Course Code	21CYB101J	Course Name	CHEMISTRY	Course Category	B		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*
CLR-2:	*Address concepts related to electrochemistry, such as corrosion, using thermodynamic principles*
CLR-3:	*Employ various organic reactions towards the design of fine chemical and drug molecules for industries*
CLR-4:	*Brief outline, reaction types and applications of polymers*
CLR-5:	*Properties, surface characterization and applications of advanced engineering materials*
CLR-6:	*Utilize the basic chemistry principles applied in various engineering problems and identify appropriate solutions*

Course Learning Outcomes (CO):	*At the end of this course, learners will be able to:*	Learning			Program Learning Outcomes (PO)											
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	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
CO-1 :	*Rationalize bulk properties using periodic properties of elements, evaluate water quality parameters like hardness and alkalinity*	*3*	*70*	*65*	*3*	*3*	*3*	*2*	*-*	-	-	-	-	-	-	-
CO-2 :	*Utilize the concepts of thermodynamics in understanding thermodynamically driven chemical reactions, determine acidic strength and redox potentials of aqueous solution*	*4*	*80*	*70*	*3*	*3*	*3*	*2*	*2*	-	-	-	-	-	-	-
CO-3 :	*Perceive the importance of stereochemistry in synthesizing organic molecules applied in pharmaceutical industries, determine acidic strength and conductance of aqueous solution*	*3*	*75*	*60*	*-*	*3*	*3*	*2*	*-*	-	-	-	-	-	-	-
CO-4 :	*Utilize the concepts of polymer processing for various technological applications, determine average molecular weight of the polymer*	*3*	*70*	*70*	*3*	*-*	*3*	*3*	*-*	-	-	-	-	-	-	-
CO-5 :	*Analyze the importance of advanced processing techniques towards engineering applications*	*4*	*80*	*70*	*3*	*2*	*3*	*3*	*3*	-	-	-	-	-	-	-
CO-6 :	*Utilize concepts in chemistry for technological advancement based on electronic, atomic and molecular level modification*	*3*	*75*	*65*	*3*	*3*	*3*	*3*	*3*	-	-	-	-	-	-	-

Unit-1

Periodic properties : 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 : 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 : 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 : 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 : 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)*** ***http://nptel.ac.in/downloads/122101001/***	***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***

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (60% weightage)								Final Examination (40% weightage)	
		CLA – 1 (15%)		CLA – 2 (15%)		CLA – 3 (20%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	*20%*	*20%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Understand										
Level 2	Apply	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*	*20%*
	Analyze										
Level 3	Evaluate	*10%*	*10%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*	*15%*
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
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