CHY1701 Engineering Chemistry		L	T	P	J	C
		3	0	2	0	4
Pre-requisite	**Chemistry of 12th standard or equivalent**	**Syllabus version**				
		1.0				

Course Objectives:

- To impart technological aspects of applied chemistry
- To lay foundation for practical application of chemistry in engineering aspects

Expected Course Outcome:

- Students will be familiar with the water treatment, corrosion and its control, engineering applications of polymers, types of fuels and their applications, basic aspects of electrochemistry and electrochemical energy storage devices
-

Student Learning Outcomes (SLO):	**1,2,14**		
Module:1	**Water Technology**	**5 hours**	**SLO: 1,14**

Characteristics of hard water - hardness, DO, TDS in water and their determination – numerical problems in hardness determination by EDTA; Modern techniques of water analysis for industrial use - Disadvantages of hard water in industries.

Module:2	**Water Treatment**	**8 hours**	**SLO:1,14**

Water softening methods: - Lime-soda, Zeolite and ion exchange processes and their applications. Specifications of water for domestic use (ICMR and WHO); Unit processes involved in water treatment for municipal supply - Sedimentation with coagulant- Sand Filtration - chlorination; Domestic water purification – Candle filtration- activated carbon filtration; Disinfection methods- Ultrafiltration, UV treatment, Ozonolysis, Reverse Osmosis; Electro dialysis.

Module:3	**Corrosion**	**6 hours**	**SLO: 2**

Dry and wet corrosion - detrimental effects to buildings, machines, devices & decorative art forms, emphasizing Differential aeration, Pitting, Galvanic and Stress corrosion cracking; Factors that enhance corrosion and choice of parameters to mitigate corrosion.

Module:4	**Corrosion Control**	**4 hours**	**SLO: 2**

Corrosion protection - cathodic protection – sacrificial anodic and impressed current protection methods; Advanced protective coatings: electroplating and electroless plating, PVD and CVD.

Alloying for corrosion protection – Basic concepts of Eutectic composition and Eutectic mixtures - Selected examples – Ferrous and non-ferrous alloys.

Module:5	**Electrochemical Energy Systems**	**6 hours**	**SLO: 1,14**

Brief introduction to conventional primary and secondary batteries; High energy electrochemical energy systems: Lithium batteries – Primary and secondary, its Chemistry, advantages and applications.
Fuel cells – Polymer membrane fuel cells, Solid-oxide fuel cells- working principles, advantages, applications.
Solar cells – Types – Importance of silicon single crystal, polycrystalline and amorphous silicon solar cells, dye sensitized solar cells - working principles, characteristics and applications.

Module:6	Fuels and Combustion	8 hours	SLO: 2
Calorific value - Definition of LCV, HCV. Measurement of calorific value using bomb calorimeter and Boy's calorimeter including numerical problems. Controlled combustion of fuels - Air fuel ratio – minimum quantity of air by volume and by weight-Numerical problems-three way catalytic converter- selective catalytic reduction of NO_X; Knocking in IC engines-Octane and Cetane number - Antiknocking agents.			
Module:7	**Polymers**	**6 hours**	**SLO: 2**
Difference between thermoplastics and thermosetting plastics; Engineering application of plastics - ABS, PVC, PTFE and Bakelite; Compounding of plastics: moulding of plastics for Car parts, bottle caps (Injection moulding), Pipes, Hoses (Extrusion moulding), Mobile Phone Cases, Battery Trays, (Compression moulding), Fibre reinforced polymers, Composites (Transfer moulding), PET bottles (blow moulding); Conducting polymers- Polyacetylene- Mechanism of conduction – applications (polymers in sensors, self-cleaning windows)			
Module:8	**Contemporary issues:**	**2 hours**	
Lecture by Industry Experts			
	Total Lecture hours:	**45 hours**	

Text Book(s)	
1.	1. Sashi Chawla, A Text book of Engineering Chemistry, Dhanpat Rai Publishing Co., Pvt. Ltd., Educational and Technical Publishers, New Delhi, 3rd Edition, 2015. 2. O.G. Palanna, McGraw Hill Education (India) Private Limited, 9th Reprint, 2015. 3. B. Sivasankar, Engineering Chemistry 1st Edition, Mc Graw Hill Education (India), 2008 4. "Photovoltaic solar energy: From fundamentals to Applications", AngÃ¨le Reinders, Pierre Verlinden, Wilfried van Sark, Alexandre Freundlich, Wiley publishers, 2017.
Reference Books	
2	1. O.V. Roussak and H.D. Gesser, ***Applied Chemistry-A Text Book for Engineers and Technologists***, Springer Science Business Media, New York, 2nd Edition, 2013. 2. S. S. Dara, ***A Text book of Engineering Chemistry,*** S. Chand & Co Ltd., New Delhi, 20th Edition, 2013.

Mode of Evaluation: Internal Assessment (CAT, Quizzes, Digital Assignments) & FAT

List of Challenging Experiments (Indicative)		**SLO: 14**
	Experiment title	Hours
1.	Water Purification : Hardness estimation by EDTA method and removal by ion-exchange resin	1 h 30 min
2. 3.	Water Quality monitoring: Total dissolved oxygen assessment in different water samples by Winkler's method Estimation of Sulphate for assessing water contamination by conductivity method	3 h

4. 5.	Material Analysis: Nickel in Nickel plated component by colorimetry Iron in carbon steel by potentiometry	3h
6.	Measurement of Retrieved water stored in smart material (hydrogel)	1 h 30 min
7.	Polymer characterization: Determination of viscosity of different natural polymer/synthetic polymers	1 h 30 min
8. 9.	Soil analysis by flame photometry: Na/K in soil & Ca in water samples	3h
10.	Preparation of a working model relevant to syllabus and its demonstration. Examples: 1. Construction and working of electrochemical energy system – students should demonstrate working of the system. 2. Construction of dye sensitized solar cell and demonstration of its working 3. Calcium in food samples	Non-contact hours
	Total Laboratory Hours	17 hours
Mode of Evaluation: Viva-voce and Lab performance & FAT		
Recommended by Board of Studies	06-06-2018	
Approved by Academic Council	**50th ACM** Date **14.06.2018**	