and seasonal cracking of brass in the presence of ammonia.	2	-	-
3.3	Corrosion control: Design and selection of materials, Cathodic Protection - sacrificial anode method and impressed current method, Corrosion inhibitors (Cathodic and anodic). Protective coatings: Introduction, galvanization and tinning.	2	2	-
Module-4: Water Technology and Quantitative Chemical Analysis				
4.1	Water technology: Introduction, water parameters, hardness of water, determination of hardness by EDTA method - numerical problems, desalination of water by electrodialysis.	2		-
4.2	Determination of COD and BOD of water effluent -numerical problems. Sewage treatment (Primary, secondary and tertiary).	1	2	
4.3	Estimation of Iron in the TMT bar by external indicator method, Calcium Oxide (CaO) in cement by Rapid EDTA method, percentage of copper in brass.	1	2	-

Module – 5: Analytical Techniques and Nano chemistry				
5.1	Analytical techniques: Introduction, principle, instrumentation, and applications of Potentiometry in the estimation of iron, Conductometry in the estimation of acid mixture, Colorimetry in the estimation of copper present in electroplating effluent, pH – sensors for the determination of pKa of vinegar and pH in soil sample.	3	2	-
5.2	Nano chemistry: Introduction, size dependent properties of nanomaterial's (surface area and catalytic), synthesis of nanomaterial by sol – gel method and co-precipitation method. Nanomaterials for water treatment (metal oxide).	1	2	-
List of Experiments:				
1	D1. Synthesis of polyurethane.	-	-	2
2	D2. Quantitative estimation of copper in brass	-	-	2
3	D3. Synthesis of iron oxide nanoparticles.	-	-	2
4	D4. Determination of chloride content in the given water sample by Argentometric method	-	-	2
5	E1. Conductometric estimation of acid mixture.	-	-	2
6	E2. Potentiometric estimation of FAS using $K_2Cr_2O_7$.	-	-	2
7	E3. Determination of pKa of vinegar using pH sensor (Glass electrode).	-	-	2
8	E4. Estimation of total hardness of water by EDTA method.	-	-	2
9	S1. Estimation of copper present in electroplating effluent by optical sensor (Colorimetry)	-	-	2
10	S2. Determination of viscosity coefficient of lubricant (Ostwald's viscometer).	-	-	2
11	S3. Estimation of iron in TMT bar by diphenyl amine method.	-	-	2
12	S4. Determination of chemical oxygen demand (COD) of industrial waste water sample.	-	-	2
13	O1. Gravimetric estimation of gypsum in Portland cement.	-	-	2
14	O2. Electroplating of desired metal on substrate.	-	-	2
15	O3. Estimation of manganese dioxide in pyrolusite.	-	-	2
16	O4. Analysis of cement for its components.	-	-	2
17	O5. Estimation of percentage of iron in steel.	-	-	2
Total No. of Lecture Hours		26	-	-
Total No. of Tutorial Hours			14	-
Total No. of Practical Hours				10/17

Self-learning topics identified: (Maximum of 5 topics)

1. Refractories: Classification based on chemical composition, properties and applications of refractory materials.
2. Polymer composites: Properties and applications of fiber reinforced polymers composites (FRPC).
3. Metal coatings- Anodization.
4. Determination of dissolved oxygen by winkler's method
5. Synthesis of nanomaterials by top down and bottom up approach

Textbooks:

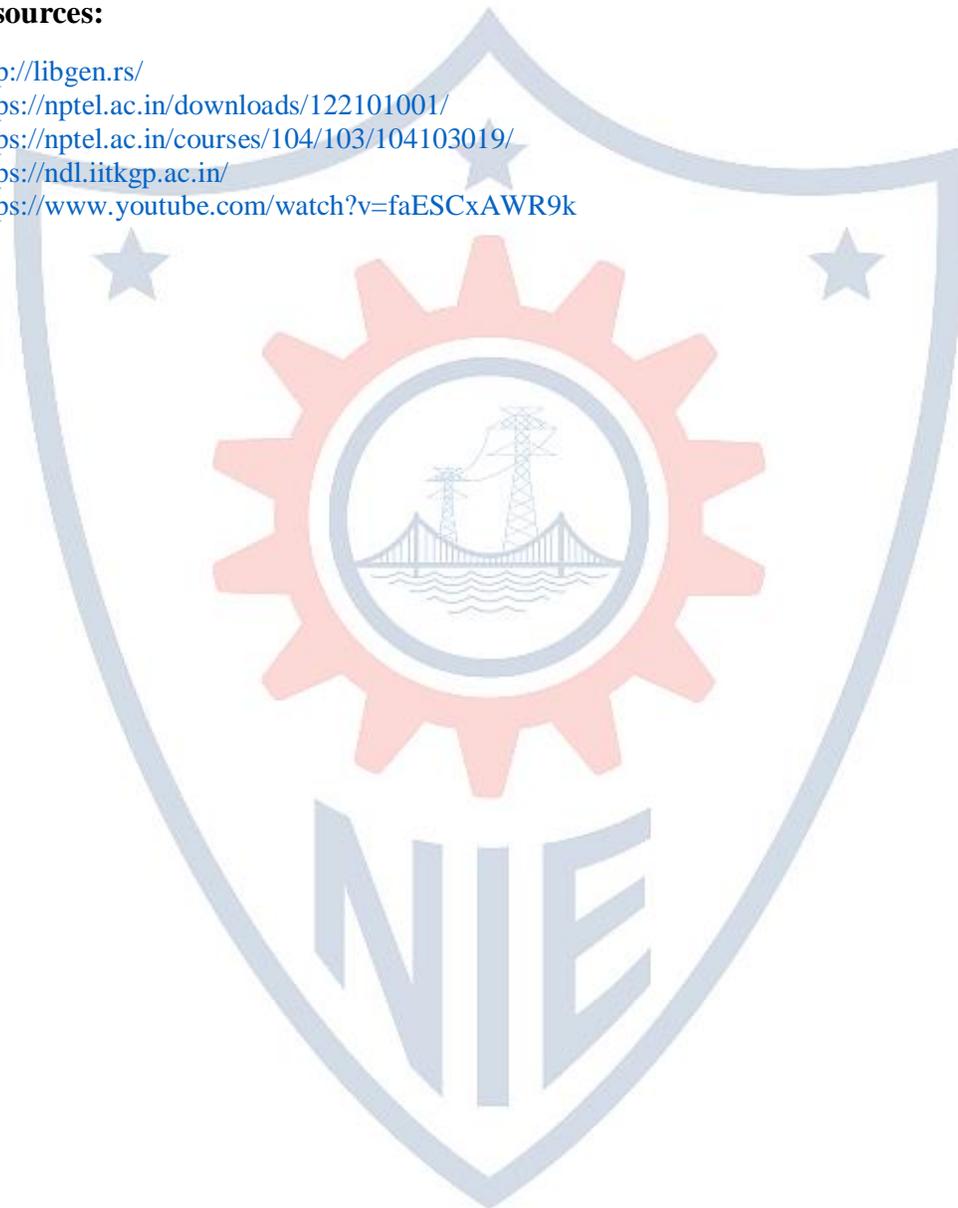
1. A Textbook of Engineering Chemistry, R.V. Gadag and Nityananda shetty, I.K. International Publishing house, 2nd Edition, 2016.
2. Textbook of engineering chemistry by Dr. K. Pushpalatha, published by wiley publications, 2nd edition.
3. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978-93-85155-70-3, 2022.
4. A text book of Engineering Chemistry 15th Edition by P. C. Jain and Monica Jain, Dhanpat Rai Publishing Co (P) Ltd., New Delhi.

Reference Books:

1. Principles of Physical Chemistry by B.R.Puri, L.R. Sharma and M.S.Pathania,S. Nagin Chand and Co.
2. Textbook of Physical Chemistry by Soni and Dharmatha, S.Chand & Sons.
3. Textbook of polymers science by Gowarikar and Vishwanathan.
4. Corrosion Engineering by M.G. Fontana, Mc Graw Hill Publications

Online Resources:

1. <http://libgen.rs/>
2. <https://nptel.ac.in/downloads/122101001/>
3. <https://nptel.ac.in/courses/104/103/104103019/>
4. <https://ndl.iitkgp.ac.in/>
5. <https://www.youtube.com/watch?v=faESCxAWR9k>



ESTD : 1946