Course Code	18CYB101J	Course Name	CHEMISTRY	Course Category	B	Basic Sciences	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:*

		Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLR-1 :	*Utilize the atomic and molecular manipulation towards the design of new materials*			
CLR-2 :	*Employ various spectroscopic techniques in identifying the structure and correlate it with their properties*			
CLR-3 :	*Exploit the periodic properties of elements for bulk property manipulation towards technological advancement*			
CLR-4 :	*Address concepts related to electrochemistry, such as corrosion, using thermodynamic principles*			
CLR-5 :	*Employ various organic reactions towards the design of fine chemical and drug molecules for industries*			
CLR-6 :	*Utilize the basic chemistry principles applied in various engineering problems and identify appropriate solutions*			

Course Learning Outcomes (CLO): *At the end of this course, learners will be able to:*

					Program Learning Outcomes (PLO)														
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		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	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	*Analyze atomic, molecular orbitals of organic, inorganic molecules to identify structure, bonding, molecular energy levels*	*2*	*70*	*65*	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*Utilize the principles of spectroscopic technique in analysing the structure and properties of molecules*	*2*	*80*	*70*	*H*	-	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*Rationalize bulk properties using thermodynamic considerations and periodic properties of elements*	*2*	*75*	*60*	-	*H*	-		-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*Utilize the concepts of thermodynamics in understanding thermodynamically driven chemical reactions*	*2*	*70*	*70*	*H*	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*Perceive the importance of stereochemistry in synthesizing organic molecules applied in pharmaceutical industries*	*2*	*80*	*70*	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-6 :	*Utilize concepts in chemistry for technological advancement based on electronic, atomic and molecular level modification*	*2*	*75*	*65*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Duration (hour)		18	18	18	18	18
S-1	SLO-1	*Schrodinger equation- introduction*	*Crystal field theory-Explanation*	*surface characterization techniques – XPS - Introduction*	*Hard soft acids and bases*	*Optical activity, absolute configurations*
	SLO-2	*Schrodinger equation-Derivation*	*Crystal field theory-Explanation*	*surface characterization techniques – XPS - Explanation*	*Hard soft acids and bases*	*conformational analysis*
S-2	SLO-1	*Particle in a box solutions*	*Energy level diagrams for transition metal ions*	*Diffraction and scattering of solids*	*Thermodynamic functions: energy*	*Isomerism in transitional metal compounds-Introduction*
	SLO-2	*Applications for conjugated molecules*	*Energy level diagrams for transition metal ions*	*Explanation*	*Entropy and free energy*	*Isomerism in transitional metal compounds-Types*
S-3	SLO-1	*Forms of the hydrogen atom wave functions*	*Magnetic properties of transition compounds*	*Ionic, dipolar interactions*	*Estimation of entropy*	*Introduction to reactions involving substitution*
	SLO-2	*plots of these functions to explore their spatial variations*	*Magnetic properties of transition compounds*	*Van der Waals interactions*	*Estimation of free energies.*	*Addition reaction*
S-4	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S 5-6	SLO-1	*Lab Introduction*	*Estimate of amount of chloride content in a water sample.*	*Determine strength of a mixture of acetic and hydrochloric acid by conductometry.*	*Determine adsorption of oxalic/acetic acid from aqueous soln. by activated charcoal*	*Experiment - Repeat - 2*
	SLO-2					
S-7	SLO-1	*Molecular orbitals of diatomic molecules-Homonuclear*	*Principles of spectroscopy-Introduction*	*Equations of state of real gases*	*Free energy and emf. Cell potentials*	*Elimination reaction*
	SLO-2	*Heteronuclear diatomic molecules*	*Principles of spectroscopy-Explanation*	*critical phenomena*	*The Nernst equation and applications*	*Oxidation reaction*
S-8	SLO-1	*Equations for atomic orbitals*	*Selection rules-Introduction*	*Effective nuclear charge, penetration of orbitals*	*Acid base, oxidation reduction*	*Reduction reaction*
	SLO-2	*Equations for molecular orbitals*	*selection rules-Explanation*	*variations of s, p, d and f orbital energies of atoms in the periodic table*	*Solubility equilibria*	*Examples*

S-9	SLO-1	*Energy level diagrams of diatomic-introduction*	*Electronic spectroscopy -Introduction*	*Electronic configurations, atomic and ionic sizes*	*Water chemistry*	*Cyclization*
	SLO-2	*Energy level diagrams of diatomic-explanation*	*Electronic spectroscopy-Explanation*	*Electronic configurations, atomic and ionic sizes*	*Water chemistry*	*Ring opening reactions*
S-10	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S 11-12	SLO-1	*Determine amount of sodium carbonate, sodium hydroxide in a mixture by titration*	*Determine strength of an acid using pH meter*	*Determine ferrous ion using potassium dichromate by potentiometric titration*	*Determine rate constant of Acid hydrolysis of an ester*	*Experiment - Repeat - 3*
	SLO-2					
S-13	SLO-1	*π-molecular orbitals of butadiene*	*Rotational spectroscopy of diatomic molecules*	*ionization energies, electron affinity and electronegativity*	*Corrosion*	*Synthesis of a commonly used drug molecule-Introduction*
	SLO-2	*π-molecular orbitals of benzene*	*Rotational spectroscopy of diatomic molecules*	*ionization energies, electron affinity and electronegativity*	*Corrosion*	*Synthesis of a commonly used drug molecule-Examples*
S-14	SLO-1	*Aromaticity-Introduction*	*Vibrational spectroscopy of diatomic molecules.*	*Polarizability, oxidation states*	*Representations of 3 dimensional structures*	*Synthesis of a commonly used drug molecule-Introduction*
	SLO-2	*Aromaticity-explanation*	*Applications of vibrational and rotational spectroscopy of diatomic molecule*	*Polarizability, oxidation states*	*structural isomers and stereoisomers*	*Synthesis of a commonly used drug molecule-Examples*
S-15	SLO-1	*Crystal field theory-Introduction*	*Nuclear magnetic resonance - Introduction*	*Coordination numbers and geometries*	*Configurations and symmetry and chirality*	*Question & Answer*
	SLO-2	*Crystal field theory-Introduction*	*Nuclear magnetic resonance - Explanation*	*Coordination numbers and geometries*	*enantiomers, diastereomers*	*Question & Answer*
S-16	SLO-1	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
	SLO-2	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*	*Tutorial Session*
S 17-18	SLO-1	*Determine hardness (Ca^{2+}) of water using EDTA – complexometry method*	*Determine strength of an acid by conductometry*	*Determine molecular weight of a polymer by viscosity average method*	*Experiment - Repeat - 1*	*Demonstration Practical Session*
	SLO-2					

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. C. N. Banwell, Fundamentals of Molecular Spectroscopy, 5th ed., McGraw-Hill publishers, 2013*	*4. B. L. Tembe, Kamaluddin, M. S. Krishnan, Engineering Chemistry (NPTEL Web-book) http://nptel.ac.in/downloads/122101001/* *5. Peter W. Atkins, Julio de Paula, James Keeler, Physical Chemistry, 11th ed., Oxford publishers, 2018* *6. K. P. C. Vollhardt, N. E. Schore, Organic Chemistry: Structure and Function 7thed., Freeman, 2014*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		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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