SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Applied Chemistry		LP: CY22151
B.E/B.Tech Regulation: 2022	: (Common to AI & DS, CSE, ECE, EEE & INT)	Rev. No: 00
Sub. Code / Sub. Name	: **CY22151 / APPLIED CHEMISTRY**	Date: 08.11.2022
Unit	: I	

UNIT I 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 conversant with basics of electrochemistry and batteries.

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	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			

Sub. Code / Sub. Name: **CY22151 / APPLIED CHEMISTRY**

Unit : 2

UNIT 2 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 develop an understanding of the laws of photochemistry and its basics.

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 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 - Example: Formation of HCl; Low quantum yield - 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 examples	T1/CH34/PG : 1151- 1153	LCD / BB
18	Stern-Volmer relationship and Applications of photochemistry	R1/CH29/PG:1133-1134	LCD / BB

Content beyond syllabus covered (if any): Photocatalyst and applications

Sub. Code / Sub. Name: **CY22151 / APPLIED CHEMISTRY**
Unit : 3

Unit : 3 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: 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 nano tubes			

Sub. Code / Sub. Name: **CY22151 / APPLIED CHEMISTRY**

Unit : 5

UNIT 5 INSTRUMENTATION TECHNIQUES

Treatment of analytical data, including error analysis. Classification of analytical methods and the types of instrumental method - Electromagnetic radiation-UV-visible and IR spectroscopy: principles, instrumentation (Block diagram only) and applications. Separation techniques chromatography: Gas chromatography, liquid chromatography -importance of column technology (packing, capillaries), separation based on increasing number of factor (volatility, solubility, interactions with stationary phase, size).

Objective: To enable the students to understand the types of instruments for material analysis and their working principle.

Session No *	Topics to be covered	Ref	Teaching Aids
28	Treatment of analytical data, Mean,The Median, Precision, Accuracy-including error analysis-types-Determinate and indeterminate errors.	T5/CH2/PG : 13, 127,128	LCD / BB
29	Classification of analytical methods-Chemical and Instrumental.	T5/CH2/PG : 68-192	LCD / BB
30	Types of instrumental method -Spectral, electroanalytical, and separatory.	T5/CH2/PG:8-10	LCD / BB
31	Electromagnetic radiation- Defintion, properties and its types-gamma rays, X-rays, ultraviolet radiation, visible light, infrared radiation, and radio waves.	T3/CH2/PG : 3-7	LCD / BB
32	UV-visible and : principles, instrumentation (Block diagram only) and applications.	T3/CH2/PG : 68-192	LCD / BB
33	IR spectroscopy:principles, instrumentation (Block diagram only) and applications.	T3/CH2/PG:193-333	LCD / BB
34	Separation techniques chromatography: Gas chromatography- liquid chromatography-definition, techniques and application.	T3/CH2/PG : C 3-C93	LCD / BB
35	Importance of column technology (packing, capillaries)-working principle and its application.	T3/CH2/PG : C96-C112	LCD / BB
36	Separation based on increasing number of factor (volatility, solubility, interactions with stationary phase, size).	T3/CH2/PG : C113-160	LCD / BB
Content beyond syllabus covered (if any): Mass Spectroscopy			

Sub. Code / Sub. Name: **CY22151 / APPLIED CHEMISTRY**
Unit : 4

UNIT 4 **CHEMICAL SENSOR**

Sensors, sensor science and technology, types of sensors. Chemical Sensors – characteristics and elements. Electrochemical sensors – voltammetry, potentiometric sensors, amperometric sensors, polarization techniques.

Objective: To acquire the basic knowledge on sensors which are essential for the software engineers for develop new devices.

Session	Topics to be covered	Ref	Teaching Aids
37	Sensor-Term, Introduction, working principle, Describe sensor performance.	R4/CH11/PG : 3-5	LCD / BB
38	Sensor science & Sensor technology- Illustration of Accuracy and Precision.	R4/CH/PG:1-11 & 82	LCD / BB
39	Types of sensors- Position Sensors, Pressure Sensors. Temperature Sensors,Force Sensors, Vibration Sensors, Piezo Sensors, Fluid Property Sensor, Humidity Sensors.	R4/CH11/PG : 115-223	LCD / BB
40	Chemical Sensors- definition, characteristics, elements and characterization of chemical sensor.	R4/CH11/PG :3-11	LCD / BB
41	Electrochemical sensors-Definition, Working principle, advantages, disadvantages & applications	R4/CH11/PG : 137-179	LCD / BB
42	Voltammetry, voltammogram, types - Cyclic voltammetry, Three Electrode system, Instrumentation.	R4/CH11/PG :179-182	LCD / BB
43	Potentiometric sensors- Principle, Classification of sensors and Applications	R4/CH11/PG :138--162	LCD / BB
44	Amperometric sensors- amperometric sensors to measure dissolved O_2 in blood- Quantitative Applications	R4/CH10/PG : 166-169	LCD / BB
45	Polarization techniques-principle and its types uses the dropping mercury electrode	R4/CH10/PG :215	LCD / BB
Content beyond syllabus covered (if any): Differential pulse voltammetry.			

* Session duration: 50 mins

OUTCOMES:

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

1. Describe the electrolytic and electrochemical cell, various fundamental aspects of electrochemistry and batteries.
2. Interpret the photochemical reactions and their applications.
3. Differentiate the nano and bulk materials, their synthesis and its applications in various fields.
4. Acquire the basic knowledge on chemical sensors to develop an interdisciplinary approach among the students which are essential for the software engineers.
5. Develop a theoretical principles of UV-visible and IR spectroscopy and separation techniques.

TEXT BOOKS:

1.Jain P.C. and Monica Jain, "Engineering Chemistry", DhanpatRai Publishing Company (P) Ltd., New Delhi, 2010.
2.Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010
3.B.K.Sharma, "Instrumental Methods of Chemical Analysis", 28th Edition, Goel Publishing House, 2012.
4.Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.

REFERENCES:

1.Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
2.B.R. Puri, L.R. Sharma, M.S. Pathania., "Principles of Physical Chemistry" Vishal Publishing Company, 2008.
3.John Vetelino, AravindReghu, Introduction to Sensors , Taylor & Francis Group, CRC Press, 1st edition, 2010.
4.Peter Gründler, Chemical Sensors, An Introduction for Scientists and Engineers, Springer-Verlag Berlin Heidelberg 2007.
5.Vogel's Textbook of Quantitative Chemical Analysis by J. Menham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th Edn, Low Price Edition, Pearson Education Ltd, New Delhi (2000).

	Prepared by	Approved by
Signature	8/11/22 8/11/22	
Name	Dr S Ananda Babu Dr. S. Anandhavelu	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