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

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	

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	

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	

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	

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	

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 – Anti-knocking agents.

Module: 7	Polymers	6 hours	

Difference between thermoplastics and thermosetting plastics; Engineering application of plastics - ABS, PVC, PTFE and Bakelite; Compounding of plastics: molding of plastics for Car parts, bottle caps (Injection molding), Pipes, Hoses (Extrusion molding), Mobile Phone Cases, Battery Trays, (Compression molding), Fiber reinforced polymers, Composites (Transfer molding), PET bottles (blow molding); 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	Sashi Chawla, A Text book of Engineering Chemistry, Dhanpat Rai Publishing Co., Pvt. Ltd., Educational and Technical Publishers, New Delhi, 3rd Ed., 2015.
2	O.G. Palanna, McGraw Hill Education (India) Pvt. Ltd., 9th Reprint, 2015.
3	B. Sivasankar, Engineering Chemistry 1st Ed., McGraw Hill Education, 2008
4	"Photovoltaic Solar Energy: From Fundamentals to Applications", Angèle Reinders et al., Wiley publishers, 2017.

Reference Books

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 Experiments		SLO: 14
	Experiment title	Hours
1.	Water Purification: Estimation of water hardness by EDTA method and its removal by ion-exchange resin	3 hours
2.	Water Quality Monitoring: Assessment of total dissolved oxygen in different water samples by Winkler's method	6 hours
3.	Estimation of sulphate/chloride in drinking water by conductivity method	
4/5.	Material Analysis: Quantitative colorimetric determination of divalent metal ions of Ni/Fe/Cu using conventional and smart phone digital-imaging methods	6 hours
6.	Arduino microcontroller based sensor for monitoring pH/temperature/conductivity in samples	3 hours
7.	Iron in carbon steel by potentiometry	3 hours
8.	Construction and working of an Zn-Cu electrochemical cell	3 hours
9.	Determination of viscosity-average molecular weight of different natural/synthetic polymers	6 hours
10.	Preparation/demonstration of a working model relevant to syllabus. Ex. 1. Construction and working of electrochemical energy system – students should demonstrate working of the system. 2. Model corrosion studies (buckling of Steel under applied load). 3. Demonstration of BOD/COD	Non-contact hours

	4. Construction of dye sensitized solar cell and demonstration of its working 5. Calcium in food samples 6. Air quality analysis	
	Total Laboratory Hours	**30 hours**
Mode of Evaluation: Viva-voce, Lab performance & FAT		
Recommended by Board of Studies	31-05-2019	
Approved by Academic Council	No. 55	Date	13-06-2019