RAMAIAH Institute of Technology

Ramaiah Institute of Technology

Department of Chemistry

Course Delivery (Lesson Plan) - 2020-21: The course will be delivered through lectures, class room interaction, group discussion and exercises.

Lesson No/ Lesson code		Topic	No. of hours
1	EP-1	**Electrochemical cells -** Basic concepts of electrochemistry – electrode potential, origin of single electrode potential.	1 period each
2	EP-2	Derivation of Nernst equation, Galvanic cells. Numerical problems.	„
3	EP-3	Reference electrodes – construction, working and applications of calomel electrode, (Ag-AgCl electrode-Just mention)	„
4	EP-4	Measurement of single electrode potential using calomel electrode. Ion-selective electrode-Glass electrode-Just mention, (No construction and working)	„
5	EP-5	Determination of pH using glass electrode. Concentration cells-definition, example and Nernst equation for a concentration cell.	„
6	EP-6	Numerical problems on electrode potential, EMF of cells and concentration cells.	**= 6 periods**
7	BT-1	**Battery:** Basic concepts. Mechanism of battery operation. Battery components. Classification of batteries – Primary, secondary and reserve batteries with examples.	1 period each
8	BT-2	Battery characteristics-voltage, capacity, energy density, power density, % energy efficiency, cycle life and shelf life.	“
9	BT-3	Modern batteries- construction, working and applications of Nickel-metal hydride battery and Al-air battery.	„
10	BT-4	Construction, working and applications of Lithium batteries – Lithium-ion battery. Solar energy storage battery.	**= 4 periods„**
11	CS-1	**Corrosion:** Metallic corrosion - Definition, Electrochemical theory of corrosion-explain with Iron as an example. Corrosion reactions-anodic and cathodic reactions (general reactions)	1 period each
12	CS-2	Types of corrosion - Differential metal corrosion, differential aeration corrosion -pitting and waterline corrosion.	
13	CS-3	Stress corrosion-caustic embrittlement.	“
14	CS-4	Factors affecting the rate of Corrosion-Primary factors: i) Nature of metal, ii) Surface state of metal iii) Nature of corrosion product, iv) Hydrogen over voltage.	“
15	CS-5	Secondary factors: i) pH of the medium, ii) Temperature, iii) Area of anode and cathode, iv) Humidity, v) Conductance of the medium and vi) Presence of impurities in the environment.	,,
16	CS-6	Corrosion control: Physical coating: metal coating- Anodic and cathodic metal coatings with examples.	,,
17	CS-7	Chemical Methods (Inorganic coatings) - anodizing and phosphating. Cathodic Protection-sacrificial anode method. Corrosion inhibitors: anodic and cathodic inhibitors.	

18	CS-8	Multifunctional coatings-Introduction and examples (Thermal and scratch resistance)	**= 8 periods**
19	ES-1	**Fuels:** Introduction to fuels. Characteristics of a good fuel. Calorific value–Definition, net and gross calorific values, units (SI),	1 period each
20	ES-2	Determination of calorific value of a solid fuel by bomb calorimeter. Numerical problems on HCV and LCV	,,
21	ES-3	Liquid fuels: Petroleum cracking - fluidized bed catalytic cracking. Reformation of petrol. Knocking – mechanism.	
22	ES-4	Prevention of knocking. Octane number, Cetane number and Unleaded petrol.	,,
23	ES-5	Bio-diesel: synthesis, advantages and applications.	,,
24	ES-6	Energy from natural resources: solar energy –Different types of solar panels. Sixth generation P-V cells. Mention about solar cars.	**= 6 periods**
25	CNM-1	**Chemistry of nanomaterials:** Introduction to nanomaterials-definition. Comparison between bulk and nano particles. Synthesis: top-down and bottom-up approaches. Chemical methods of synthesis-solution combustion and hydrothermal method.	1 period each
26	CNM-2	Mention the Characterization techniques like PXRD, SEM, and TEM of nanomaterials. Mention the applications and disadvantages of Nanomaterials.	**= 2 periods**
27	WT-1	**Water technology:** Water treatment physical and chemical methods. Types of hardness and its determination by EDTA method.	1 period each
28	WT-2	Numerical problems on Hardness. Determination of Dissolved Oxygen by Winkler's method.	,,
29	WT-3	Biological Oxygen Demand – Definition, determination. Chemical Oxygen Demand – Definition and determination.	"
30	WT-4	Numerical problems on BOD and COD.	"
31	WT-5	Determination of amount of chloride present in water sample by Argentometric method.	,,
32	WT-6	Determination of sulphate by gravimetric.	,,
33	WT-7	Determination of Nitrate using phenol disulphonic acid -spectrophotometric method.	"
34	WT-8	Potable water – Definition, purification of water. Membrane based technology for water purification: Reverse Osmosis. Technology for water conservation-mention few examples.	**= 8 periods**
35	PS-1	**Polymer Science:** Introduction, Glass transition temperature (Tg), factors influencing Tg (flexibility, Intermolecular forces, Molecular weight, Branching & cross linking).	1 period each
36	PS-2	Conducting polymers - Definition, mechanism of conduction in polyacetylene,	,,
37	PS-3	Synthesis, properties and applications of Nylon-6,6. Urea formaldehyde. Teflon and PMMA.	,,
38	PS-4	Testing of polymers-TGA-DSC	= 4 periods
39	LC-5	**Liquid Crystals:** Introduction, positional and orientational order in solid, liquid crystals and liquids. Director. Classification – thermotropic and lyotropic with examples.	1 period each
40	LC-6	Types of mesophases – Nematic, Chiral nematic (cholesteric), Smectic and Columnar – arrangements of molecules with examples.	,,
41	LC-7	Liquid crystalline behavior in homologues series – PAA and MBBA series. Applications of liquid crystals in display systems.	,,
42	LC-8	Explanation of display working, mention of LCD devices.	**= 4 periods**

Abbreviations used: EP- Electrochemical cells, BT -Battery Technology, CS - Corrosion science, ES-Energy sources, CNM- Chemistry Nanomaterials, WT- Water Technology, PS- High Polymers. LC-Liquid Crystals.

Text Books:

1. P. C. Jain and Monica Jain, A text Book of Engineering Chemistry, Dhanapat Rai Publications, New Delhi, 17th Edition, 2018.

2. R.V. Gadag and Nithyananda Shetty, A text Book of Engineering Chemistry. Medtech Publishers. 1st Edition 2019.

Reference Books:

1. F.W. Billmeyer, Text Book of Polymer Science, John Wiley & Sons, 4th Edition, 2007.

2. M.G. Fontana, N. D. Greene, Corrosion Engineering, McGraw Hill Publications, New York, 3rd Edition, 2005.

3. Principles of Physical Chemistry B.R. Puri, L.R. Sharma & M.S. Pathania, S. Nagin Chand & Co., 48th Edition 2019.

4. G.A. Ozin and A.C. Arsenault, "Nanochemistry: A Chemical approach to Nanomaterials", RSC Publishing, 2005.

5. Liquid Crystals by S. Chandrashekar, Camridge University Press, 2nd Edition, 2010

6. Introduction to Liquid Crystals by Peter J. Collings. CRC Press, 2nd edition, 2019.