

<b>Prerequisites if any</b>	None
<b>Learning objectives</b>	<ol style="list-style-type: none"> <li>To impart a sound knowledge on the principles of chemistry involving the different application-oriented topics required for relevant engineering branches.</li> <li>To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.</li> </ol>

**Course Outcomes:**

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

COs	Course Outcomes	Bloom's level
CO1	Explain basic concepts of fuels, energy storage and energy conversion devices, solar cells.	Understand Apply
CO2	To understand the principle of corrosion, corrosion control and the concept of phase rule.	Understand Apply
CO3	Having comprehensive knowledge in the field of engineering macromolecules and materials.	Understand Apply
CO4	To understand and apply the concept of analytical techniques 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
<b>Module – 1 Energy, source, conversion, and storage</b>				
1.1	<b>Fuels:</b> Introduction, Calorific value, Determination of calorific value using bomb calorimeter, Numerical problems on GCV and NCV. Octane and cetane number, reformation of petrol with reactions.	2	2	-
1.2	<b>Green fuels:</b> Introduction, power alcohol, synthesis, and applications of biodiesel.	1	-	-
1.3	<b>Energy devices:</b> Introduction, classification of battery and fuel cell, differences between fuel cell and battery. Construction, working and applications of Li-ion battery, Methanol-oxygen fuel cell, construction, working and importance of photovoltaic cells.	3	-	-
<b>Module – 2 Corrosion science and engineering</b>				
2.1	<b>Corrosion:</b> Introduction, electrochemical theory of corrosion, types of corrosion - differential metal, differential aeration (waterline and pitting), stress corrosion (caustic embrittlement).	3	-	-
2.2	<b>Corrosion control:</b> (i) Cathodic protection – sacrificial anode method and impressed current method and corrosion inhibitors. Corrosion testing by weight loss method. Corrosion penetration rate (CPR)- numerical problems.	1	2	-
2.3	<b>Metal finishing:</b> Introduction, technological importance. Electroplating: Introduction, electroplating of chromium (hard and decorative), Electroless plating: Introduction, electroless plating of nickel.	2	-	-
<b>Module – 3 Macromolecules for engineering applications</b>				
3.1	<b>Polymers:</b> Introduction, methods of polymerization - (Bulk, solution, suspension, and emulsion polymerization), Determination of molecular weight of polymers by number average and weight average method, numerical problems. Synthesis, properties, and industrial applications of polyvinylchloride (PVC) and polystyrene (PS).	2	2	-
3.2	<b>Fibers:</b> Introduction, synthesis, properties and industrial applications of Kevlar and polyester.	1	-	-
3.3	<b>Plastics:</b> Introduction, classification, synthesis, properties, and industrial applications of poly (methyl methacrylate) (PMMA) and Teflon (PTFE).	1	-	-
3.4	<b>Lubricants:</b> Introduction, classification, properties (viscosity, pour point, cloud point, flash point, fire point, oiliness, saponification, emulsification, volatility) and application of lubricants.	2	-	-
<b>Module – 4 Phase Rule and Analytical techniques</b>				
4.1	<b>Phase rule:</b> Introduction, definition of terms: phase, components, degree of freedom, phase rule equation; condensed phase rule- Phase diagram: Two component –lead –silver system – Desilverisation of lead.	2	2	-
4.2	<b>Analytical techniques:</b> Introduction, Potentiometry: instrumentation and its application in the estimation of Iron, Colorimetry: principle and application in the estimation of copper, determination of pKa of the acid.	-	4	-

	Conductometry – principle and its application in the estimation of acid mixture.			
<b>Module – 5 Materials for Engineering applications</b>				
5.1	<b>Alloys:</b> Introduction, classification, composition, properties, and application of stainless steel, solders, Brass and Alnico.	2	-	-
5.2	<b>Ceramics:</b> Introduction, classification based on chemical composition; properties and applications of perovskites (CaTiO <sub>3</sub> ).	2	-	-
5.3	<b>Nano chemistry:</b> Introduction, size -dependent properties of nanomaterial (surface area, catalytical and thermal), synthesis and applications of nanoparticles (sol-gel, and co-precipitation method).	2	2	-
<b>List of Experiments:</b>				
1	D1. Synthesis of polyurethane.	-	-	2
2	D2. Preparation of urea formaldehyde resin.	-	-	2
3	D3. Synthesis of iron oxide nanoparticles.	-	-	2
4	D4. Determination of acid value of biofuel.	-	-	2
5	E1. Conductometric estimation of acid mixture.	-	-	2
6	E2. Potentiometric estimation of FAS using K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> .	-	-	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. Estimation of percentage of iron in steel.	-	-	2
14	O2. Electroplating of desired metal on substrate.	-	-	2
15	O3. Synthesis of biodiesel.	-	-	2
16	O4. Synthesis of Aluminium oxide nano particle.	-	-	2
17	O5. Estimation of manganese dioxide in pyrolusite.	-	-	2
<b>Total No. of Lecture Hours</b>		26	-	-
<b>Total No. of Tutorial Hours</b>			<b>14</b>	-
<b>Total No. of Practical Hours</b>				<b>10/17</b>

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

1. High energy fuels: Production of hydrogen by electrolysis of water and its advantages.
2. Metal coating- galvanization and tinning.
3. Composites: Properties and industrial applications of carbon –based reinforced composites (graphene/carbon nano tubes as fillers).
4. Glass electrode- construction, advantages and disadvantages.
5. Abrasives: Classification, properties, and application of Silicon carbide(carborundum).

**Textbooks:**

1. A Text book of Engineering Chemistry, R.V. Gadag and Nityananda shetty, I.K. International Publishing house, 2<sup>nd</sup> Edition, 2016.
2. Textbook of engineering chemistry by Dr. K. Pushpalatha, published by wiley publications, 2<sup>nd</sup> 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 15<sup>th</sup> 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