SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Applied Chemistry	LP: CY22153 Rev. No: 00
B.E/B.Tech/: **I Year (Common to BIO, CHE & CVE)** Regulation: **2022** Sub. Code / Sub. Name : **CY22153 / Technical Chemistry** Unit : **1**	Date: 08.11.2022

Unit Syllabus: ELECTROCHEMISTRY

Electrodes and electrochemical cells – electrode potential, standard electrode potential, single electrode potential and its determination, types of electrodes – calomel, quinhydrone and glass electrode. Nernst equation - determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Batteries – Primary (dry battery) and secondary batteries (Lead – acid storage battery and Lithium ion battery) and next generation batteries.

Objective: To make the students to understand the importance of electrochemistry.

Session No *	Topics to be covered	Ref	Teaching Aids
1	Electrodes and electrochemical cells. Cell terminology, Types of cell- Electrochemical cell and electrolytic cell.	R2/CH24/PG :835	LCD / BB
2	Electrode potential- Origin, oxidation and reduction potential, Standard Hydrogen Electrode potential (SHE) - Construction & working principle and its use in determination of unknown electrode potential.	R2/CH24/PG : 838	LCD / BB
3	Construction & working principle of calomel, quinhydrone and glass electrodes.	R2/CH24/PG : 837	LCD / BB
4	Derivation of Nernst equation – Concentration dependence of electrode potential. Applications of Nernst equation.	R2/CH24/PG : 844	LCD / BB
5	Determination of pH of a solution by using quinhydrone and glass electrodes.	R2/CH24/PG : 845	LCD / BB
6	Electrochemical series – Arrangement of reduction potentials. EMF series- Applications	R2/CH24/PG : 846,865	LCD / BB
7	Batteries –Definition, Primary batteries- Construction & working principle of dry cells, Zinc-Carbon batteries and alkaline batteries.	T2/CH4/PG :129	LCD / BB
8	Secondary batteries - (Rechargeable)- Construction, working principle and uses of Lead – Acid storage battery and Lithium battery.	T2/CH4/PG :132	LCD / BB
9	Next generation batteries- Higher energy density – Construction, working principle and advantages of Aluminium- Air battery and Lithium ion solid battery.	T2/CH4/PG:131, 134	LCD / BB
Content beyond syllabus covered (if any): Fuel cells			

* Session duration: 50 minutes

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Sub. Code / Sub. Name: **CY22153 / Technical Chemistry**
Unit : 2

Unit Syllabus: PHOTOCHEMISTRY

Laws of photochemistry – Grotthuss-Draper law, Stark–Einstein law and Lambert Beer Law – determination iron by spectrophotometer. Quantum efficiency – Photo physical processes - internal conversion, inter-system crossing, fluorescence, phosphorescence and photo-sensitization-Quenching of fluorescence and its kinetics, Stern-Volmer relationship. Applications of photochemistry.

Objective: To enable the students to acquire knowledge on photochemical process and laws of photochemistry and its applications

Session No *	Topics to be covered	Ref	Teaching Aids
10	Introduction to electromagnetic radiation and its properties	T1/CH35/PG:1193-1195	LCD / BB
11	Photochemistry– Photochemical reactions with examples – difference between photochemical and thermal reaction	T1/CH34/PG : 1141-1143	LCD / BB
12	Laws of Photochemistry - Grotthus – Draper law, Stark–Einstein law and Beer-Lambert Law – Applications and Limitations	T1/CH34/PG : 1143- 1145	LCD / BB
13	Beer-Lambert Law – problems; determination of iron by spectrophotometer	T1/CH34/PG : 1182- 1187	LCD / BB
14	Quantum efficiency (Φ) - classification of reactions based on quantum yield – Reason for high and low quantum yield, High quantum yield with example – formation of HCl, Low quantum yield with example – formation of HBr	T1/CH34/PG : 1147-1150	LCD / BB
15	Jablonski Diagram - Internal conversion - Inter-system crossing Fluorescence & Phosphorescence	T1/CH34/PG : 1154- 1157	LCD / BB
16	Photosensitization – Mechanism and examples - quenching Difference between Fluorescence and Phosphorescence	T1/CH34/PG : 1158- 1162	LCD / BB
17	Photochemical reaction kinetics with example	T1/CH34/PG : 1151- 1153	LCD / BB
18	Stern-Volmer relationship and Applications of photochemistry	R1/CH29/PG:1133-1134; T2/CH 26/PG : 927	LCD / BB
Content beyond syllabus covered (if any): Photocatalyst and applications			

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Sub. Code / Sub. Name: **CY22153 / Technical Chemistry**

Unit : 3

Unit Syllabus: NANOCHEMISTRY

Basics and scale of nanotechnology, different classes of nanomaterials, Distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Synthesis of nanomaterials, fabrication (lithography) and its applications – Basics of nanophotonics and quantum confined materials (surface plasmon resonance).

Objective: Objective: To acquaint the students with the basics of nanomaterials, their properties and uses.

Session No *	Topics to be covered	Ref	Teaching Aids
19	Introduction - Basics of Nanochemistry – Nano-technology – Nano-science – Nano-Chemistry features.	T1/CH 37/PG: 1303, 1304	LCD/BB
20	Difference between Nanomaterials and Bulk Materials.	T1/CH 37/PG: 1303, 1304	LCD/BB
21	Properties of nanomaterials-Physical and chemical.	T1/CH 37/PG: 1304,1337-1338	LCD/BB
22	Synthesis of nanomaterials - Mechanical milling, vibratory milling, or attrition milling, Mechanochemical synthesis,	T1/CH 37/PG: 1332-1337, R1/22/971-972	LCD/BB
23	Laser ablation & Ion sputtering-Fabrication and its application	T1/CH 37/PG: 1332-1337, R1/22/972-979	LCD/BB
24	Synthesis of nanomaterials-Bottom-up approach- Physical vapor deposition method (PVD), Chemical vapor deposition method (CVD).	T1/CH 37/PG:1317-1332, R1/22/961-971	LCD/BB
25	Synthesis of nanomaterials - Top down approach-Sol gel method, Hydrothermal method, Chemical reduction method, Solvothermal method	T1/CH 37/PG:1317-1332	LCD/BB
26	Nanophotonics-Fundamentals, Challenges, Future Prospects and Applied Applications.	T1/CH 37/PG:1337	LCD/BB
27	Quantum confined materials-Size effect, (surface plasmon resonance (SPR)-principle, application).	T1/CH 37/PG:1304-1305	LCD/BB
Content beyond syllabus covered (if any): Carbon nanotubes			

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Sub. Code / Sub. Name: **CY22153 / Technical Chemistry**

Unit : 4

Unit Syllabus: WATER TECHNOLOGY

Sources, impurities in water and their effects. WHO guideline and BIS guideline for drinking water. Water characteristics – Hardness – Types of hardness – Disadvantages of hard water. Boiler troubles: Scale, Sludge, Priming and Foaming, Caustic embrittlement and Boiler corrosion. Water softening methods - Internal treatment of water: Carbonate conditioning, Phosphate conditioning and Calgon conditioning - External treatment of water: Ion exchange process. Domestic water treatment. Water analysis: Hardness – determination by EDTA method, Alkalinity – determination by double indicator method, Determination of dissolved oxygen by Winkler's method and Determination of chloride by Mohr's method

Objective: To make the students conversant with boiler feed water requirements, related problems and the water treatment and analysis methods.

Session No *	Topics to be covered	Ref	Teaching Aids
28	Sources of water, impurities in water and their effects. WHO guideline and BIS guideline for drinking water.	T1/CH 1/PG : 1-2	LCD / BB
29	Water characteristics – Hardness – Types of hardness – Disadvantages of hard water in domestic and industry	T1/CH 1/PG : 2-6	LCD / BB
30	Boiler feed water - requirements, disadvantages of hard water in boilers and heat exchangers - scale and sludges formation and their preventive methods.	T1/CH 1/PG : 6-8	LCD / BB
31	Priming & foaming, caustic embrittlement – explanation with the elimination of these problems.	T1/CH 1/PG : 11-12	LCD / BB
32	Boiler corrosion due to various agents and its prevention, Softening of hard water (external) - Internal conditioning methods- Principle- Phosphate, Calgon, Carbonate, Colloidal conditioning	T1/CH 1/PG : 8-12	LCD / BB
33	Softening of hard water (external) - Zeolite process,- advantages & limitations, Demineralization (Ion exchange) process – explanation with mechanisms, regeneration of resins	T1/CH 1/PG : 15-19	LCD / BB
34	Domestic water treatment - Removal of suspended particles, disinfection- Break point chlorination	T1/CH 1/PG : 20-25	LCD / BB
35	Water analysis: Hardness – determination by EDTA method- Alkalinity – determination by double indicator method	T1/CH 1/PG : 28-30 & 33-35	LCD / BB
36	Determination of dissolved oxygen by Winkler's method and Determination of chloride by Mohr's method	T1/CH 1/PG : 35-36	LCD / BB

Content beyond syllabus covered (if any): Electro dialysis

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Sub. Code / Sub. Name: **CY22153 / Technical Chemistry**

Unit : 5

Unit Syllabus: MATERIALS CHEMISTRY

Polymers: Introduction – Monomers, functionality and its significance, Free radical polymerization mechanism. Conducting polymers – mechanism of conduction in polyacetylene and applications. Composites: Definition, need for composites. Constitution – Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of composites materials. Hybrid composites, Binding materials and its applications

Objective:

Session No *	Topics to be covered	Ref	Teaching Aids
37	Introduction – Polymers – Monomer; Classification of polymers – Natural and Synthetic (Inorganic and Organic) examples	T1/CH 1/PG : 119-125	LCD / BB
38	Degree of polymerization – Functionality- bi, mixed, poly functional monomers and its significance	T1/CH 1/PG : 121-122	LCD / BB
39	Free radical polymerization mechanism	T1/CH 1/PG : 127-130	LCD / BB
40	Conducting polymers – mechanism of conduction in polyacetylene and applications	T1/CH 1/PG : 178-181	LCD / BB
41	Composites: Definition, need for composites and classification	T1/CH 1/PG : 1005-1010	LCD / BB
42	Constitution – Matrix materials (Polymer matrix, metal matrix and ceramic matrix and Reinforcement (fiber, particulates, flakes and whiskers)	T1/CH 1/PG : 1006-1007; T2/CH 10/PG : 436-438	LCD / BB
43	Properties of composite materials –mechanical, electrical and corrosive	T1/CH 1/PG : 1007-1010; T2/CH 10/PG : 438	LCD / BB
44	Applications of composite materials- Aerospace, automobile and transportation, corrosive environments, electrical, energy, marine and sports	T1/CH 1/PG : 1005; T2/CH 10/PG : 447-448	LCD / BB
45	Binding materials and its applications	T1/CH 12/PG : 491-497	LCD / BB

Content beyond syllabus covered (if any): Nylon 6:6

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OUTCOMES:

Upon successful completion of the course, students should be able to:

1. Identify electrochemical cells, corrosion and fundamental aspects of batteries
2. Interpret the photochemical reactions and make use of spectroscopic techniques
3. Realize the structures, properties and applications of nanoparticles.
4. Describe the hardness of water, the problems caused by the hard water and their removals to arrive for soft water.
5. Illustrate the various materials that are important both in industry and domestic.

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpet Rai & Sons, New Delhi, 17th Edition, 2018.
2. S.S.Dara, "A Text Book of Engineering Chemistry", S.Chand & Co. Ltd., New Delhi, 12th Edition, 2016.

REFERENCES:

1. B.R. Puri, L.R. Sharma, M.S. Pathania., "Principles of Physical Chemistry" Vishal Publishing Company, 2008.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.

	Prepared by	Approved by
Signature		
Name	Dr. T. Balusamy Dr. N. Nachiappan	Dr. G. Devasagayam
Designation	Asst. Professor	Prof. & Head
Date	08.11.2022	08.11.2022
Remarks *:		

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD