

<b>SUBJECT CODE:</b> <b>UCH168C/UCH268C</b>	<b>ENGINEERING CHEMISTRY</b>	<b>Credits: 04</b>
<b>L:T:P - 3 :2 : 0</b>		CIE Marks: 50
<b>Total Hours/Week: 5</b>		SEE Marks: 50

UNIT-I	16Hrs.
<p><b>Principles of volumetric analysis:</b> Introduction, Fundamentals of volumetric analysis. Terminology - titration, equivalence point, indicators. Types of titrations – Acid-Base, Complexation, Precipitation &amp; Redox titrations. Standard solution – concentration terms; Normality, Molarity, Mole fraction, percentage by weight and numerical problems on Normality &amp; Molarity. Requirements primary of standard substance. <b>Acid-base titration:</b> acids-base indicator, Ostwald’s theory of acid – base indicator. Action of indicator – Phenolphthalein &amp; Methyl orange. Choice of indicator for acid-base titrations, Titration curves – HCl v/s NaOH , CH<sub>3</sub>COOH v/s NaOH.</p> <p><b>Bio Fuels:</b> Introduction, Limits of conventional fuel &amp; Need for Biofuel. Classification of bio fuels. Biomass, Sources of biomass. Biodiesel- production of biodiesel by transesterification, mechanism of acid catalyzed reaction and alkali catalyzed reactions. Advantages and disadvantages of biodiesel. Fuel cell technology eg: CH<sub>3</sub>OH – O<sub>2</sub> fuel cell. Microbial production of bio gas (Bio-methanation).. <b>Bio refineries:</b> concept, types of bio refineries, Co production of ethanol and other chemicals</p>	
UNIT-II	18Hrs.
<p><b>Corrosion Science:</b> 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 &amp; Related to environment. Numerical problems on Corrosion Penetration Rate (CPR) &amp; Weight loss method.</p> <p><b>Corrosion Control:</b> Protective coatings – Inorganic coatings – (i) Anodizing – meaning, Anodizing of Al and applications (ii) Phosphating – process and applications. Metal coatings– (i) Galvanization (anodic coating) (ii) Tinning (cathodic coating).</p>	

### **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 Haring Blum cell and Numericals. Electroplating of Chromium and applications.

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

#### **UNIT-III**

**16 Hrs.**

### **Green Chemistry:**

Introduction, Aims and Objectives, Major environmental pollutants, Basic principles (12 principles). Various green chemical approaches – Microwave synthesis, Bio catalysed reactions, Phase transfer catalysis. Synthesis of typical organic compounds by conventional and green routes, i) Adipic acid ii) Indigo. Atom economy – Synthesis of ethylene oxide & Synthesis of ethyl bromide. Industrial applications of green routes.

### **Pollution abatement in chemical industries**

Introduction, Need for abatement of pollutants, Effect of industrial pollutants on environment. Abatement processes in Sugar industry, Distilleries, Cement Industry; Standards for effluents discharge, nature of effluents, ill effects and treatment procedure in each industry.

**Effluent Analysis:** Biological Oxygen Demand (BOD) and Chemical Oxygen Demand(COD). Numerical problems on COD & BOD.

#### **UNIT-IV**

**16 Hrs.**

### **Engineering materials**

**Polymer composites:** Introduction, structure of polymer composites, Properties and applications of Kevlar and Carbon fibres.

**Organic Light Emitting Diodes (OLEDs):** Introduction, Definition, Anatomy of OLED, Types of OLEDs, Comparisons between LED and OLED, Advantages and Disadvantages. Applications of OLEDs.

**Shape Memories Alloys:** Introduction, Phases of Shape Memories Alloys, Shape Memories effect – One way and Two way effects. Example – Nitinol(Ni-Ti Alloy): Meaning, Composition, Production by Vacuum Arc Remelting (VAR) method. Properties – Physical and Mechanical. Applications of Nitinol.

### **Polymer materials**

**Plastics & Resins:** Introduction, Commercial thermoplastics & thermosets. Preparation, Properties & Applications of plasticized PVC & PET.

**Elastomers:** Introduction, Classification, Olefin Elastomers, Synthetic rubber, Preparation, Properties & Applications of Poly sulphide rubber & Silicon rubber.

**Adhesives:** Introduction, Classification, Preparation, Properties & Applications of Epoxy resin.

**Conducting Polymers:** Introduction, Mechanism of conduction in polyacetylene, enhancing conductivity in poly acetylene by doping methods. Applications of conducting polymers.

**Biodegradable Polymer :** Introduction, Composition, Preparation, Properties & Applications of poly lactic acid (PLA) and poly caprolactone (PCL).

#### Reference Books

##### Text Books:

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

##### Reference Books:

1. Puri. B. R, (1992), Principles of Physical Chemistry (33<sup>rd</sup> edition), L.R. Sharma & M.S. Pathania & Co.
2. Jain & Jain (2013), Engineering Chemistry (15<sup>th</sup> edition), Dhanapath Rai pub. Co.
3. Dr. Timmanagoudar. P. L. & Dr. Patil. S. K. (2014), A Text Book of Engineering Chemistry (1<sup>st</sup> edition), EBPB, Gadag
4. Dr. Das A. K. (2012), Environmental Chemistry with Green Chemistry, Books & Allied (P) Ltd, Kolkata.
5. Kenneth Doxsee & James Huchison (2004), Green organic Chemistry (1<sup>st</sup> edition), United States: Thomson Brooks.
6. Gowariker V. R., Viswanathan N. V. & Jayadev Sreedhar (1988), Polymer Science (1<sup>st</sup> edition), New Age Int. Publication.
7. David M. Mousdale (2010), Introduction to Bio fuels (1<sup>st</sup> edition), CRC Press.
8. Wim Soetaert Erick J. Vandamme (2009), Bio fuels (1<sup>st</sup> edition), Willey.
9. Otsuka K & Wayman C M (1998), Shape memory materials (1<sup>st</sup> edition), Cambridge University Press.
10. Alastaer Buckley (2013), Organic Light Emitting Diodes Materials, Devices & Applications (1<sup>st</sup> edition), Woodhead Publishing Ltd., Delhi.

#### Course Outcomes

After completion of the course student will be able to

1. Conduct experiment along with analysis and interpretation of data
2. Identify renewable sources to solve conventional crises.
3. Develop practical solutions for control of corrosion in metallic structures.



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

Sl. No.	Name of the experiment
<b>PART – A</b>	
	1. Determination of molecular weight of polystyrene by Ostwald's Viscometer.
	2. Potentiometric estimation of Iron in stainless steel using standard $K_2Cr_2O_7$ solution.
	3. Determination of pKa of a soft drinks using standard NaOH by pH meter.
	4. Conductometric estimation of HCl & $CH_3COOH$ in acid mixture by Standard NaOH.
	5. Colorimetric estimation of copper in PCB.
	6. Study of titration curve of $Na_2CO_3$ versus HCl using pH meter.
<b>PART – B</b>	
	1. Preparation and Standardization of a solution.
	2. Determination of total hardness of water before & after R.O. treatment 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 percentage of Fe in mild steel using standard $K_2Cr_2O_7$ solution.
	6. Determination of chloride in water by Mohr's method.

#### Reference Books \*

##### Text Books:

##### Reference Books:

1. Sudharani (2012), Laboratory manual in Engineering Chemistry (3<sup>rd</sup> 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 (5<sup>th</sup> edition), John Wiley & Sons.Inc., New York.
3. Sunita Rattan (2009), Practical Engineering Chemistry (2<sup>nd</sup> 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
<b>CO1</b>	2	1	1	1		2						1	3	1	1
<b>CO2</b>	2	1	1	2	2	2		1	1			1	3	1	1
<b>CO3</b>	2	2		2	2	2	2	1	1			1	3	1	1
<b>CO4</b>	2	1		2	2	2			1			1	3	1	1