COURSE INFORMATION SHEET

Course code: CH 101
Course title: Chemistry
Pre-requisite(s): Intermediate level chemistry
Co- requisite(s):
Credits: 4 L: 3 T: 1 P: 0
Class schedule per week: 04
Class: B.Tech.
Semester /Level: I/First
Branch: ALL
Name of Teacher:

Course Objectives

This course enables the students:

1.	To create concept of Chemical bonding & Coordination Chemistry.
2.	To understand the basic 3D structure in organic chemistry including stereochemistry, aromaticity and reaction mechanism.
3.	To understand the reaction dynamics and to know different types of catalysis.
4.	To understand the modern techniques related to spectroscopy and structural characterization.
5.	To develop knowledge on the physical state and electrochemistry of molecules.

Course Outcomes

After the completion of this course, students will be:

CO1	Able to explain the bonding in a molecular structure.
CO2	Able to explain the 3D structure, aromaticity and stereochemistry of organic molecules.
CO3	Able to explain the spectroscopic data for structural characterization of the molecules.
CO4	Able to predict the rate, molecularity and mechanism of a simple as well as catalytic reaction.
CO5	Able to interpret the phases of solid and the electrochemical behavior of the molecules.

(CH 101) Chemistry

Syllabus

Module I: Chemical Bonding

Ionic bond: Radius ratio rule, Born-Landé equation, Born-Haber cycle. *Metallic Bond:* valence bond and band theories, defects in solids, Werner's Theory, Bonding in Transition metal complexes, Ligands, coordination complexes, Ligand Field, Crystal Field Theory, Octahedral, Tetrahedral and square planar complexes, CFSE, Jahn Teller theorem, electronic spectra, magnetism, and isomerization in coordination compounds. **[9L]**

Module II: Organic Structure and Stereochemistry

Covalent bond: Lewis structure, Valence Bond theory, Molecular orbital theory, Molecular orbital of diatomic and polyatomic system, hybridization, conjugated molecules, Huckel molecular orbital theory of conjugated systems. Isomerism, Geometrical isomerism: *cis–trans* and syn-anti isomerism; Optical isomerism & Chirality; Wedge, Fischer, Newmann and Sawhorse Projection formulae and interconversions; E/Z, D/L, R/S nomenclature system; Conformational studies of ethane, n-butane, Cyclohexane. **[9L]**

Module III: Kinetics and Catalysis:

Order & molecularity of reactions: chain, parallel, Competing, Side, Consecutive reactions; Kinetics of Fast reactions, Characteristics of catalyst, types of catalysis, catalytic poison; Theories of catalysis; Acid base catalysis: including kinetics, Enzyme catalysis, Mechanism and kinetics of enzyme catalyzed reaction, Michaelis-Menten equation, Important catalysts in industrial processes; Hydrogenation using Wilkinsons catalyst, Hydroformylation by using Cobalt-catalyst, Phase transfer catalyst. **[9L]**

Module-IV: Spectroscopic Techniques

Absorption and emission Spectroscopy, Lambert-Beers Law, Principles and applications of UV-Visible, Factors influencing for UV-VIS spectrum; Rotational and Vibrational spectroscopy, Principle of FT-IR, and NMR spectroscopy; Modern techniques in structural elucidation of compounds by UV-VIS, IR, & NMR Spectroscopy. **[9L]**

Module V: Phase and Chemical equilibrium

Phase Rule: Terms Involved, Phase diagram of one component (Water) & two component (Pb/Ag) system & their applications. Law of chemical equilibrium, equilibrium constants and their significance, Weak and strong electrolytes, Standard electrode potential and its application to different kinds of half cells, EMF and its measurement and application, Batteries and Fuel Cells, Chemical and Electrochemical corrosion, Factors affecting the rate of corrosion. **[9L]**

Text books:

1. Huheey, J. E., Inorganic Chemistry: Principles of Structure and Reactivity, 4th edition, Pearson.
2. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Seventh Edition, Pearson
3. Atkins, P. W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.

Reference books:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
2. Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier (2009).
3. William Kemp, Organic Spectroscopy, 3rd Ed., 2008 Macmillan.

Gaps in the syllabus (to meet Industry/Profession requirements) : NA

POs met through Gaps in the Syllabus : NA

Topics beyond syllabus/Advanced topics/Design : NA

POs met through Topics beyond syllabus/Advanced topics/Design

Course Delivery methods	
Lecture by use of boards/LCD projectors/OHP projectors	Y
Tutorials/Assignments	Y
Seminars	N
Mini projects/Projects	N
Laboratory experiments/teaching aids	Y
Industrial/guest lectures	Y
Industrial visits/in-plant training	N
Self- learning such as use of NPTEL materials and internets	Y
Simulation	N

Course Outcome (CO) Attainment Assessment tools & Evaluation procedure

Direct Assessment

Assessment Tool	**% Contribution during CO Assessment**
Mid Sem Examination Marks	25
End Sem Examination Marks	50
Quiz	10+10
Teacher's assessment	5

Assessment Components	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Mid Sem Examination Marks	√	√	√		
End Sem Examination Marks	√	√	√	√	√
Quiz I	√	√			
Quiz II			√	√	

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping of Course Outcomes onto Graduate Attributes

Course Outcome #	Graduate Attributes											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	2		3	3	3		3	2	2		3
2	3	3		3	3	3		3	2	2		3
3	3	1		2	1	2		3	2	2		3
4	3			3	2	2		2	2	2		3
5	2	3		3	3	3	3	2	2	2		3

Mapping Between COs and Course Delivery (CD) methods				
CD	**Course Delivery methods**		**Course Outcome**	**Course Delivery Method**
CD1	Lecture by use of boards/LCD projectors/OHP projectors		CO1	CD1 and CD2
CD2	Tutorials/Assignments		CO2	CD1 and CD2
CD3	Seminars		CO3	CD1 and CD2
CD4	Mini projects/Projects		CO4	CD1 and CD2
CD5	Laboratory experiments/teaching aids		CO5	CD1 and CD2
CD6	Industrial/guest lectures		-	-
CD7	Industrial visits/in-plant training		-	-
CD8	Self- learning such as use of NPTEL materials and internets		-	-
CD9	Simulation		-	-

Course code: CH 102
Course title: Chemistry Lab
Pre-requisite(s): Intermediate level Chemistry
Co- requisite(s):
Credits: 1.5 L: 0 T: 0 P: 3
Class schedule per week: 03
Class: B. Tech.
Semester / Level: I/First
Branch: ALL
Name of Teacher:

Syllabus

1. Gravimetric estimation of Nickel by Dimethylglyoxime.
2. Quantitative estimation of Ca^{2+} and Mg^{2+} ions by complexometric titration using Na_2-EDTA.
3. To verify Bears Law using Fe^{3+} solution by spectrophotometer/colorimeter and to determine the concentration of a given unknown Fe^{3+} solution.
4. Separation of binary organic mixture by acid-base extraction and analysis using given FTIR and NMR spectrum.
5. Preparation of Diazoamino Benzene and report the melting point and yield of product.
6. Draw melting point-mass percent composition diagram for two component mixture and determine the Eutectic Temperature.
7. To study the kinetics of acid-catalyzed hydrolysis of ethyl acetate and to evaluate the value of the rate constant.
8. To determine the rate law for the reaction between iodide and hydrogen peroxide in an acidic environment and to determine the effect of a catalyst on the rate of reaction.
9. To determine the strength of the given strong acid by strong base Potentiometrically.
10. To determine the transition temperature of the given salt hydrate.
11. Qualitative detection of special elements in organic compounds.
12. To draw the pH-titration curve of strong acid vs strong base.

Reference book:

1. Experimental Physical Chemistry, By B. Viswanathan, P. S. Raghavan, Narosa Publishing House (1997).
2. Vogels Textbook of Practical Organic Chemistry
3. Experiments in General chemistry, C. N. R. Rao and U. C. Agarwal
4. Experimental Organic Chemistry Vol 1 and 2, P R Singh, D S gupta, K S Bajpai, Tata McGraw Hill