SUBJECT CODE: UCH129C/UCH229C	ENGINEERING CHEMISTRY	Credits: 04
L:T:P - 4 : 0 : 0		CIE Marks: 50
Total Hours/Week: 04		SEE Marks: 50

UNIT-I	13 Hrs.

Principles of volumetric analysis :

Introduction, Fundamentals of volumetric analysis, Terminology - titration, equivalent point, indicators. Standard solution – concentration terms; Normality, Molarity, Mole fraction, PPM, percentage by weight. Requirements primary of standard substance. Types of titrations. Acid-base titration, acids-base indicator, Ostwald's theory of acid – base indicator. Action of indicator – Phenolphthalein & Methyl orange. Choice of acids – base indicator, Titration curves –HCl v/s NaOH , CH_3COOH v/s NaOH & Na_2CO_3 v/s HCl. Complexation titrations - Theory of EDTA complexation titration, estimation of Zn.

Water Technology :

Introduction, Natural sources of water – Impurities in water (Dissolved, suspended, colloidal and biological) Water analysis – Different constituents in water, Hardness – Definition, Types of hardness, Unit of hardness. Disadvantages of hard water; scales sludge formation, priming & foaming. Determination of hardness by EDTA method and numerical problems. Alkalinity – Definition, Determination by Duel indicator method (Phenolphthalein & Methyl orange), & numerical problems. Water pollution Introduction, Sewage, aerobic & anaerobic oxidation. BOD – Definition, Determination of BOD, Significance of BOD and numerical problems, COD – Definition, determination of COD, Significance of COD, and numerical problems

UNIT–II	13 Hrs.

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.

Principles of volumetric analysis :

Introduction, Fundamentals of volumetric analysis, Terminology - titration, equivalent point, indicators. Standard solution – concentration terms; Normality, Molarity, Mole fraction, PPM, percentage by weight. Requirements primary of standard substance. Types of titrations. Acid-base titration, acids-base indicator, Ostwald's theory of acid – base indicator. Action of indicator – Phenolphthalein & Methyl orange. Choice of acids – base indicator, Titration curves –HCl v/s NaOH , CH_3COOH v/s NaOH & Na_2CO_3 v/s HCl. Complexation titrations - Theory of EDTA complexation titration, estimation of Zn.

UNIT–III	13 Hrs.

Green Chemistry:

Introduction, Aims and Objectives, Major environmental pollutants, Basic principles, various green chemical approaches – Microwave synthesis, Biocatalysed reactions, Phase transfer catalysis. Alternative reaction conditions. Synthesis of typical organic compounds by conventional and green root: i) Adipic acid ii) Poly carbonates iii) Indigo iv) Disodium iminodiacetate. Atom economy – Synthesis of ethylene oxide & Synthesis of ethyl bromide. Industrial applications.

Nano Technology:

Introduction, Nanomaterials – meaning, properties, classification. Synthetic roots: Bottom up, Top down approaches. Synthesis of nanomaterials - Bottom up methods; Inert gas condensation, Precipitation method, Top down methods; High Pressure Torsion (HPT), Laser ablation synthesis. Characterization of Nano materials – SEM. Nano scale materials: Nano clusters, Nano wires , Carbon nano sheets & tubes, Dendrimers.

UNIT–IV	13 Hrs.

Bio Fuels:

Introduction, Limits of conventional fuel & Need for Biofuel. Green house gases, Photo synthesis for Biofuels, Types of biomass, energy need for biofuel production, Direct burning. Biomass, Production of biodiesel by transesterification, Acid catalysed reaction and Alkali catalysed reaction. Advantages, disadvantages of Biodiesel, Hydrogen economy, fuel cell technology eg: $CH_3OH – O_2$ fuel cell. Bio production of gases CH_4 and H_2. Biorefinery Concept, Types of biorefinery, Co production of ethanol and other biofuels, biomass gasification.

Polymers:

Introduction, definitions, classification, polymerization, mechanism of poly merization. Free radical mechanism with polyethylene as an example, Methods of polymerization, Glass transition temperature, Synthesis, structure – property relationship, properties and applications of Poly Vinyl Acetate, Nylon 6,10, Compounding of polymers.

Elastomers – Definition. Classification with example, Synthetic rubber - Synthesis, properties & applications of Silicon rubber, Vulcanization of Silicon rubber, Conducting polymers – Definition, Mechanism of conduction in polyacetylene and applications, Polymers blends & composites.

Reference Books

Text Books:

1. Uppal.M.M (2002), Engineering Chemistry (6th edition), Khanna Publishers.
2. Dhara.S.S. & Umare.S.S (2010), Engineering Chemistry (12th edition), S. Chand & Company Ltd., Delhi.

Reference Books:

1. Gadag & Nityanand Shetty.I.K. (2018), Engineering Chemistry (3rd edition), International P.H. Delhi.
2. O.G.Palanna (2017), Engineering Chemistry (2nd edition) Tata Mc. Graw Hill Education Pvt. Ltd.
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. Gowariker. V. R, Viswanathan. N. V., Jayadev Sreedhar (1986), Polymer Science (1st edition), New Age Int. Publication.
6. Gabor L, Hornyak, Harry F. Tibbals (2008), Introduction to Nanoscience and Nanotechnology (1st edition),
7. Manasi Karkare (2008), Nanotechnology (1st edition), I. K. International P.H. New Dehli.
8. David M. Mousdale (2010), Introduction to Bio fuels (1st edition).
9. Wim Soetaert Erick J. Vandamme (2009), Bio fuels (1st edition), John Wiley & Sons. Inc., New York.
10. 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.

Course Outcomes

After completion of the course student will be able to

1. Estimate the impurities present in water which creates awareness about water quality.
2. Understand various modes of corrosion and hence encourage the effective utilization of metals.
3. Gain the knowledge of eco friendly chemical synthesis, which in turn creates the awareness about renewable material source and importance of prevention of environmental pollution for the future.
4. Understand the importance of the materials in nanoscale and their properties, which will encourage them to think of new material world.
5. Encourage use of renewable material as fuel.
6. Gain the knowledge of replacement of conventional materials by polymers for various engineering applications.

SUBJECT CODE: UCH134L/UCH234L	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 coefficient of a given liquid using Ostwald's Viscometer.
2. Potentiometric estimation of FAS by using standard $K_2Cr_2O_7$ solution.
3. Colorimetric estimation of copper.
4. Conductometric estimation of HCl & CH_3COOH in the acid mixture using standard NaOH.
5. Determination of pKa of a weak acid using standard NaOH by pH meter.
6. Study of titration curve of Na_2CO_3 versus HCl using pH meter.

PART – B

1. Estimation of total hardness of water sample using standard solution of disodium salt of EDTA solution.
2. Determination of percentage of copper in brass by using std. sodium thiosulphate solution.
3. Determination of alkalinity of given water sample using standard Hydrochloric acid solution.
4. Determination of amount of CaO present in the given sample of cement solution by EDTA method.
5. Determination of water of hydration in Mohr's salt using standard $K_2Cr_2O_7$solution.
6. Estimation of chloride in water by Mohr's method.

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**

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