101908/CH900B ENGINEERING CHEMISTRY

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	Module 1 (12hours)	
1.1	Electrochemical cell, Single electrode potential, Helmholtz electrical double layer	1
1.2	Cell representation, Free energy and EMF-Nernst Equation-Derivation-single electrode	1
1.3	Cell (Numerical)– Applications	2
1.4	Different types of electrodes (brief)	1
1.5	Reference electrodes - Calomel electrode - Construction and Working. Determination of E^o using calomel electrode, Glass Electrode-Determination of pH using glass electrode.	2
1.6	Potentiometric titration - Introduction -Redox titration only.	1
1.7	Energy storage devices- lithium batteries for electric vehicles - Lithium-ion battery, Lithium ion/Polymer battery, Lithiumsulphur battery - Supercapacitors- Classifications based on mechanism with example - EDLC & Pseudo capacitors.	2
1.8	Corrosion - Electrochemical corrosion – mechanism. Galvanic series-electroless plating –Copper and Nickel plating.	2
	Module 2 (10 hours)	
2.1	Introduction- Types of spectrum - electromagnetic spectrum – molecular energy levels	1
2.2	Beer Lambert's law (Numerical).	2
2.3	UV-Visible Spectroscopy –Principle - Types of electronic transitions - Energy level diagram of ethane,butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications	2
2.4	IR-Spectroscopy – Principle - Number of vibrational modes - Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numerical) –Applications.	2
2.5	1H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMRincluding MRI (brief).	3
3	Module 3 (7 hours)	

3.1	Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications –TGA of CaC_2O_4. H_2O and polymers.	1

3.2	DTA-Principle, instrumentation (block diagram) and applicationsDTA of $CaC_2O_4.H_2O$.	1
3.3	Chromatographic methods - Basic principles and applications of column and TLC- Retention factor. GC and HPLCPrinciple, instrumentation (block diagram) - retention time and applications.	4
3.4	Surface characterization Technique - SEM – Principle and instrumentation (block diagram).	1
4	Module 4 (13 hours)	
4.1	Classification of polymers - Nomenclature of polymers, Degree of polymerization, Functionality, Tacticity	1
4.2	Types of polymerization – Addition polymerization - Mechanism Free radical and Ionic -Condensation polymerization	1
4.3	Polymerization techniques - Bulk, solution, suspension, emulsion	1
4.4	Molecular weight of polymers – Number average molecular weight - Weight average molecular weight - Viscosity average molecular weight (numerical).	2
4.5	Structure - property relationship of polymers – Strength - Effect of heat on polymers (Tg)	1
4.6	Plastics- compounding of plastics - Plasticizers, fillers, accelerators, stabilizers, coloring agents (only function and examples)	1
4.7	Moulding Techniques - Injection, transfer, extrusion, blow (only brief procedure)	1
4.8	Engineering polymers - Polyurethane, Epoxy resin (DGEBA), PF resin, ABS, Kevlar, Silicones (Structure, properties & applications)	2
4.9	Conducting polymers-Classification-Doping (Conducting mechanism) - Chemical synthesis of Polyaniline and Polypyrrole – Applications – OLED -Construction and working – Advantages.	2
4.10	Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterial.	1
5	Module 5 (11 hours)	
5.1	Water characteristics -Hardness- Types of hardness- Temporary and Permanent-Disadvantages of hard water -Units of hardness- ppm and mg/L	1

5.2	Degree of hardness (Numericals)	1
5.3	Estimation of hardness-EDTA method (Numerical).	2

5.4	Water softening methods -Ion exchange process-Principle, procedure and advantages, Reverse osmosis – principle, process and advantages.	2
5.5	Municipal water treatment (brief)	1
5.6	Disinfection methods - chlorination, ozone and UV irradiation.	1
5.7	Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD- definition, estimation (only brief procedure) and significance (Numericals).	2
5.8	Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.	1