Code: 1BCHCS102/202 **Course: Applied Chemistry for Computer Science & Engineering Stream**

Credits: 3 **CIE: 50 Marks**

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

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

Prerequisites if any	NA
Learning objectives	To enable students to acquire knowledge on principles of chemistry for computer science and engineering applications.

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 of functional materials used in memory devices and display systems.	Understand
CO2	Evaluate next-generation energy systems, fuel cells, and green hydrogen technologies	Understand Apply
CO3	Analyse quantum materials, conducting polymers, and their roles in engineering applications	Understand Apply
CO4	Apply concepts of sensors in quantitative measurement and e-waste management	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 Computer Science & Engineering Stream	No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1 Materials for Memory Devices and Display Systems (8hr)				
1.1	**Memory Devices:** Introduction, basic concepts of electronic memory, classification of electronic memory devices.	1	0	0
1.2	Organic semiconductors: Types of organic semiconductors used in memory devices, p-type semiconductor-pentacene and n-type semiconductor - perfluoropentacene, difference between organic and inorganic memory devices, construction, working and advantages of pentacene semiconductor chip.	2	1	0
1.3	**Display Systems**: Introduction, Photoactive and electroactive materials, Light absorbing and emitting materials used in optoelectronic devices. Liquid crystals (LC's) – Introduction, classification, properties and applications of Liquid Crystals in Display systems (LCD's).	2	1	0
1.4	Properties and application of Organic Light Emitting Diodes (OLED's) and Quantum Light Emitting Diodes (QLED's).	1	0	0
Module – 2 Next Generation Energy Systems and Green Fuels (8hr)				
2.1	**Energy Systems:** Introduction, classification of batteries, construction, working and applications of Lithium ion, Lithium polymer and Sodium ion batteries.	2	1	0
2.2	**Battery Parameters:** Cell balancing importance, Thermal Management, State of Charge (SOC) and State of Health (SOH), Fault detection.	1	0	0
2.3	**Clean Energy:** Introduction to hydrogen as a fuel., construction, working principle, applications and limitations of Solid-oxide fuel cell (SOFCs). Difference between fuel cell and battery. Production of green hydrogen by photocatalytic water splitting using TiO_2 method and its advantages.	1	1	0
2.4	**Solar Energy:** Introduction, construction and working of photovoltaic cell (PV cell), advantages and disadvantages of PV cells.	1	1	0
Module - 3 Quantum Materials and Polymers for Engineering Applications (8hr)				
3.1	**Quantum Dots:** Introduction, size dependent properties - quantum confinement effect, surface-to-volume ratio & band gap, synthesis and applications of Cd-Se Quantum dots by wet chemical method,	1	0	0
3.2	Quantum dot sensitized solar cells (QDSSCs) - Construction, working principle and applications.	1	1	0
3.3	**Polymers:** Preparation, properties, and commercial applications of Poly(methyl methacrylate) (PMMA) and PVC. Determination of molecular weight of polymers by number average and weight average method and numericals.	1	1	0

3.4	**Conducting polymers:** Conduction mechanism of Polyaniline (PANI) and Polyacetylene and their applications in organic electronics.	2	1	0
Module – 4 E-Waste Management (8hr)				
4.1	**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	1	0
4.2	**Recycling and Recovery:** Separation of materials by eddy currents, magnetic, optical sorting, density-based methods.	2	1	0
4.3	Different approaches of recycling-thermal treatments, pyrometallurgical methods, hydrometallurgical extraction. Extraction of gold and copper from e waste.	1	0	0
4.4	Role of stake holders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies).	0	1	0
Module – 5 Sensors and its Engineering Applications (8hr)				
5.1	**Sensors**: Introduction, principle, working and applications of Electrochemical sensors for SOx, NOx and heavy metal detection.	1	1	0
5.2	Principle, working and applications of optical sensors, colorimetric estimation of Cu from PCB effluent, Thermometric sensors, Smart sensors.	1	1	0
5.3	**Disposable sensors (DS)**: Introduction, principle, working mechanism of biosensors for glucose detection. Characteristics of disposable sensors and advantages of DS over Classical sensors,	1	1	0
5.4	**Analytical estimations:** Principle and applications of conductometric estimation of strong, weak and acid mixture, potentiometric estimation of Iron in industrial effluent. Determination of pH/pKa in beverages using pH sensors.	2	0	0
	Total No. of Lecture Hours	**26**		
	Total No. of Tutorial sessions		**14**	**0**
	Total No. of practical classes			**0**
	Total No. of Hours/Sessions			**40**

Self-learning topics:

1. Case study: 1 Materials for Memory Devices and Display Systems
2. Case study: 2 Next Generation Energy systems and Green Fuels
3. Case study: 3 Quantum materials and polymers for Engineering Applications
4. Case study: 4 E-Waste Management
5. Case study: 5 Sensors and its engineering applications

Textbooks:

1. Applied Chemistry for Computer Science and Engineering and Allied Branches By: C Manasa, Dr. Vrushabendra B, Dr. Srikantamurthy N, Publisher Astitva Prakashan
2. Applied Chemistry for Computer Science Engineering", by Dr. Hari Krishna S, Ms. Suneetha Rani N, Publisher Book Rivers
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.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc21_ee32/preview

2. https://onlinecourses.nptel.ac.in/noc25_ee108/preview