Code: BCHES102/202 **Course:** Applied Chemistry for Computer Science & Engineering stream

Credits: 4 **L:T:P 2:2:2/ 2:0:2**

SEE: 100 Marks **CIE: 100 Marks**

SEE Hours: 3 **Max. Marks: 100**

Prerequisites if any	
Learning objectives	1. To enable students to acquire knowledge on principles of chemistry for engineering applications. 2. To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	**Course Outcomes**	**Bloom's level**
CO1	Understand the principles and applications of energy storage devices, sensors, memory devices and display systems.	Understand
CO2	Comprehend the mechanism of corrosion, its control and concepts of electrode and its application.	Apply
CO3	Know the importance and applications of bio polymers, green fuels, and e- waste management.	Analyze
CO4	Perform accurate quantitative measurements and equipment handling to analyse the data and interpret the results to arrive at a conclusion.	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	2	-	-	-	-	2		PSO4-2			
CO2	3	2	-	-	-	-	2	-	-	-	-	2					
CO3	3	2	-	-	-	-	2	-	-	-	-	2					
CO4	3	2	-	-	-	-	2	-	-	-	-	2					

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1 Energy Systems and Sensors (8hr)				
1.1	**Energy Systems:** Introduction to batteries, classifications, Construction, working and applications of Zn – Air, Lithium ion, and Sodium ion batteries.	2	-	-
1.2	Principle, Properties and Applications of Quantum dots sensitized solar cells (QDSSC's).	-	2	-
1.3	**Sensors**: Introduction, principle, characteristics and applications of Electrochemical sensors, Thermometric sensors.	2	-	-
1.4	Conductometric sensors, Optical sensors. Electrochemical gas sensors for SOx, NOx, heavy metal detection, Pesticide, Optical sensors for the measurement of DO.	-	2	-
1.5	**Disposable sensors (DS)**: Introduction, principle, characteristics of disposable sensors, advantages of DS over Classical sensors, biosensors for glucose detection.	2	-	-
Module – 2 Materials for Memory and Display Systems (8hr)				
2.1	**Memory Devices:** Introduction, Basic concepts of electronic memory, Classification of electronic, memory devices.	2	1	-
2.2	Types of organic memory devices (Organic molecules (p and n-type), polymeric materials, organic inorganic hybrid materials).	1	-	-
2.3	**Display Systems**: Photoactive and electroactive materials, Nanomaterials and organic materials [Light absorbing and emitting materials] used in optoelectronic devices. Liquid crystals (LC's) –Introduction, classification, properties and application in Liquid Crystal Displays (LCD's).	-	2	-
2.4	Properties and application of Organic Light Emitting Diodes (OLED's) and Quantum Light Emitting Diodes (QLED's), Light emitting electrochemical cells.	1	-	-
Module – 3 Corrosion and Electrode System (8hr)				
3.1	**Corrosion Chemistry:** Introduction, electrochemical theory of corrosion, types of Corrosion - differential metal and differential aeration (Pitting Corrosion).	1	-	-
3.2	Corrosion control - galvanization, anodization and sacrificial anode method. Corrosion Penetration Rate (CPR) – Introduction and numerical problem.	1	-	-
3.3	**Electrode System**: Introduction, types of electrodes. Reference electrode – Calomel electrode – construction, working and applications of calomel electrode.	1	2	-
3.4	Ion selective electrode – definition, construction, working and applications of glass electrode. Determination of pH using glass electrode.	1	-	-
3.5	**Analytical Techniques**: Introduction, principle and instrumentation of Conductometry; its application in the estimation of weak acid. Potentiometry; its application in the estimation of iron.	1	1	-

Module – 4 Biopolymers and Green Fuels (8hr)				
4.1	**Biopolymers:** Introduction, general characteristics, classification and advantages of biopolymers, biobased plastics. Properties and applications of PLA.	2	-	-
4.2	Molecular weight - Number average, weight average methods and numerical problems			
4.3	**Green Fuels:** Introduction, construction and working of solar photovoltaic cell, advantages, and disadvantages. Green hydrogen: Introduction to hydrogen as a fuel.	1	2	-
4.4	Introduction to electrolysis of water. Generation of hydrogen by electrolysis of water: Alkaline water electrolysis and Proton Exchange Membrane Electrolysis.	2	-	-
Module – 5 E-Waste Management (8hr)				
5.1	**E-Waste:** Introduction, sources of e-waste, Composition, Characteristics, and need of e waste management. Toxic materials used in manufacturing electronic and electrical products, health hazards due to exposure to e-waste.	2	-	-
5.2	Recycling and Recovery: Different approaches of recycling (separation, thermal treatments, hydrometallurgical extraction, pyrometallurgical methods, direct recycling).	2	1	-
5.3	Extraction of gold from E-waste. Role of stake holders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies).	1	1	-
List of Experiments:				
1	D1. Chemical Structure drawing using software: ChemDraw or ACD/ ChemSketch.	-	-	2
2	D2. Determination of strength of an acid in Pb-acid battery	-	-	2
3	D3: Synthesis of Iron-oxide Nanoparticles	-	-	2
4	D4. Electrolysis of water	-	-	2
5	E1. Conductometric estimation of acid mixture	-	-	2
6	E2. Potentiometric estimation of FAS using $K_2Cr_2O_7$	-	-	2
7	E3. Determination of pKa of vinegar using pH sensor (Glass electrode)	-	-	2
8	E4. Estimation of total hardness of water by EDTA method	-	-	2
9	S1. Estimation of Copper present in electroplating effluent by optical sensor (colorimetry)	-	-	2
10	S2. Determination of Viscosity coefficient of lubricant (Ostwald's viscometer)	-	-	2
11	S3. Estimation of iron in TMT bar by diphenyl amine/external indicator method	-	-	2
12	S4. Determination of Chemical Oxygen Demand (COD) of industrial waste water sample	-	-	2
13	O1: Evaluation of acid content in beverages by using pH sensors and simulation.	-	-	2
14	O2. Design an experiment to Identify the presence of proteins in given sample.	-	-	2
15	V1. Water analysis-Determination of Chemical parameters (Alkalinity)	-	-	2
16	V2. Verification of Beer-Lambert's law	-	-	2
	Total No. of Lecture Hours	**26**		
	Total No. of Tutorial Hours		**14**	**-**
	Total No. of Practical Hours			**10/16**

Self-learning topics identified: (Maximum of 5 topics)

1. Construction, working and applications of Lead-acid battery
2. History of Organic / polymer electronic memory devices
3. Ag/AgCl reference electrode – Construction and its working
4. Properties of H_2 gas pertaining to fuel
5. Impact of heavy metals on environment and human health

Textbooks:

1. A Text book of Engineering Chemistry, SS Dara & Dr. SS Umare, S Chand & Company Ltd., 12th Edition, 2011
2. A Text Book of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.

Reference Books:

1. High Performance Metallic Materials for Cost Sensitive Applications, F. H. Froes, et al. John Wiley & Sons, 2010
2. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
3. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
4. OLED Display Fundamentals and Applications, Takatoshi Tsujimura, Wiley–Blackwell, 2012

Online Resources:

1. https://nptel.ac.in/downloads/122101001/
2. https://nptel.ac.in/courses/104/103/104103019/
3. https://ndl.iitkgp.ac.in/
4. https://www.youtube.com/watch?v=faESCxAWR9k