

SUBJECT CODE: UCH168C/UCH268C	ENGINEERING CHEMISTRY	Credits: 04
L:T:P - 3 : 2 : 0		CIE Marks: 50
Total Hours/Week: 05		SEE Marks: 50

UNIT-I	16Hrs.
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Water Technology:

Introduction, sources, impurities and specifications of water, Boiler feed water - boiler problems, Scale and sludge formation, priming and foaming, boiler corrosion (due to dissolved O₂, CO₂ and MgCl₂).

Chemical analysis of water: Standard for portable water, Determination of; Dissolved oxygen, Chlorides, Sulphates, TDS and numerical problems.

Water softening: Softening of water by ion exchange process. Desalination of sea water by reverse osmosis.

Self Study: BOD and its determination.

Electro Chemical Technology

Introduction, Origin of electrode potential, Nernst equation, concentration cell, numerical on Concentration cell, Reference electrode – Calomel electrode. Determination of single electrode potential using calomel electrode, Ion selective Selective Electrode – Glass electrode, Determination of pH of solution using glass electrode.

Energy storage devices: Introduction, Basic concept, Classification, Characteristics of batteries.

Construction and working of;

- 1) Nickel Metal hydride battery
- 2) Lithium ion batteries;
 - i) Li-Air battery ii) Li-Cobalt oxide battery iii) Li-Sulphur battery

Self Study: Electrochemical Sensors & applications.

UNIT-II	18Hrs.
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Corrosion Science:

Introduction, Corrosion – Definition, Types of corrosion, Chemical (Dry) and Electrochemical (Wet) corrosion. Theory of electrochemical corrosion by taking Iron as an example. Types of Electrochemical corrosion - Differential metal corrosion, Differential aeration corrosion. e.g. water line corrosion, Pitting corrosion. Stress corrosion e.g. Caustic embrittlement. Factors affecting the rate of corrosion; Related to metal & Related to environment. Numerical problems on Corrosion Penetration Rate (CPR) & Weight loss method.

Corrosion Control: Protective coatings: Inorganic coatings – (i) Anodizing – meaning, Anodizing of Al and applications (ii) Phosphating – process and applications. Cathodic protection - i) Sacrificial anodic method ii) Impressed current method.

Self study: Corrosion control by Metallic coating methods.

Metal Finishing : Introduction, Technological importance of metal finishing. Factors governing electroplating - Polarization, Decomposition potential and Over voltage.

Electroplating process: Theory of electroplating - Definition, Principle components of an electroplating bath. Effects of plating variables on the nature of electro deposit.

Determination of throwing power of plating bath by Harring-Blum cell and Numerical problems. Surface preparation for electroplating. Electroplating of Chromium and applications.

Electroless plating process: Meaning, Distinction between electroplating and electroless plating. Surface preparation, Electroless plating of Copper on PCB and applications.

Self study: Information on Multifunctional Coating.

UNIT-III

16Hrs.

Green Chemistry:

Introduction, definition, Major environmental pollutants, Basic principles of green chemistry (12 principles). Various green chemical approaches – Microwave synthesis, Bio catalysed reactions, Phase transfer catalysis. Super critical conditions for solvent free reactions. Synthesis of typical organic compounds by conventional and green route; i) Adipic acid ii) Paracetamol

Atom economy – Synthesis of Ethylene oxide & Methyl Methacrylate. Industrial applications of green chemistry, Numerical problems on Atom economy.

Self study: Information on recent green technology, green chemical products and application

Fuel Technology :

Non Renewable Energy Sources: Introduction, Definition, classification, characteristics of fuel, Combustion, Calorific value- Definition, HCV, LCV, Determination of CV solid/liquid fuel by Bomb calorimeter, numerical problems.

Renewable Energy Sources:

Biofuel - Introduction, Classification of biofuels. Biomass, Sources of biomass. Biodiesel-production of biodiesel by trans-esterification, mechanism of acid catalyzed reaction and alkali catalyzed reactions. Advantages and disadvantages of biodiesel. Fuel cell technology eg: $\text{CH}_3\text{OH} - \text{O}_2$ fuel cell.

Solar Energy – P.V.Cell; Introduction , Construction and Working of Typical P.V.Cell, Preparation of solar grade silicon by union carbide process, Advantages & Disadvantages of P.V.Cell.

Self study: Information on Wind Energy.

Polymer materials:

Introduction, definitions, classification, polymerization types. Mechanism of polymerization- Cationic/Anionic polymerizations of styrene. Molecular weight of polymers- Number average and weight average methods, numerical problems. Glass transition temperature and factors affecting. Synthesis, properties and applications of; i) Epoxy resin ii) Silicon rubber iii) PLA iv) PET.

Conducting polymers – Definition, Mechanism of conduction in polyacetylene and applications, Graphene – introduction, Mechanism of conduction in graphene and applications.

Self study: Polymer membranes and their applications

Dyes: Introduction, definition, sensation of colour, classification based on applications of dyes. Theories of dyes- Wit theory, Electronic theory, Relationship of absorbed and visible colours. Synthesis, Properties and applications of; i) Azo dyes

Fluorescent dyes – Introduction, Classification, fluorphores and their bio-Applications.

Self study: Information on food dyes with example and applications

Reference Books**Text Books:**

1. Dr. Suba Ramesh et al (2011), Engineering Chemistry (1st edition), Wiley India Pvt. Ltd., Delhi.
2. Shashi Chawla (2003), A Text Book of Engineering Chemistry (3rd edition), Dhanpat Rai & Co. Pvt., Pub. Delhi.

Reference Books:

1. Dr. Dhara.S.S. & Dr. Omare.S.S (2010), Engineering Chemistry (12th edition), S. Chand & Company Ltd., Delhi.
2. Jain & Jain (2013), Engineering Chemistry (16th edition), Dhanapath Rai pub. Co.
3. Kenneth Doxsee & James Huchison (2004), Green Organic Chemistry (1st edition), Thomson-Brooks/Cole.
4. David M. Mousdale (2017), Introduction to Bio fuels (3rd edition), CRC Press.

Course Outcomes**

After completion of the course student will be able to

1. Apply and demonstrate quantitative chemical analysis and electrochemical analysis techniques and incorporate new methods to produce soft water for industrial and domestic use at cheaper cost.
2. Analyze engineering problems related to corrosion and develop/practice suitable preventive measures. Utilize surface modification methods to improve various cost effective properties of

materials.

3. Apply the principles of green chemistry in design and development of alternative ecofriendly chemical synthesis methods to minimize hazardous substances and impart the knowledge of conventional and non-conventional energy sources and their effective management.
4. Acquire the knowledge of different polymer materials and dyes for wide variety of engineering applications.

* Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	1											1			
CO2	3	2	1										1			
CO3	3	2	1				2						1			
CO4	3	1	1										1			

SUBJECT CODE: UCH172L/272L	ENGINEERING CHEMISTRY LABORATORY	Credits: 1.5
L:T:P - 0 – 0 – 3		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

Sl. No.	Name of the experiment
PART – A	
	<ol style="list-style-type: none"> 1. Determination of viscosity of liquid by Ostwald's Viscometer. 2. Potentiometric estimation of Iron in the given solution using standard $K_2Cr_2O_7$ solution. 3. Determination of pKa of a weak acid by standard NaOH using pH meter. 4. Conductometric estimation of HCl & CH_3COOH in acid mixture by Standard NaOH. 5. Colorimetric estimation of copper in the given solution.
PART – B	
	<ol style="list-style-type: none"> 1. Preparation standard solution and Standardization of a given solution. 2. Determination of total hardness of a given water sample by EDTA method. 3. Determination of amount of CaO in the cement solution by EDTA method. 4. Determination of alkalinity of water sample by dual indicator method. 5. Determination of amount of Fe in a given solution using standard $K_2Cr_2O_7$ solution.

Reference Books
<p>Text Books:</p> <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Sudharani (2012), Laboratory manual in Engineering Chemistry (3rd edition), Dhanapat Rai Publishing Company Private Limited, New Delhi. 2. Jeffery.G.H., Basett.J., Mendham.J & Denney R.C.(1989), Vogel's Test Book of quantitative Chemical Analysis (5th edition), John Wiley & Sons.Inc., New York. 3. Sunita Rattan (2009), Practical Engineering Chemistry (2nd edition). Publisher S.K.Kataria & Sons.

Course Outcomes

After completion of the course student will be able to

1. Write systematic procedure for setting up & conduct of experiment.
2. Perform experiment on volumetric analysis individually along with interpretation of / results of analysis and calculation.
3. Perform experiments using instruments for trace of chemical analysis with high accuracy.
4. Incorporate the practical knowledge of chemistry for engineering applications.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										1			
CO2	3	2										1			
CO3	3	2										1			
CO4	3	2										1			