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.

Principles of volumetric analysis:
Introduction, Fundamentals of volumetric analysis. Terminology - Titration, equivalence point, indicators. Types of titrations – Acid-Base, Complexation, Precipitation & Redox titrations. Standard solution – concentration terms; Normality, Molarity, Mole fraction, percentage by weight and numericals on Normality & Molarity. Requirements of primary standard substance.

Acid-base titration: Acids-base indicator, Ostwald's theory of acid – base indicator. Action of indicator – Phenolphthalein & Methyl orange. Choice of indicator for acid-base titrations, Titration curves – HCl v/s NaOH , Na2CO3 v/s HCl.

Bio Fuels:
Introduction, Limits of conventional fuel & 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: CH3OH – O2 fuel cell. Microbial production of bio gas (Bio-methanation).

Bio refineries: concept, types of bio refineries, Co production of ethanol and other chemicals.

Self study: Identification of non-edible seeds for biodiesel production and combustion characteristics.

UNIT–II	18Hrs.

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. Numericals 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 coatings.

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 Numericals. Surface preparation for electroplating. 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 route - i) Adipic acid ii) Indigo.

Atom economy – Synthesis of ethylene oxide & Ethyl bromide. Industrial applications of green chemistry.

Self study: Numericals on Atom economy.

Pollution abatement in chemical industries

Introduction, Need for abatement of pollutants, Effect of industrial pollutants on environment. Abatement processes in Sugar industry, 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). Numericals 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).

Self study: *Biodegradable methods:*

i) Photodegradable

ii) Hydro degradable

Reference Books

Text Books:

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

Reference Books:

1. Puri B. R. (1992), Principles of Physical Chemistry (33rd edition), L.R. Sharma & M.S. Pathania,&Co.
2. Jain & Jain (2013), Engineering Chemistry (15th edition), Dhanapath Rai pub. Co.
3. Dr. Timmanagoudar P. L. & Dr. Patil S. K. (2014), A Text Book of Engineering Chemistry (1st edition), EBPB, Gadag.
4. Dr. Das A. K. (2014), Environmental Chemistry with Green Chemistry (1st edition), Books & Allied (P) Ltd, Kolkata.
5. Kenneth Doxsee & James Huchison (2004), Green organic Chemistry (1st edition), United States: Thomson Brooks.
6. Gowariker V. R., Viswanathan N. V., Jayadev Sreedhar (1988), Polymer Science (1st edition), New Age Int. Publication.
7. David M. Mousdale (2010), Introduction to Bio fuels (1st edition).
8. Wim Soetaert Erick J. Vandamme (2010), Bio fuels (1st edition), CRC Press.
9. Otsuka K & Wayman C M (1998), Shape memory materials (1st edition), Cambridge University Press.
10. Alastaer Buckley (2013), Organic Light Emitting Diodes Materials, Devices & Applications (1st 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.**
4. **impart modification of sources to solve conventional crises.**
5. **utilize eco friendly reactions scheme and chemical process for the need of the society.**
6. **resolve the effect of chemicals for industry and environmental related problems.**
7. **discuss the evolution of new materials for future applications.**
8. **apply knowledge to replace conventional materials by polymers for various 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	3										1	3	1	1
CO2	3	3											3	1	1
CO3	2	3											3	1	1
CO4	3	3											3	1	1
CO5	2	3			2	3						1	3	1	1
CO6	3	3			1	2							3	1	1
CO7	3	2				2							3	1	1
CO8	3	2				1							3	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

1. Determination of viscosity of liquid 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. Open Ended Project.

PART – B

1. Preparation and Standardization of a solution.
2. Determination of total hardness of water before and 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 duel indicator method.
5. Determination of percentage of Fe in mild steel using standard $K_2Cr_2O_7$ solution.
6. Open Ended Project.

Reference Books

Text Books:

Reference Books:

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	2	1	1	1		2						1	3	1	1
CO2	2	1	1	2	2	2		1	1			1	3	1	1
CO3	2	2		2	2	2	2	1	1			1	3	1	1
CO4	2	1		2	2	2			1			1	3	1	1