Code: 1BCHEC102 **Course: Applied Chemistry for Electronics and Communication Engineering**

Credits: 3 **CIE: 50 Marks**

L:T:P: 2:2:0 **SEE: 50 Marks**

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

Prerequisites if any	**None**
Learning objectives	To impart a strong foundation in the principles of chemistry with emphasis on application-oriented topics relevant to Electronics and Communication Engineering.

Course Outcomes:

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

COs	Course Outcomes	Bloom's level
CO1	Impart the knowledge of semiconductors and display systems for electrical and electronic applications.	Understand Apply
CO2	Apply the concepts of energy systems for electric vehicles.	Understand Apply
CO3	Apply the concepts of corrosion science and metal finishing techniques for microelectronics.	Understand Apply
CO4	Understand the principles of sensors, polymers, and analytical techniques in various engineering applications.	Understand Apply

Mapping with POs and PSOs:

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

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

Course Structure

	Applied Chemistry for Electronics and Communication Engineering	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module-1: Materials for Electrical and Electronics Applications			
1.1	**Semiconductors:** Introduction, classifications, and band theory of materials. Production of silicon union carbide process, electronic grade silicon by Czochralski (CZ) process, and Float Zone (FZ) method.	2	-	-
1.2	Semiconductor grade silicon by Chemical Vapor Deposition (CVD). Epitaxy method and Ion implantation - basic concepts and process.	1	1	-
1.3	**Flexible and Stretchable Electronics:** Polymers used in flexible and stretchable electronics, working mechanism and applications (PDMS).	2	1	-
1.4	**Sustainable Electronics:** Sustainable materials used in electronics.	1	-	-
	Module-2: Energy Systems for Electric Vehicles			
2.1	**Batteries:** Introduction, materials for anode, cathode, and electrolyte. Classification of batteries, construction, working, and applications of Li-ion, and Lithium polymer (LiPo) and Na-ion battery.	2	1	-
2.2	**Battery Performance Metrics**: Voltage, current density, capacity, power density, energy density, cycle life, and shelf life. Factors affecting battery performance: Temperature, charging/discharging rates, and aging mechanisms.	1	1	-
2.3	**Battery Testing:** Cell balancing: importance, Thermal management, state of charge, State of health and recycling of batteries.	1	1	-
2.4	**Fuel Cells**: Introduction and classification of fuel cells. Construction, working, and applications of polymer electrolyte membrane (PEM) fuel cell. Difference between batteries and fuel cells.	1	-	-
	Module-3: Corrosion and its control and Metal finishing for Microelectronics			
3.1	**Corrosion Chemistry:** Introduction, types, and electrochemical theory of corrosion. Factors influencing the corrosion rate: Physical state of the metal, nature of the metal, area effect, pH, temperature, and nature of the corrosion product.	2	1	-
3.2	**Types of corrosion** - Differential metal (Galvanic) corrosion in electronic circuits and differential aeration (Pitting) corrosion. **Corrosion control method**: Galvanization, Tinning, Anodization, Impressed current method, and Sacrificial anode method.	1	1	-
3.3	**Metal finishing:** Introduction, Electroplating- Surface preparation, electroplating of nickel using Watt's bath and its applications.	1	-	-

3.4	Electroless plating- Composition of bath and its advantages. Electroless copper plating on PCB. Difference between electroplating and electroless plating.	1	1	-
Module-4: Display Systems and E-Waste Management				
4.1	**Liquid crystals** (LC's) - Introduction, classification, properties, and application of Liquid Crystals in Displays (LCD's).	1	1	-
4.2	Properties and applications of Organic Light Emitting Diodes (OLED's) and Quantum Light Emitting Diodes (QLED's).	1	-	-
4.3	**E-waste Management:** Introduction, sources, types, and effects of e-waste on environment and human health. Recycling: Different approaches to recycling - separation by Eddy currents, magnetic, optical sorting, and density-based separation. Recovery and disposal of e-waste.	2	1	-
4.4	**Process of metal extraction**: hydrometallurgical and pyrometallurgical extraction methods. Extraction of copper and gold from e-waste.	1	1	-
Module-5: Sensors and Polymers in Engineering Applications				
5.1	**Sensors:** Introduction, working principle, and applications of Electrochemical sensors (Potentiometric sensors for the estimation of iron in industry waste), Optical sensors: Estimation of copper in PCB effluent by colorimetric sensors, and thermometric and smart sensors.	2	-	-
5.2	Principle, working and applications of conductometric sensors for the estimation of acid and acid mixtures in effluent, p^H sensors for the determination of p^H/p^{Ka} in water quality monitoring.	2	1	-
5.3	**Polymers used in optoelectronics:** Preparation, properties, and commercial applications of poly(methyl methacrylate)(PMMA) and polyaniline (PANI). **Conducting polymers:** Conduction mechanism of polyacetylene and their applications in organic electronics.	1	1	-
5.4	Molecular weight of polymers by number average and weight average methods and Numericals.	-	1	-
	Total No. of Lecture Hours	**26**		
	Total No. of Tutorial Hours/ sessions		**14**	**-**
	Total No. Hours/sessions			**40**

Self-learning topics:

1. Case study: 1 Materials for electrical and electronics industry
2. Case study: 2 Energy Systems for Electric vehicles
3. Case study: 3 Corrosion and Metal finishing for microelectronics
4. Case study: 4 Display systems and e-waste management
5. Case study: 5 Sensors and polymers in Engineering Applications

Textbooks:

1. Applied Chemistry for Electrical And Electronics Engineering and Allied Branches, C Manasa, Dr. Srikantamurthy N, Dr. Vrushabendra B, Publisher Astitva Prakashan
2. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978-93-85155-70-3, 2022.
3. Engineering Chemistry: Fundamentals and Applications by By Shikha Agarwal, Cambridge University Press, 23 May 2019

Reference Books:

1. A Textbook of Engineering Chemistry, By S S Dara & S S Umare, Aruna M Sudame, S, Chand and company limited
2. Textbook of Engineering Chemistry by Shashi Chawla, Publisher: Dhanpat Rai, Edition: 6, 2022, Pages: 828.
3. Engineering Chemistry, 3rd edition, by R.V. Gadag, A. Nityananda Shetty, Publisher: Dreamtech Press