

Revised - LESSON PLAN

Department: CHEMISTRY

Semester: B.E Second

Subject code and Subject: CHE 22; Engineering Chemistry

Prepared by: Mr. B.M. Nagabhushana

Preparation date: 05-02-07

Reviewed by: Mr. K. Nagaraju

Dr. Sunitha M R &

Review date: 07-02-07

Dr. Riya Datta

Re validated on:

Contact Hours: 4 Hours/week

No. of hours required: 52

Max. Final Exam Marks: 100

Max. Internal Assessment Marks: 25

Duration of Final Exam: 3 Hours

Lesson No/ Lesson code	Topic	Duration
1 EP-1	Electrode potential- Construction of Galvanic cell; notation and conventions. EMF of a cell; standard electrode potential,	1 hour each
2 EP-2	Single electrode potential – Definition, Origin – HelmHoltz Electrical double layer, Derivation of Nernst's equation.	„
3 EP-3	Factors affecting single electrode potential; classification – primary and secondary cells. Types of electrodes- Reference electrodes: definition, limitations of primary reference electrode and the need for developing secondary reference electrodes.	„
4 EP-4	Secondary reference electrodes: construction, electrode reactions and applications of Calomel and Ag-AgCl electrode.	„
5 EP-5	Measurement of single electrode potential. Ion selective electrodes–definition; Glass electrode–construction, notation, electrode reactions, advantages and limitations; Determination of pH of a solution using glass electrode.	„
6 EP-6	Concentration cells. Numerical problems on E, E ^o and E _{cell}	„ =(6 hrs)
7 BT-1	Battery technology- Introduction, Classification of batteries (primary, secondary and reserve batteries.); Basic concepts – principal components of a battery.	1 hour each
8 BT-2	Operating mechanism during discharge and charge	„
9 BT-3	Battery characteristics – voltage, current, capacity, electrical storage capacity, energy density, power density, energy efficiency, cycle life, shelf life and tolerance to service conditions.	„
10 BT-4	Classical battery: Construction, working and applications of Pb – acid and Ni – Cd batteries	„
11 BT-5	Modern batteries: Construction, working and applications of Zn- air, Nickel-Metal hydride and Lithium-MnO ₂ batteries.	„ =(5 hrs)
12 FC-1	Fuel Cells- Fuel cells – Introduction, Definition, differences between a battery and a fuel cell and advantages. Types of fuel cells – Alkaline fuel cells, Phosphoric acid fuel cells, Molten carbonate fuel cells, Solid polymer electrolyte fuel cells and Solid oxides fuel cells – Mention of electrode materials, electrolyte used and one or two applications (construction and reactions not be insisted).	1 hour each
13 FC-2	Construction, working, reaction and applications of H ₂ –O ₂ and Methanol – O ₂ fuel cells.	„ = (2 hrs)

14	LC-1	Liquid crystals- Introduction, meaning, positional and orientational order in solid, liquid crystals and liquids. Director. Classification – Thermotropic and Lyotropic with examples.	1 hour each
15	LC-2	Nematic, Chiral nematic (Cholesteric), Smectic and Columnar – arrangements of molecules with examples.	„
16	LC-3	Types of mesophases – Liquid crystalline behaviour in homologues series – PAA and MBBA series.	„
17	LC-4	Applications of liquid crystals in display systems – explanation of display working, mention of LCD devices.	„ =(4 hrs)
18	IM-1	Instrumental Methods of Analysis: Theory, instrumentation and application of Colorimetry	1 hr each
19	IM-2	Theory, instrumentation and application of Potentiometry and Conductometry	„ = (2 hrs)
20	EG-1	Energy- Introduction to energy; Fuels – Definition, Classification: Natural and synthetic or (i) Primary – Solid, Liquid and Gaseous fuels and (ii) Secondary – Solid, Liquid and Gaseous fuels. Importance of hydrocarbons as fuels. Calorific value – definition, classification – Gross and Net calorific values, units (S.I.). Experimental determination of calorific value of solid / liquid fuels by using Bomb Calorimeter,	1 hour each
21	EG-2	Numerical problems on calorific value. Petroleum cracking – definition, Fluidized bed catalytic cracking.	„
22	EG-3	Reforming of petrol – explanation with reactions. Knocking – mechanism, prevention of knocking: anti-knocking agents	„
23	EG-4	Octane number, Cetane number, Unleaded petrol, Power alcohol: blend composition, advantages and disadvantages.	„
24	EG-5	Synthetic petrol – Bergius process and Fischer Tropsch process.	„
25	EG-6	Solar Energy: Photovoltaic cells – Introduction, definition, importance. Solar grade silicon. Properties of silicon relevant to photovoltaics.	„
26	EG-7	Production of solar grade silicon by chemical vapour deposition method and purification by zone reforming. Doping of silicon, P-N junction and working of a PV cell.	„ = (7hrs)
27	CR-1	Corrosion science- Corrosion – Definition; Chemical corrosion – Electrochemical theory of corrosion (single metal – Fe): Formation of galvanic cells (due to heterogeneities) with anodic and cathodic areas, a conducting medium, cathode reactant, reactions at anode and cathode (in acidic, neutral and alkaline media) and cell reaction.	1 hour each
28	CR-2	Types of corrosion – Differential metal corrosion – Concept of electrode potential difference; Differential aeration corrosion – same metal placed in media identical except for their oxygen concentration – e.g. pitting corrosion and water line corrosion; Stress corrosion – Caustic embrittlement.	„
29	CR-3	Factors affecting the rate of corrosion – Primary factors (Related to metal) – Nature of the metal and surface state of the metal, hydrogen over voltage, Inherent tendency of the metal to form protective films; Potential of electrode	„
30	CR-4	Secondary factors (Related to environment) – pH of the medium,	„

		temperature, area effect, humidity of air, conductance of medium, presence of chemicals in atmosphere (CO ₂ , H ₂ S, SO ₂ , Fumes of HCl, H ₂ SO ₄ etc.)	
31	CR-5	Protective coating – Inorganic coatings – (i) Anodizing – meaning, anodizing of Al – process and applications & (ii) Phosphating – process and applications; Metal coatings – (i) Galvanization (anodic metal coating) & (ii) Tinning (cathodic metal coating).	„
32	CR -6	Corrosion inhibitors – Definition, Anodic inhibitors and cathodic inhibitors. Cathodic protection – Sacrificial anodic method and Impressed voltage method & Anodic protection.	„ = (6 hrs)
33	HP-1	Polymers – Definition, classification – Natural and Synthetic with examples; Polymerization – Definition, types of polymerization – addition and condensation with examples.	1 hour each
34	HP-2	Mechanism of polymerization – Free radical mechanism by taking the formation of polyethylene as an example – Initiation, Chain Propagation & Chain termination – coupling, disproportionation, chain transfer.	„
35	HP-3	Methods of polymerization – Bulk, Solution, Suspension and Emulsion polymerization (technique, advantages, disadvantages and applications).	„
36	HP-4	Glass transition temperature (T _g) – meaning, parameters affecting T _g (flexibility, intermolecular forces, molecular weight, branching and cross linking), significance; Structure and property relationship (strength, crystallinity, elastic nature, and chemical resistance).	„
37	HP-5	Resins and plastics – Meaning, Distinction between resins and plastics. Compounding of resins – Incorporation of additives such as plasticizers, fillers, accelerators, colourants, stabilizers and their significances.	„
38	HP-6	Synthesis, properties and applications of TEFLON, PMMA, Polyurethane and Phenol – formaldehyde resins. Elastomers – deficiencies of natural rubber and advantages of synthetic rubber; Synthesis and applications of Neoprene and Butyl rubber. Adhesives – Manufacture and applications of Epoxy resins.	„
39	HP-7	Conducting polymers – Introduction, definition, mechanism of conduction in Polyacetylene; Structure and applications of conducting Polyaniline.	„ =(7 hrs)
40	MF-1	Metal Finishing- Technological importance of metal finishing – To impart corrosion resistance, particular physical and mechanical properties to the surface decoration (e.g. electrical conductivity, heat, wear resistance or solderability); In modern engineering – manufacturing of electronic components – PCBs, capacitors and conductors; Electroforming, electrochemical machining, electropolishing and electrochemical etching. Polarization, Decomposition potential and Over voltage–explanation and their applications with a special reference to the electro deposition of the metals.	1 hour each
41	MF-2	Electroplating process – Principle components of an electroplating process – Electroplating bath, cathode, anode (soluble or insoluble),	„

		an inert vessel, D.C. electrical power source, reactions at anode and cathode.	
42	MF-3	Effects of plating variables on the nature of electro deposit – Metal ion concentration, electrolytes, complexing agents, organic additives (brighteners, levelers, structure modifiers and wetting agents), current density, pH, temperature and throwing power.	„
43	MF-4	Surface preparation – Importance of surface preparation prior to plating: (i) Removal of organic substances – Degreasing – use of organic solvents and alkaline solution, (ii) Removal of inorganic substances – De-scaling processes – Grinding, Polishing, sand blasting and pickling & (iii) Rinsing with water. Electroplating of Cr and Au – Electrolyte composition, additives, pH, current density, temperature, anode, cathode (including reactions) and applications.	„
44	MF-5	Electroless plating – distinction between electroplating and electroless plating (Driving force, anode reactant and reaction, site of anode and cathode reactions) and advantages.	„
45	MF-6	Electroless plating of Copper on PCB and Nickel on Al – preparation of the surface, composition, operating conditions, and reactions (anodic, cathodic and over all).	„ =(6 hrs)
46	WT-1	Water Technology Natural sources of water – impurities present in water. Water analysis – Determination of different constituents in water – Hardness – Definition, types of hardness and its determination by EDTA method – numerical problems;	1 hour each
47	WT-2	Alkalinity – Definition and its determination by phenolphthalein and Methyl orange indicator – numerical problems; Determination of Chloride by argentometric, Fluoride by SPADNS colorimetric.	„
48	WT-3	Nitrate by phenol disulphide (spectrophotometric) and Sulphate by gravimetric, Determination of Dissolved Oxygen by Winklers method.	„
49	WT-4	Biological Oxygen Demand – Definition, determination and numerical problems; Chemical Oxygen Demand – Definition, determination and numerical problems.	„
50	WT-5	Sewage treatment – Primary treatment, Secondary treatment by activated sludge treatment and Tertiary treatment.	„
51	WT-6	Potable water – Definition, purification of water by Flash evaporation, Electro dialysis and Reverse Osmosis.	„
52	WT-7	Hazardous chemical (compounds of Cd, As, Pb and Hg) with ill effects.	„ =(7 hrs)

Abbreviations used: EP- Electrode Potential, BT-Battery Technology, FC- Fuel cells, LC- Liquid crystals, IM- Instrumental methods of analysis, EG- Chemical fuels (Energy), CR- Corrosion science, HP- High polymers, MF- Metal finishing, WT- Water technology

Internal Assessment details: Three tests will be conducted after as per the time-table announced by the Principal. Each test carries 25 marks. The average of the best two test performances will be taken for evaluating I.A marks. Portion for tests will be notified in advance prior to each test.

Test 1:

Lesson plan Nos.

Date:

Test 2:

Lesson plan Nos.

Date:

Test 3:

Lesson plan Nos.

Date:

Text Books

1. Engineering Chemistry by M.M.Uppal, Khanna Publishers, Sixth Edition, 2001
2. A text Book of Engineering Chemistry- by Jain and Jain, Dhanapatrai Publications, New Delhi.

Reference Books

1. Principles of Physical Chemistry B.R.Puri, L.R.Sharma & M.S.Pathania, S.Nagin Chand &Co., 33rd Ed., 1992.
2. Text Book of Polymer Science by F.W.Billmeyer, John Wiley & Sons, 1994.
3. Liquid crystals and plastic crystals , Vol-I, edited by G.W.Gray and P.A.Winsor, Ellis Horwood series in Physical Chemistry, New York.(p.No. 106-142).
4. Corrosion Engineering – by M.G.Fontana, Mc Graw Hill Publications.
5. Environmental Chemistry by Stanley E. Manahan, 7th Edition, Lewis Publishers,

- Reference Books:**
1. Principles of Physical Chemistry- Puri & Sharma
 2. Liquid Crystals- Peter Collings
 3. Corrosion Engineering- M.G. Fontana

TERM	Section	Staff (Name & Signature with Date)	HOD (Signature with Date)
12.02.2007 to 09.06.2007	A	1 _____	
		2 _____	
		3 _____	
	B	1 _____	
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	C	1 _____	
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D	1 _____		
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H	1 _____		
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