B.Sc. Semester –III

DSC-5: Chemistry (Theory) 3

Course title - Chemistry-5

Course Code: C 3 CHE 1 T 1

Type of Course	Theory/ Practical	Credits	Instruction hour per week (hr)	Total hours of Syllabus / Sem	Duration of Exam (hr)	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DSC -5	Theory	04	04	64	03	20	80	100

Course Outcomes (CO):

After completion of course, Chemistry (Theory) - V students will be able to:

CO1 : Explain anomalous properties of lithium, diagonal relationship among elements. preparation, structure and bonding in oxides and oxyacids of nitrogen, oxoacids of phosphorus, sulphur and chlorine, inter halogen compounds and xenon compounds.

CO2: Understand the general characteristics of d and f- block elements with reference to electronic configuration, colors, variable oxidation states, magnetic properties etc., Lanthanide contraction and its consequences .separation of lanthanoids by ion-exchange method .

CO3: Gain knowledge of acidic character, comparative acid strengths of alcohols and phenols and mechanism of named reactions.

CO4: Familiar with Williamson's ether synthesis of epoxides and Crown Ethers formation and properties.

CO5: Understand different thermodynamic processes, first law of thermodynamic, work done, significance of enthalpy, Joule-Thomson effect and applications Kirchhoff's equation.

CO6: Appreciate the significance of entropy, second& third law of thermodynamics, change in entropy and Gibbs -Helmholtz equation, thermodynamic parameters with respect temperature.

CO7: Derive Nernst distribution law and under different molecular states .

CO8: Acquaint with the industrial applications of Nernst distribution law.

CO9:Gain the knowledge of mechanism of solvent extraction .

CO10: Understand different Chromatography separation techaniques and its applications..

DSC-5: Chemistry 5 (C 3 CHE 1 T 1)	64 Hrs
UNIT-I : CHEMISTRY OF s , p , d & f -BLOCK ELEMENTS	**16 Hrs**

Chemistry of s- and p- block elements:

General characteristics, anomalous properties oflithium.Diagonal relationship of Li with Mg, and Be with Al. properties of s and p block elements with respect to oxides and nitrides of Li,Na,Mg and Al.

Preparation and structure of oxyacids of nitrogen. Preparation and bonding in oxoacids of phosphorus, sulphur and chlorine. Preparation and bonding in inter halogen compounds ClF_3, BrF_5 , IF_7 andPseudo halogens. Preparation and bonding in Xenon compounds- XeF_2, XeF_4, XeF_6 and XeO_3 .

(10 Lectures)

Chemistry of d- and f- block elements:

General characteristics of d-block elements with reference to electronic configuration, colors, variable oxidation states, magnetic, catalytic properties and ability to form complexes. IUPAC nomenclature of elements with atomic number greater than hundred. General characteristics of f-block elements with reference to electronic configuration, oxidation states, colors and magnetic properties. Lanthanide contraction and its consequences. Separation of lanthanoids by ion-exchange method.

(06 Lectures)

UNIT-II ALCOHOLS, PHENOLS AND ETHERS	16hrs

Alcohols:

Synthesis of primary, secondary and tertiary alcohols using Grignard reagent, ester hydrolysis. Reduction of aldehydes and ketones, carboxylic acids and esters. Reactions of alcohols with halo acids, esterification reaction and oxidation of alcohols with PCC, $KMnO_4$, HNO_3, $K_2Cr_2O_7$ and Oppenauer oxidation.Polyhydric alcohols:Preparation of glycol from ethene and glycerol from propene,Oxidation of ethylene glycol **(06Lectures)**

Phenols:

Acidic character, comparative acid strengths of alcohols and phenols, effect of substituent on acidity of phenol (Explain with $–NO_2$, $-CH_3$ groups and ortho effect). Reactions of Phenol: Kolbe's reaction, Claisen rearrangement, Fries rearrangement, Ledrer-Mannase reaction, Reimer-Tiemann reaction. Schotten-Baumann Reaction.

(Mechanism to be discussed for all the reactions)

(04 Lectures)

Ethers:

Preparation of ethers, mechanism of Williamson's ether synthesis

Reaction of ethers**:** mechanism of C-O bond cleavage by HI (Explanation with symmetric ethers and unsymmetric ethers containing tertiary alkyl group and benzene ring).

Epoxides: Synthesis fromalkenes using peroxides, acid and base

catalyzed ring opening of epoxides with mechanism and polyether formation. Crown Ethers: Formation and properties (Phase Transfer Catalyst). **(06 Lectures)**	
UNIT-III: THERMODYNAMICS-I, PHASE EQUILIBRIA AND DISTRIBUTION LAW	**16 hrs**
Thermodynamics I: Internal energy and first law of thermodynamics. Concept of enthalpy, derivation of work done in isothermal and adiabatic expansion (T-V and P-V relationships) of an ideal gas for reversible and irreversible processes. Joule-Thomson effect and its derivation. Joule-Thomson co-efficient and its derivation. Effect of temperature on enthalpy of reaction (Kirchhoff's equation), numerical problems are to be solved wherever required. **(06 Lectures**) **Thermodynamics II:** Carnot Cycle, Concept of entropy and its physical significance, thermodynamic scale of temperature, statements of second law of thermodynamics, calculation of entropy change for reversible and irreversible processes. Free energy functions: Gibbs and Helmholtz energy, variation of S, G, A with T, V and P. Gibbs-Helmholtz equation, free energy change and spontaneity. Statement of third law, calculation of absolute entropy of molecules. Numerical problems are to be solved wherever applicable. **(06Lectures)**	

Distribution law: Nernstdistribution law and thermodynamic derivation of partition co-efficient. Distribution law for changes in molecular state(Association and dissociation). Applications of solvent extraction- simple and multiple extractions. Derivation for multiple extractions., numerical problems. **(04 Lectures)**	
UNIT-IVSEPARATION TECHNIQUES	**16 hrs**
Solvent Extraction: Types, theory and mechanism. Extraction by ion-association and Chelation. Synergistic extraction. Determination of Uranium using oxine. **Chromatography**: Classification, techniques and development of chromatograms. **Paper Chromatography**: Theory, R_f value, factors affecting R_f value and its calculations, techniques and applications. Separation of Pb^{2+}, Ag^{+} and Hg_2^{2+}. **Column Chromatography**: Theory, techniques and applications. Separation of methylene blue and malachite green. **Thin-Layer Chromatography**: Superiority of TLC, theory, methodology and applications. **Ion Exchange Chromatography**: Principle, types of ion exchangers. Action of cation and anion exchange resins and applications. Separation of amino acids from its mixture. **Gas Chromatography and High-Performance Liquid Chromatography:** Principle, instrumentation and applications	

Formative Assessment for Theory		
Sl. No	Assessment type	Marks
01	Internal Assessment test 1	05
02	Internal Assessment test 2	05
03	Assignment	10
	Total	20
Formative Assessment as per the guidelines		

Recommended Books/References

1. Modern Inorganic Chemistry: R.D.Madan, S.Chand and Co.Ltd, New Delhi, 2019
2. Chemistry of degree students, R.L.Madan, S.Chand and Co.Ltd, New Delhi.
3. Concise Inorganic Chemistry: J. D. Lee, , 5th Edn, New Age International (1996)
4. BasicInorganicChemistry, Cotton,F.A.,Wilkinson,G.&Gaus,P.L.,3rdEd.,Wiley.
5. UniversityChemistryMahan,B.H.3rdEd.Narosa(1998).
6. AGuidebooktoMechanisminOrganicChemistry Peter Sykes,OrientLongman,New Delhi(1988).
7. AdvancedOrganicChemistry, Bahl,A.&Bahl,B.S.,S.Chand publications,2010.
8. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
9. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998.
10. Organic Chemistry - M. K. Jain, Nagin & Co., 1987.
11. Organic Chemistry- Mehta and Mehta, 2005.
12. PhysicalChemistry W.J.Moore:, 1972.
13. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co., 1993.
14. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd., 1982.
15. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co. 1987.
16. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons, 1992.
17. Engineering Chemistry, P.C. Jain and Monika Jain, Dhanpad Rai and Sons, Delhi, Jalandhar, 1995.
18. Synthetic Organic Chemistry: Gurudeep R. Chatwal. Himalaya Publishing House – 1990.
19. Industrial Chemistry, Clerk Ranken MJP Publisher.
20. Industrial Chemistry, Vijay Varma, Arjun Publishing House.
21. Industrial Chemistry, B.K.Sharma, 9th Edn. Krishna Prakashan Media (P) Ltd. Meerut (1997-98)

Syllabus DSC-6: Chemistry Practicals - VI	64Hrs
Organic and Physical Chemistry Experiments	
Course outcomes (COs): At the end of the course, students will be able to: 1. Understand theory, techniques and applications of organic estimations, separation techaniques like solvent extration and chromatography. 2. Provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes. **PART-A –Organic Estimations** 1.Estimation of Phenol by Bromination method 2.Estimation of Aniline by Bromination method 3.Estimation of acetamide by Hydrolysis method 4.Estimation of Acetone (Ketone) by Iodoform method. 5.Estimation of Sugars (Glucose) using Fehling's solution. **PART-B Physical Experiments** 1. Determination of partition coefficient of I_2 between CCl_4 and H_2O 2. Study the distribution of acetic acid between water and toluene. 3. Study the distribution of benzoic acid between water and toluene. 4. Determination of enthalpy of ionization of acetic acid by calorimetric method. 5. Determination of enthalpy of Neutralization of strong acid with strong base 6. Determination of specific refraction of liquids A & B and calculation of percentage composition of unknown liquid mixture of A and B using Abbe's refractometer by graphical method. 7. Separation of amino acids by paper chromatography and measuring Rf values.	

Examination

In a batch of ten students, not more than two students should get the same experiment in the practical examination. Selection of experiments may be done by the students based on the lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus. Manual is not allowed in the examination.

Distribution of Marks for organic & physical Experiments

Accuracy-18 marks, Technique and Presentation-3marks Calculation and graph- (5+4) 9 marks, Journal-5 marks, Viva-Voce-5 marks, Total=40 marks.

Deduction of Marks for accuracy:

Error up to ±5% - 18 marks, ±10%-15 marks, ±15%- 12 marks, ±20%- 09 marks, above ±20% zero (0) marks

Books recommended:

1. Advanced Practical Chemistry, agadamba Singh, R.K.P. Singh, Jaya Singh, L.D.S.Yadav, I.R. Siddiqui, Pragati prakashan, 7th edition, 2017.
2. College Practical Chemistry: V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati. University Press-2011.
3. Advanced Practical Inorganic Chemistry, Gurdeep Raj, Goel Publishing House, Meerut.
4. Comprehensive Practical Organic Chemistry: V K Ahluwalia, and Renu Aggarwal, University Press-2000.