

Subject Code: 2SC1030201	Subject Title: CHEMISTRY
Core Type: Core Course	

Course Objective:

Generally, familiarity with the following areas in chemistry: inorganic, organic, physical, analytical and biochemistry. The ability to work effectively and safely in a laboratory environment. Opportunities for student and faculty to interact with alumni and with professional chemists. The basic analytical and technical skills to work effectively in the various fields of chemistry. The ability to synthesize, separate and characterize compounds using published reactions, protocols, standard laboratory equipment, and modern instrumentation.

Teaching scheme (hours) per week		Credit			Theory Marks		Practical Marks		Total
Theory	Practical	Theory	Practical	Total	Uni. Assessment	Cont. Assessment	Uni. Assessment	Cont. Assessment	
4	4	4	2	6	70	30	30	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1	(A) COORDINATION COMPOUNDS Definition, Nomenclature of Complex, Werner's theory and its experimental verification, Concept of Effective Atomic Numbers (E.A.N.) for Coordination Compounds, Limitations of Valence bond theory of transition metal complexes, An Elementary idea of (C.F.T.) Crystal field splitting of d-orbital in O and Td, Factors affecting to the crystal field splitting, Application of common complexes & chelates. (B) ACTINIDE Electronic Configuration, Oxidation state, Synthesis of Pu.	18	25
2	ORGANIC COMPOUND OF NITROGEN Preparation of nitroalkanes and nitroarenes, Chemical reactions of nitroalkanes, Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media, Picric acid Halonitroarenes: reactivity, Structure and nomenclature of amines, physical properties, Stereochemistry of amines, separation of a mixture of primary, secondary, tertiary amines, Structure feature effecting basicity of amines, Amine salts as phase-transfer catalyst, Preparation of alkyl and arylamines (reduction of nitro compound, nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction, Hofmann bromamide reaction Reactions of amines: electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid, Synthetic transformations of aryl salts, Azo coupling	18	25

3	(A) CHEMICAL KINETICS. Introduction of following terms, Rate of reaction, Order of reaction, Molecularity. Rate equation for second order reaction. ($a=b$) & ($a \neq b$), Characteristics of second order reaction, Rate equation for third order reaction, Characteristics of third order reaction, Numerical. (B) NUCLEAR CHEMISTRY. Concept of Nuclear particle, Definition of Isotopes, Isotones, Isobars, Isomers. Packing fraction, Nuclear binding energy, Nuclear coulomb barrier, Rate of ratio active disintegration, half-life period, Average life period, Rutherford & Sodi's law (Group transfer law), Numerical.	12	25
4	NAME REACTIONS AND MECHANISM: Aldol Condensation, Baeyer-Villiger Oxidation, Benzoin Condensation, Birch Reduction, Claisen Condensation, Claisen Rearrangement, Cope Elimination, Curtius Rearrangement, Dakin Reaction, Favorskii Reaction, Hofmann Elimination, Pinacol Rearrangement.	12	25

Course Outcome:

- ❖ Have solid foundations in the fundamentals and application of current chemical and scientific theories.
- ❖ Are capable to design, carry out, record and analyze the results of chemical experiments.
- ❖ Are capable to use modern instrumentation and classical techniques, to design experiments, and to properly record the results of their experiment.
- ❖ Are skillful in problems solving, critical thinking and analytical reasoning.
- ❖ Are capable to identify and solve chemical problems and explore new areas of research.
- ❖ Are capable to use modern library searching and retrieval methods to obtain information about a topic, chemical, chemical technique, or an issue relating to chemistry.

List of References:

Inorganic Chemistry

1. 'Source Book on Atomic Energy' by Glasstone, 1969.
2. 'Modern Inorganic Chemistry' by G.F. Liporn, ELBS, 4th edn, Collins Educational, 1983.
3. 'Inorganic Chemistry' D.F. Shriver, P.W. Atkins and C.H. Longford, 3rd edn, ELPS Oxford University Press, 1999.
4. 'Nuclear and Radio Chemistry' by G. Friedlander, J.W. Kennedy, E.S. Macias and J.M. Miller, 3rd edn, John Wiley, 1981.
5. Essentials of Nuclear Chemistry' H.J. Arnicall, 4th edn, New Age International, 1995.
6. 'Concise Inorganic Chemistry' J.D. Lee, 5th edn.
7. 'Inorganic Chemistry', D.F. Shriver, P.W. Atkins, 3rd edn, Oxford, 1999.
8. 'Concise Inorganic Chemistry' J.D. Lee, 4th edn, Chapman and Hall ELBS, 1991.
9. 'Inorganic Chemistry' by A.G. Sharp, 3rd edn, ELBS, Longman, 1990.

Organic Chemistry

1. 'Organic reaction and mechanism, P.S. Kalsi, New Age international Publishers.
2. Text book of organic Chemistry, P.S. Kalsi, New Age international Publishers.
3. Organic Chemistry Vol. I & II, S.M. Mukherji, S.P. Singh, R.P. Kapoor.
4. Reaction mechanism in Organic Chemistry, S.M. Mukherji, S.P. Singh. 3rd edn, Macmillan.
5. Reaction Mechanism and Reagents in Organic Chemistry, Gurdeep R. Chatwal 4th edn, Himalaya Publication House.
6. Text book of Organic Chemistry, Arun Bahal, S. Chand.
7. Organic Chemistry, R. Morrison and R. Boyd, 6th edn, Pearson Education 2003.
8. Organic Chemistry, T.W. Graham Solomons, 4th edn, John Wiley, 1998.

Physical Chemistry

1. Advance Physical Chemistry by Gurdeepraj.
2. Physical Chemistry (Question and Answer) by R.N.Madan, G.D.Tuli, S.Chand.
3. Principal of Physical Chemistry by Puri, Sharma, Pathania.
4. Chemical Thermodynamics by R.P.Rastogi and R.R.Misra.
5. Nuclear Chemistry by C.V.Shekhar, Dominent-Publisher, New Delhi.
6. Essentials of physical Chemistry by B.S.Bahal, ArunBahal, G.D.Tuli.
7. Physical Chemistry by P.W.Atkins, 5th edn, Oxford 1994 7th edn-2002.
8. Physical Chemistry by R.A.Albert and R.J.Silby, John Wiley 1995.
9. Physical Chemistry by G.H.Barrow, 5th edn, Mac Graw Hill, 1988, 6th edn, 1996.
10. Physical Chemistry by W.J.Moore, 4th edn, Orient Longmans 1969.

e-Resource:

1. www.google.com
2. <http://onlinelibrary.wiley.com/>
3. https://en.wikipedia.org/wiki/Main_Page

List of Experiments:

Note: This syllabus is to be completed by assigning two laboratory sessions per week, each of two hours. Total laboratory work is 60 hrs/sem (4 hrs/week) or 15 weeks. The number of students in the laboratory batch should not exceed fifteen (15). The medium of instruction should be English in laboratory course.

Sr.No	Practical Exercise
1.	1. Organic Chemistry 1) Identification of an organic compound through the functional group analysis, Determination of melting point and boiling point, Preparation of suitable derivative. 2) Candidate should perform the analysis of at least 10 compounds.
2.	2. Volumetric Titrations 1) To determine the strength of NaOH and Na ₂ CO ₃ present in the solution mixture of NaOH & Na ₂ CO ₃ and to find out their percentage composition. 2) To determine the strength of NaHCO ₃ and Na ₂ CO ₃ present in the solution mixture of NaHCO ₃ & Na ₂ CO ₃ and to find out their percentage composition. 3) To determine the Normality, gram/liter and molarities of H ₂ C ₂ O ₄ , 2H ₂ O and H ₂ SO ₄ present in the solution mixture of H ₂ C ₂ O ₄ , 2H ₂ O & H ₂ SO ₄ by using X N NaOH and Y N KMnO ₄ solutions. 4) To determine the Normality, gram/liter and molarity of H ₂ C ₂ O ₄ , 2H ₂ O and K ₂ C ₂ O ₄ present in the solution mixture of H ₂ C ₂ O ₄ , 2H ₂ O & K ₂ C ₂ O ₄ by using X N NaOH and Y N KMnO ₄ solutions. 5) To determine the amount of Ca ⁺² and Mg ⁺² ion by EDTA solution from the mixture solution of CaCl ₂ and MgCl ₂ .
3.	3. Demonstrations ☐ Melting point and Boiling point of an organic compound. ☐ Calibration of burette and Pipette.

Scheme of Practical Examination

Exam: - 4 Hrs

Marks: - 50

Ex.	Outline for Practical Examination	Marks
Ex.-1	Organic Qualitative Analysis of Binary mixture (Acids, Phenols, bases and Neutrals)	15
Ex.-2	(Any One) 1) To determine the strength of NaOH and Na ₂ CO ₃ present in the solution mixture of NaOH & Na ₂ CO ₃ and to find out their percentage composition. 2) To determine the strength of NaHCO ₃ and Na ₂ CO ₃ present in the solution mixture of NaHCO ₃ & Na ₂ CO ₃ and to find out their percentage composition. 3) To determine the Normality, gram/liter and molarities of H ₂ C ₂ O ₄ , 2H ₂ O and H ₂ SO ₄ present in the solution mixture of H ₂ C ₂ O ₄ , 2H ₂ O & H ₂ SO ₄ by using X N NaOH and Y N KMnO ₄ solutions. 4) To determine the Normality, gram/liter and molarity of H ₂ C ₂ O ₄ , 2H ₂ O and K ₂ C ₂ O ₄ present in the solution mixture of H ₂ C ₂ O ₄ , 2H ₂ O & K ₂ C ₂ O ₄ by using X N NaOH and Y N KMnO ₄ solutions. 5) To determine the amount of Ca ⁺² and Mg ⁺² ion by EDTA solution from the mixture solution of CaCl ₂ and MgCl ₂ .	15
Ex.-3	Viva – voce	10
Ex.-4	Journals, Assignment and Routine Performance	10
	Total marks	50