Course code	**BSC/2-T**			
Category	**Basic Science Course**			
Course title	**Chemistry**			
Scheme and Credits	**L**	**Tu**	**Credits**	
	3	**1**	**4.0**	
Course Assessment Methods	**Internal Examination (30 marks):** □ Three minor tests each of 20 marks including third minor in open book mode will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. □ Class Performance will be measured through percentage of lectures attended (04 marks) □ Assignments, quiz etc. will have weightage of 06 marks **End semester examination (70 marks)**: □ Nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Two questions are to be set from each unit. All questions will carry equal marks.			

Course Outcomes

By the end of the course students will be able to:

CO1. Analyze structure of molecules in terms of atomic and molecular orbitals.

CO2. Rationalize bulk properties and processes using thermodynamic considerations.

CO3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO4. Rationalize periodic properties such as ionization potential, electro negativity, oxidation states and electronegativity.

CO5. List major chemical reactions that are used in the synthesis of molecules.

CO6. Describe intermolecular forces and working of lithium ion batteries.

Course contents:

UNIT I

Molecular structure and batteries. (11 lectures)

Molecular orbitals theory and Energy level diagrams of diatomic molecules (CO, NO, N_2). Pi-molecular orbitals of butadiene and benzene and aromaticity, Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties, Band structure of solids and the role of doping on band structures.

Lithium ion batteries-construction, working principle, operation and applications.

UNIT II

Spectroscopic techniques and Intermolecular Forces (11 lectures)

Principles of spectroscopy and selection rules, Electronic spectroscopy, Fluorescence and its applications in medicine, Infrared spectroscopy and applications, Nuclear magnetic resonance and magnetic resonance imaging, Diffraction and Scattering.

Intermolecular forces: Ionic, dipolar and van Der Waals interactions, Equations of state of real gases and critical phenomena.

UNIT III

Thermodynamics and Periodic properties (10 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications, Water chemistry and Corrosion, Use of free energy considerations in metallurgy through Ellingham diagrams.

Effective nuclear charge, penetration of orbitals, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases.

UNIT IV

Stereochemistry and Organic reactions (10 lectures)

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.

Suggested Text Books

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane (iii)Fundamentals of Molecular Spectroscopy, by C. N. Banwell
3. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.
4. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Chemistry-I by Gourkrishna Dasmohapatra
7. Textbook of engineering chemistry by Jaya Shree Anireddy.
8. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	3	2	-	3	-	-	1	1	-	-	-	2
CO2.	3	3	3	2	-	-	2	-	-	-	1	-
CO3.	3	2	2	-	3	-	-	-	-	-	-	-
CO4.	2	2	3	3	-	3	-	-	-	-	-	1
CO5.	3	-	3	-	-	2	3	-	-	-	-	-
CO6.	3	2	2	2	2	-	3	2	-	-	-	2
3 –High 2-Medium 1-Low												

Course code	**BSC/2-P**
Category	**Basic Science Courses**
Practical Course title	**Chemistry**
Contact Hours	**03**
Credits	**1.5**
Course Assessment Methods	**Internal: 30 Marks; External: 70 Marks** The internal and external assessment is based on the level of participation in laboratory Sessions, timely submission of experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of laboratory file and ethical practices followed. There will be a continuous process for laboratory course evaluation. Two internal examinations (each of 30 marks) for the laboratory courses (Minor Laboratory Evaluations: MLE I and MLE II) will be conducted in the week before or after the internal examinations for the theory courses. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department. The final practical examination of duration three hours will be conducted only in groups of 20-25 students. The Course Coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the proformas (attached herewith as Annexures I and II) to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

Pre-requisites: Experiments in chemistry induced at plus two levels in schools.

About the Course:

The chemistry laboratory course consists of experiments illustrating the principles of chemistry relevant to the study of science and engineering. This lab course involves implementation of scientific approach and to familiarize with the experiments in chemistry relevant for research projects in higher semesters.

S. No.	Course Outcomes: By the end of the lab course a student would be able to:	RBT Level
CO-1	Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.	(LOTS: Levels 3: Apply)
CO-2	Develop skills relevant to synthesize organic polymers and analyse the salt sample.	(HOTS: Level 4: Analyse)

CO-3	Estimate rate constants of reactions from concentration of reactants/products as a function of time.	(HOTS: Level 5: Evaluate)
CO-4	To acquire the practical skill to use TLC for the identification of drugs.	(HOTS: Level 4: Analyse)
CO-5	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.	(HOTS: Level 6: Create)
CO-6	Function as a member of a team, communicate effectively and engage in further learning. Also understand how chemistry addresses social, economical and environmental problems and why it is an integral part of curriculum.	(LOTS: Levels 3: Apply)

List of Experiments

Choice of 10-12 experiments from the following:

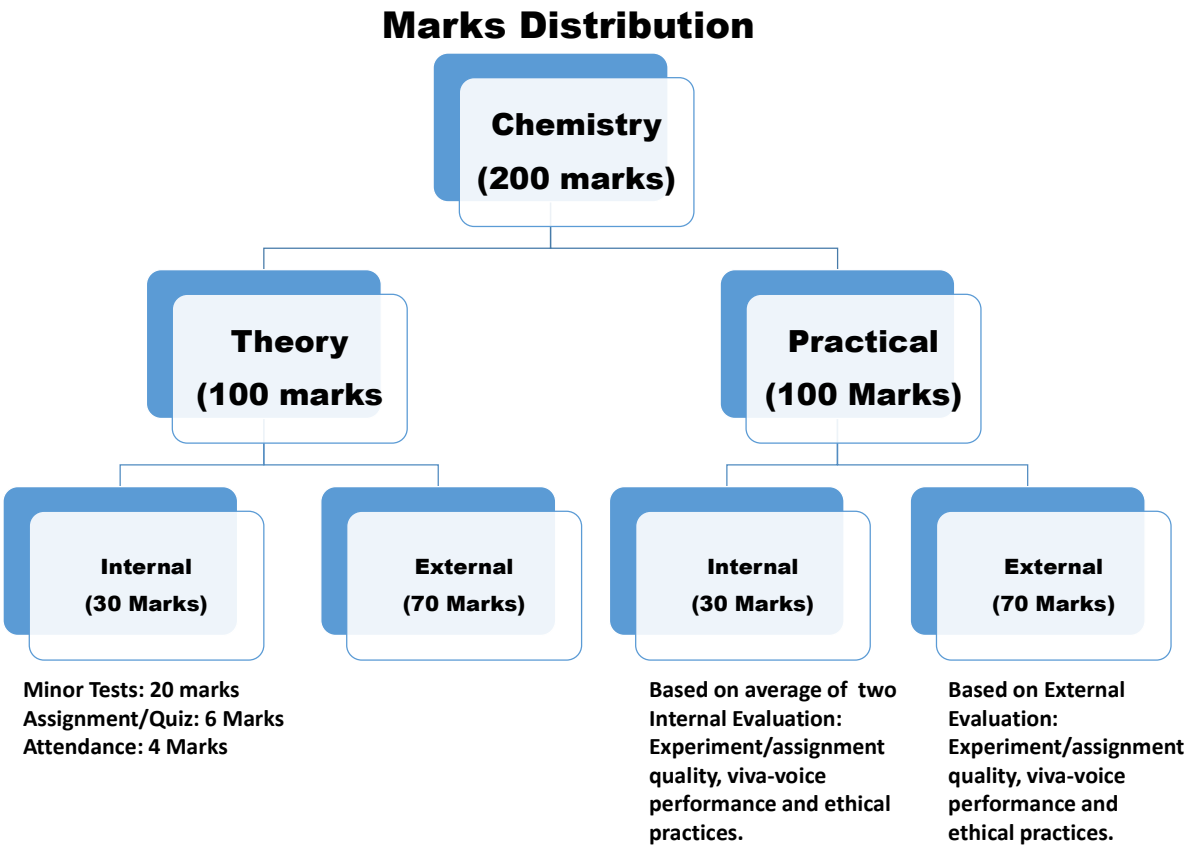
1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids
16. Adsorption of acetic acid by charcoal
17. Acid-Base titrations
18. Use of the capillary viscometers to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	2	2	-	2	1	-	-	-	2	-	-	-
CO2.	-	2	-	-	-	1	1	-	2	-	-	-
CO3.	-	2	-	1	-	-	-	-	2	-	-	-
CO4.	-	2	-	-	-	1	-	-	2	-	-	-
CO5.	-	2	-	3	1	-	1	2	2	-	-	-
CO6.	-	-	-	-	-	-	-	3	2	1	-	2
3 –High 2-Medium 1-Low												



Exam pattern of Theory exam (Total: 70 marks)
There will be total 9 questions.
Question no. 1 will be compulsory and you will have to attempt five question in all, including one question from each unit.
All question will carry 14 marks.