Course Code	21CYB101J	Course Name	Chemistry	Course Category	B	Engineering Science	L	T	P	C
							3	1	2	5

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	Data Book / Codes/Standards	*Periodic Table*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Exploit the periodic properties of elements for bulk property manipulation towards technological advancement and interpret water quality parameters*
CLR-2 :	*Address concepts related to electrochemistry, such as corrosion, using thermodynamic principles and measure the acidic strength and redox potentials of aqueous solution*
CLR-3 :	*Employ various organic reactions towards the design of fine chemical and drug molecules for industries and measure the acidic strength and conductance of aqueous solution*
CLR-4 :	*Brief outline, reaction types and applications of polymers and determine average molecular weight of the polymer*
CLR-5 :	*Properties, surface characterization and applications of advanced engineering materials and measure the acidic strength of aqueous solution*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*
CO-1 :	*Rationalize bulk properties using periodic properties of elements, evaluate water quality parameters like hardness and alkalinity*
CO-2 :	*Utilize the concepts of thermodynamics in understanding thermodynamically driven chemical reactions, determine acidic strength and redox potentials of aqueous solution*
CO-3 :	*Perceive the importance of stereochemistry in synthesizing organic molecules applied in pharmaceutical industries, determine acidic strength and conductance of aqueous solution*
CO-4 :	*Utilize the concepts of polymer processing for various technological applications, determine average molecular weight of the polymer*
CO-5 :	*Analyze the importance of advanced processing techniques towards engineering applications and measure the acidic strength of aqueous solution*

Program Outcomes (PO) (1- Low, 2 – Medium, or High-3)											
1	2	3	4	5	6	7	8	9	10	11	12
Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning
3	-	*3*	*2*	-	-	-	-	-	-	-	-
3	*3*	*3*	-	-	-	-	-	-	-	-	-
-	*3*	*3*	2	-	-	-	-	-	-	-	-
3	-	*3*	*3*	-	-	-	-	-	-	-	-
3	-	*3*	-	*3*	-	-	-	-	-	-	-

Unit-1: PERIODIC PROPERTIES **18 Hours**

Coordination numbers and geometries - Crystal field theory - Octahedral & Tetrahedral complexes - Optical & magnetic properties of transition metal complexes - Isomerism in transitional metal compounds - Effective nuclear charge, penetration of orbitals - variations of orbital energies of atoms in the periodic table - Electronic configurations, atomic and ionic sizes - ionization energies, electron affinity and electronegativity - Hard soft acids and bases

Experiments:

- Determination of the amount of sodium carbonate and sodium hydroxide in a mixture by titration
- Determination of hardness (Ca2+) of water using EDTA – Complexometry method.

Unit-2: USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA **18 Hours**

Thermodynamic functions: Energy, Entropy and free energy - Estimation of entropy & free energies - Free energy and emf. Cell potentials - The Nernst equation and applications - Acid base, oxidation reduction - Solubility equilibria - Corrosion - Free energy of a corrosion reaction - Pourbaix diagram Salient Features and phase diagram for Iron.

Experiments:

- Determination of strength of an acid by Conductometry.
- Determination of ferrous ion using potassium dichromate by Potentiometric titration

Unit-3: STEREOCHEMISTRY AND ORGANIC REACTIONS **18 Hours**

Representations of 3 dimensional structures - structural isomers and stereoisomers - configurations and symmetry and chirality - enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis - Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings - Synthesis of a commonly used drug molecule.

Experiments:

- Estimation of amount of chloride content of a water sample.
- Determination of the strength of a mixture of acetic acid and hydrochloric acid by Conductometry.

Unit-4: POLYMERS **18 Hours**

Introduction to concept of macromolecules - Tacticity - Classification of Polymers - Thermoplastics, Thermosets and Elastomers - Types of Polymerization - Important addition and condensation polymers – synthesis and properties – Polypropylene, polystyrene, PVC, Teflon, Nylon, PET, Polyurethane and Synthetic rubber, Conducting polymers – introduction, types – n and p doping, examples (polyacetylene and P3HT), applications.

Experiments:

- Determination of molecular weight of polymer by viscosity average method.

Unit-5: ADVANCED ENGINEERING MATERIALS **18 Hours**

Mechanical properties of solid – stress-strain relationship - Tensile strength, Hardness, Fatigue, Impact strength, Creep – Composite materials - introduction - Types of composites - Fibre Reinforced Composites. Particle Reinforced Composites. Metal Matrix Composites. Ceramic Matrix Composites. Examples and applications. Surface Characterisation techniques - XRD and XPS

Experiments:

- Determination of strength of an acid using pH meter.

Learning Resources	*1. B. H. Mahan, R. J. Meyers, University Chemistry, 4th ed., Pearson publishers, 2009.* *2. M. J. Sienko, R. A. Plane, Chemistry: Principles and Applications, 3rd ed., McGraw-Hill publishers, 1980* *3. B. L. Tembe, Kamaluddin, M. S. Krishnan, Engineering Chemistry (NPTEL Web-book)*	*4. Peter W. Atkins, Julio de Paula, James Keeler, Physical Chemistry, 11th ed., Oxford publishers, 2018* *5. K. P. C. Vollhardt, N. E. Schore, Organic Chemistry: Structure and Function 7thed., Freeman, 2014* *6. W. D. Callister, D. G. Rethwisch, Materials Science and Engineering: An Introduction, 8th ed., Wiley, 2009* *7. J. C. Kuriacose, J. Rajaram, Chemistry in Engineering and Technology, Tata McGraw-Hill Education, 1984*

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA) - By the Course Faculty				By The CoE	
		Formative CLA-I Average of unit test (45%)		**Life Long* Learning** CLA-II- Practice (15%)		**Summative** Final Examination (40% weightage)	
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10	-	20	-	10	-
Level 2	Understand	30	-	20	-	30	-
Level 3	Apply	30	-	20	-	30	-
Level 4	Analyze	30	-	40	-	30	-
Level 5	Evaluate	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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