SANDIP UNIVERSITY

SANDIP UNIVERSITY

Courses of Study

2019-20

Msc Chemestry

IILP

SANDIP UNIVERSITY

School of Science

M.Sc (Part Time) Chemistry 2018-19

Semester	Course I				Course II				Course III				Course IV				Course V				Course VI				Course VII				Course VIII				L	T	P	C	Contact Hours
I																					Code				Code				Code								
	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C					
	4	0	0	**4**	4	0	0	**4**	4	0	0	**4**	4	0	0	**4**	0	0	4	**2**	0	0	4	**2**	0	0	4	**2**	0	0	0	**0**					
	PC				PC				PC				PC				PC				PC				UC								16	0	12	22	28
	Inorganic Chemistry-I				Organic Chemistry-I				Physical Chemistry-I				Analytical Chemistry-I				Laboratory-I				Laboratory-II				Seminar I												
II																									Code				Code								
	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C									
	4	0	0	**4**	4	0	0	**4**	4	0	0	**4**	4	0	0	**4**	0	0	4	**2**	0	0	4	**2**	0	0	4	**2**									
	PC				PC				PC				PCE				PC				PC				UC								16	0	12	22	28
	Inorganic Chemistry-II				Organic Chemistry-II				Physical Chemistry-II				Basics of Nanochemistry				Laboratory-III				Laboratory-IV				Seminar II												

SANDIP UNIVERSITY

School of Science

M.Sc (Part Time) Chemistry 2018-19

Semester	Course I				Course II				Course III				Course IV				Course V				Course VI				Course VII				Course VIII				L	T	P	C	Contact Hours
III																																	12	0	12	20	24
	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C					
	4	0	0	**4**	4	0	0	**4**	4	0	0	**4**	0	0	4	**2**	0	0	8	**4**	0	0	0	**2**	0	0	0	**0**	0	0	0	**0**					
	PC				PC				PCE				PC				UC				UC																
	Organic Reaction Mechanism				Organic Spectroscopy				Organic Stereochemistry				Pericyclic Reactions				Project Stage I				Internship I																
IV																																	0	0	32	16	32
	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C	L	T	P	C					
	0	0	32	**16**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0		0	0	0	**0**					
	UC																																				
	Project Stage II & Viva Voce																																				
																																TOTAL	44	0	68	80	112

Department Elective I					
Transportation Engineering					
Course Code	**Course**	**L**	**T**	**P**	**C**
1					3
2					3
3					3

Department Elective II					
Water Resources and Environmental Engineering					
Course Code	**Course**	**L**	**T**	**P**	**C**
1					3
2					3
3					3
4					
5					

SANDIP UNIVERSITY

School of Engineering and Technology

M.Sc Chemistry (Part Time)

Year: First Year **Semester: I**

Course: Organic Chemistry **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
4	0	0	4	20	20	10		-	100	-	100
Max. Time, End Semester Exam (Theory) -3Hrs.											

Prerequisite	1. **Basics of Organic Chemistry** 2. **Basics of Organic reactions**

Course Objectives
1. To learn a chemical bonding, effect of electronic effects in molecules.
2. To learn a basics, principles and applications of stereochemistry in organic molecules.
3. To learn an Aliphatic Nucleophilic Substitution Reactions
4. To study Elimination Reactions in organic Chemistry.
5. To study Aromatic Electrophonic Substitution Reactions and its applications in various organic reactions.

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**Nature of Bonding in Organic Molecules** **A) Delocalized Chemical Bonding**–Conjugation, cross conjugation, Resonance, Inductive Effect, Hyper conjugation, Tautomerism. **B) Reactive Intermediates**: Generation, structure, stability and chemical reactions involving carbocation's, carbanions, free radical, carbenes and nitrenes. **C) Introduction to aromaticity** in Benzenoid and non– Benzenoid	10

		compounds, Reactive intermediate-Benzyne, Huckel Rule. **D) Crown ether and Fullerenes.**	
2	I	**Stereochemistry** Isomerism and its types, Chirality, Stereogenic Centre, Optical Activity, Representation of three dimensional molecules, E-Z Notation for Geometrical Isomers, R.S. System of nomenclature, Two Stereogenic Centers.Diagonal Form**Partial Differentiation:** Partial derivatives of first and second order, Total Derivatives, Partial derivatives of implicit functions, composite functions and associated Theorems.	6
3	I	**Stereo chemical Principles** Enantiometric relationships, diastereomeric relationships, dynamic stereochemistry, prochiral relationship, stereo-specific and stereo selective reactions. Introduction of optical activity in the absence of chiral carbon (biphenyls, spiranes, allenes and helical structures).	6
4	I	**Aliphatic Nucleophilic Substitution** The S_N2, S_N1, S_Ni and SET mechanism. The Neighboring Group Particpation mechanism, anchimeric assistance, The Neighbouring Group Participation by heteroatoms, sigma bonds and Pi-bond, phenonium ions, norbornyl system. Nucleophile Substitution at an allylic, and vinylic carbon. Effect of nature of alkyl halide, nucleophile, leaving group, and solvent on S_N2 and S_N1. Phase transfer catalyst, ambident nuclephile and regioselectivity.	8
5	I	**Elimination and Aromatic Electrophilic Substitution Reactions** **A) Elimination Reactions** E^2, E^1, E^1cb Mechanisms, Orientation, stereochemistry in elimination, Reactivity-effect of structure, attacking nucleophile and leaving groups, competition between substitution & elimination, syn eliminations. **B) Aromatic Electrophilic Substitution** The arenium ion mechanism, orientation and reactivity, energy profile diagram, The ortho/ para ratio, ipso attack, Orientation in other ring system's-Naphthalene, Anthracene, Six and five membered heterocycles, Diazonium coupling, Vilsmeier reaction, Gattermann – Koch reaction and Riemer-Tieman reaction.	10
		Total No. of Hrs	40

Beyond the Syllabus
Curve fitting

Course Outcome

Students should able to	
CO1	Students will understand chemical bonding, effect of electronic effects in molecules.
CO2	Students will understand principles and applications of stereochemistry in organic molecules.
CO3	Students will understand Aliphatic Nucleophilic Substitution Reactions and their applications
CO4	Students will understand Elimination Reactions in organic Chemistry and their reactions
CO5	Students will understand Aromatic Electrophonic Substitution Reactions and its applications in various organic reactions.

RecommendedResources	
Text Books	1. Advanced Organic Chemistry: Part B-Reactions and Syntheiss by F. A. Carey and R. J. Sundberg, Kluwer Academic/Plenum Publication, Part B, 4th edition, **2001**.
Reference Books	1. Organic Chemistry by Morrison and Boyd, Prentice Hall of India Prt Ltd, New Delhi, 6th edition, **2001**. 2. A guide book to Mechanism in Organic Chemistry by Peter Sykes, 6th Edition. 3. March's Advanced Organic Chemistry by M. Smith and J. March, Wiley-Interscience, 7th edition, **2007**.
E-Resources	https://onlinecourses.nptel.ac.in/noc18_ce04/preview

SANDIP UNIVERSITY

School of Engineering and Technology

M.Sc. Chemistry- (Part Time)

Year: First Year **Semester: I**

Course: Inorganic Chemistry **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
4	-		4	20	20	10			100		100
Max. Time,End Semester Exam (Theory) -3Hrs.									**End Semester Exam (Lab) – 2Hr**		

Prerequisite	1. **Fundamental of Inorganic Chemistry** 2. **Basics of chemical bonding**

Course Objectives	
1	To study the organometallic compounds
2	To learn the chemistry of various elements of periodic table

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**Symmetry & Stereochemistry** Molecular symmetry and symmetry groups – symmetry elements and operations. Symmetry planes, reflections, inversion centre, proper/ improper axes of rotation, products of symmetry operations, equivalent symmetry elements and atoms, symmetry elements and optical isomerism, symmetry point groups, classes of symmetry operations, classification of molecular point groups.	10
2	I	**Crystallographic Symmetry** Unit cell, screw axis, glide plane on unit cell, crystal lattice, space lattice, stereographic projectors. Examples on crystallographic planes, cubic planes, Miller indices, Bravais lattices.	8
3	I	**Chemistry of Main group Elements** Hydrogen & its compounds:Hydrides Classification, e deficient, e precise & e rich hydrides Alkali & alkaline earth metals Solutions in non-aqueous Media.	8

		Application of crown ethers in extraction of alkali & alkaline earth metals Boron group Boron Hydrides, preparation, structure & bonding with reference to LUMO, HOMO, interconversion of lower & higher borances, Metalloboranes, Carboranes	
4	I	**Chemistry of Main group Elements II** Carbon group Allotropes of Carbon, C60 and compounds (fullerenes), Intercalation compounds of Graphite, Carbon nanotubes, synthesis, Properties, structure- single walled, Multiwalled, applications, classification of organomentallic compounds Nitrogen group Nitrogen activation, Boron nitride, Oxidation states of nitrogen & their interconversion PN & SN compounds Oxygen group Metal selenides & tellurides, oxyacids & oxoanions of S & N. Silicates, including Zeolites Halogen group Interhalogens, Pseudohalogen, synthesis, properties& applications, structure, oxyacids & oxoanions of Hallogens Bonding.	8
5	I	**Organometallic Chemistry** Organometallic compounds of Li, Mg, Be, Ca, Na Synthesis , properties, uses & structures. Organometallic compounds of B, Si, Sn, Pb, Ga,As, Sb, Bi. Structures, Synthesis, Reactions.	6
		Total No. of Hrs	40

Beyond the Syllabus
Symmetry of materials

Course Outcome	
Students should able to	
CO1	Analyze the molecular symmetry and symmetry groups
CO2	Describe the basic concept of symmetry
CO3	Explain the symmetry of crystal
CO4	Explain the chemistry of various elements of periodic table
CO5	Explain the chemistry of organometallic compounds.

RecommendedResources	
Text Books	1. Chemical Application and Group Theory by F.A. Cotton, 3rd edition, **1999**. 2. Advanced Inorganic Chemistry by F. A. Cotton, G. Wilkinson, C.A. Murillo and M.Bochmann, 6th edition, 2003.
Reference Books	1. Symmetry in Chemistry by H. Jaffe' and M. Orchin. 2. Group Theory and its Chemical Application by P. K. Bhattacharya, Himalaya Publication, 2nd edition, **1989**. **3.** Inorganic Chemistry by Shriver and Atkins, Oxford, 4th edition, **2003**.
E-Resources	https://onlinecourses.nptel.ac.in

SANDIP UNIVERSITY

School of Engineering and Technology

M.Sc. Chemistry- (Part Time)

Year: First Year **Semester: I**

Course: Analytical Chemistry **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
4	0		4	20	20	10			100		100
Max. Time,End Semester Exam (Theory) -3Hrs.									**End Semester Exam (Lab) – 2Hr**		

Prerequisite	1. Basic concept of instrumental techniques 2. Fundamentals of analytical chemistry

Course Objectives	
1	To Understand the basic concept of analytical chemistry
2	To learn chromatographic techniques
3	To study separation techniques
4	To learn the hyphenated techniques

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**Concepts of Analytical Chemistry** **A) Error in Chemical Analysis:** Errors & precision, classficiation of errors, determinate errors, determination of accuracy of quantitative analytical methods, accuracy sought. **B) Accuarcy and Precision :** The test of statistics precision, averages, study of an analytical procedure, sampling errors, presentation of results**.** **C) Principles and Methods of Sampling :** Introduction, theory of sampling, pit falls is sampling, technique of sampling gases, liquids and solids, transmission and storage of samples, sources specific	6

		sampling information.	
2	I	**Chromatographic Techniques** **A) Paper Chromatography:-** Preparation of sample solution, solvent selection,developement of chromatogram,Location of spot of paper chromatography **B) Thin layerChromatography:-** Preparation of sample solution, solvent selection,developement of chromatogram,Location of spot of thin layerchromatography **C) Column Chromatography:-** Types of column, Adsorbends,eluents, column resolution on chromatogram and applications of chromatography	8
3	I	**Gas Chromatography** Gas chromatography theory and Instrumentation, Column types, Solid/Liquid Stationary Phases, Column Switching techniques, Basic and Specialized detectors, elemental detection, chiral separations, pyrolysis gas chromatography and it,s application	8
4	I	**Electrophoresis** Principle & Instrumentation, Types of Electrophoresis , moving boundary electrophorosis, Zone Electrophoresis, Polyacrylamide gel Electrophoresis , Paper Electrophoresis, Isoelectric focusing Electrophoresis , Two dimensional Electrophoresis , Capillary Electrophoresis, Application of Electrophoresis.	6
5	I	**Separation & Hyphenated techniques** **A) High Performance Liquid Chromatography :** HPLC theory and instrumentation, Adsorption chromatography, Liquid-Liquid partition techniques, Microbore and capillary chromatography, Affinity techniques, Size exclusion, ion pait separtions, Chiral and Isotope separations, Applications and problems. **B) Hyphenated Techniques :** Mass spectrometry principle, Instrumentation, Ionization methods–EL, CI, FAB, arc & spark, photoionization, thermal ionization, FI & FD, laser induced, Photoelectic ionization, SIMS, Mass analyzers – Magnetic, Double foucusing, Time of flight, Quadrupolar, Ion cyclotron resonance analyzer. Coupled techniques, GC- FTIR, GC- MS (Use of stable isotopes), HPLC-MS.	12
		Total No. of Hrs	40

Beyond the Syllabus
Working on advance analytical techniques

Course Outcome
Students should able to

CO1	Students will understand basic concept of analytical chemistry
CO2	Students will understand chromatographic techniques
CO3	Students will understand separation techniques
CO4	Students will understand the hyphenated techniques

RecommendedResources	
Text Books	3. Analytical Chemistry by G. D. Christian, Wiley, 6th edition. 4. Computational Chemistry by G. Grant and W. Richards, Oxford University press. 5. Computer Programming in Fortran 77 and Fortran 90 by V. Rajaraman, Prentice Hall India. 6. Practical Aspects of Gas chromatography/ Mass spectrometry. 7. G. M . Message, John Wiley & Sons, New York, **1984**.
Reference Books	1. **Spring International, 3rd Edition, New Delhi, StudentsEdn, 1994.** 2. HPLC: Analytical Chemistry by Open Learning, John Wiley & Sons, New York, **1991**, **Protein Purification: Principles & Practice.**
E-Resources	https://nptel.ac.in

SANDIP UNIVERSITY

School of Engineering and Technology

M.Sc. Chemistry- (Part Time)

Year: First Year **Semester: I**

Course: Physical Chemistry **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
4	-	-	4	20	20	10		-	100	-	100
Max. Time,End Semester Exam (Theory) -3Hrs.											

Prerequisite	1. Introduction and basic concepts of physical chemistry 2. Basic concept and equations of thermodynamics

Course Objectives	
1	To learn the energy and its transformation.
2	To determine the spontaneity of given transformation and energy interaction.
3	To Understand the conditions by which the reaction rate is altered and determine the rate of chemical reaction with respect to concentration
4	To understand atomic and molecular structures, properties as well as chemical reactivity
5	To study the molecular basis of thermodynamics and interaction between partials and thermodynamic properties
6	To learn the energy and its transformation.

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**Thermodynamics** **A)First law of thermodynamics** **I) Conservation of Energy** The basic concepts, the first law of thermodynamics, work of compression &	10

		expansion, Expansion against constant pressure, reversible expansion, Heat: heat capacity, enthalpy. **II) State Functions and Differentials:** Exact & In-exact differentials. State functions, changes in internal energy, temperature dependence of the internal energy, Temperature dependence of the enthalpy. Work of adiabatic expansion- Irreversible adiabatic expansion. B**) Second Law of Thermodynamics** Definition of entropy, The second law, the entropy changes in the system, natural events. Entropy changes in the universe – The enthalpy change when a system is heated, Entropy changes in surroundings, The entropy of phase transition, The Helmholtz& Gibbs function, The Third law of Thermodynamics, Zeroth law of thermodynamics.	
2	I	**Changes of State** Physical Transformation of pure materials. The stability of phases, Phase equilibrium & phase diagrams, The solid – liquid boundary, The liquid-vapour boundary, The solid- vapour boundary, The solid-liquid-vapour equilibrium. Colligate properties- The common features, the elevation of boiling point, The depression of freezing point, solubility, osmosis, Mixtures of volatile liquid–vapour pressure diagram–The representation of distillation, azeotropes, and immiscible liquids.	8
3	I	**Quantum Chemistry** Classical approach in quantum chemistry. Historical development of quantum theory principal of quantum mechanics, black body radiation,photoelectriceffect,wave particle duality, uncertainty principles, Schrödinger equation, operators simple system– free particle, Particle in a box, Two dimensional Three dimensional box (Derivation), Hydrogen like atoms atomic orbital. .	6
4	I	**Chemical Kinetics** Reaction rate, rate law & rate constants, the determination of rate law, first order reactions, second order reactions, third order reaction, n^{th} order reaction, half-life, Simple reactions, the temperature dependence of reaction rates (Arrhenius Equation), Consecutive reactions, The steady state approximations, Unimolecular reactions, enzyme catalysis– MichaelisMenton mechanism, lineweaver and Eadie plots, Complex reaction, chain reactions, fast reactions, flash photolysis.	8
5	I	**Kinetic Theory of Gases & Reaction dynamics**	8

		A)Kinetic Theory of Gases Postulates of kinetic theory of gases, P-V-T relations for an ideal gas, Non-ideal behaviour of gases, Equation of state, Van der Waal's equation, Excluded volume and molecular diameter, Relations of van der Waal's constants with virial coefficients and Boyle temperature. **B)Statistical thermodynamics** Boltzmann distribution law, Partition function of translational,vibrational and rotational of diatomic molecule, Maxwell-Boltzmann law for distribution of molecular velocities, Equilibrium constant from partition function, Fermi Dirac and Bose- Einstein statistics.	
		Total No. of Hrs	40

Beyond the Syllabus
Thermodynamics of equilibrium

Course Outcome	
Students should able to	
CO1	Students able to understand the energy and its transformation
CO2	Students able to understand the spontaneity of given transformation and energy interaction
CO3	Students able to understand the conditions by which the reaction rate is altered and determine the rate of chemical reaction with respect to concentration
CO4	Students able to understand the atomic and molecular structures, properties as well as chemical reactivity
CO5	Students able to understand the molecular basis of thermodynamics and interaction between partials and thermodynamic properties

RecommendedResources	
Text Books	1. Physical Chemistry by P.W. Atkin, Julio de Paula, ELBS, 4th Edition. 2.Physical Chemistry by R. J. Silbey, R. A. Alberty, M. G.Bawendi, Wiley 4th edition, 2005 3. Physical Chemistry by G. M. Barrow, Tata Mc – Graw Hill, 1988. 4. Quantum Chemistry by I . Levine, Prentice Hall, 5th edition, 1999. 5. Physical Chemistry by Thomas Engel and Philip Reid, 3rdedition. Principles of Physical chemistry by S. H. Maron and C .F .Pruton, 4th edition.
Reference Books	1. Chemicals Kinetics by K.J. Laidler, Tata Mc. Graw Hill, **1998**. 2. Basic Chemical Thermodynamics by E. Brian Smith, ELBS, **1990**. 3. Physical Chemistry Molecular Approach by D. Mcquarie and J. Simom (Viva) **2000**. 4. Pysical Chemistry by Puri, Sharma and Pathania
E-Resources	https://nptel.ac.in

School of Engineering and Technology

M.Sc. Chemistry- (Part Time)

Year: First Year **Semester: I**

Course: Laboratory –I (physical and inorganic chemistry practical) **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
0	-	2	2					50			50
Max. Time,End Semester Exam (Theory) -3Hrs.											

Prerequisite	1. Introduction and basic concepts of physical chemistry 2. Basic concept and equations of inorganic chemistry

Course Objectives	
1	To study chemical kinetics of reactions
2	To study the instrumental analysis of various complex solutions.
3	To learn analysis of ores
4	To learn various instrumental methods
5	To study chemical kinetics of reactions
6	To study the instrumental analysis of various complex solutions.

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**Chemical Kinetics**: Determine the order of reaction between potassium persulphate and potassium iodide	
2	I	**Colorimetry**: Copper EDTA photometric titration.	
3	I	**pH Metry** : To titrate the given mixture of $CO_3^{2-}$and HCO_3^-ions against a strong acid HCl using pH meter and to determine the strength of it	

4	I	**Conductometry**: Determination of equivalence conductivity at infinite dilution and dissociation constant of acetic acid.	
5	I	**Colorimetry**: Determination of maximum wavelength by colorimetric techniques.	
6	I	**Study of a Redox Reaction:** Standardization of potassium permanganate by oxalic acid Standardization of potassium permanganate by oxalic acid	
7	I	**Ore Analysis**: Determination of silica and manganese in pyrolusite.	
8	I	**To analyse the given sample of haematite ore for its** (A) Acid insoluble analysis (B) Iron by redox titrations	
9	I	**Metal ion Estimation**: To analyze the binary mixture of copper and Zinc	
10	I	**Non-Instrumental:** Determine the radius of glycerol molecule from Viscosity measurement.	
		Total No. of Hrs	

Beyond the Syllabus
Thermodynamics of equilibrium

Course Outcome	
Students should able to	
CO1	Students able todetermine chemical kinetics of reactions
CO2	Students able to perform analysis of ores
CO3	Students able touse various instrumental methods of chemical analysis
CO4	Students able todetermine chemical kinetics of reactions
CO5	Students able to perform analysis of ores

RecommendedResources	
Text Books	1. Physical Chemistry by P.W. Atkin, Julio de Paula, ELBS, 4th Edition. 2.Physical Chemistry by R. J. Silbey, R. A. Alberty, M. G.Bawendi, Wiley 4th edition, 2005 3. Physical Chemistry by G. M. Barrow, Tata Mc – Graw Hill, 1988.
Reference Books	1. Chemicals Kinetics by K.J. Laidler, Tata Mc. Graw Hill, **1998**. 2. Basic Chemical Thermodynamics by E. Brian Smith, ELBS, **1990**.
E-Resources	https://nptel.ac.in

SANDIP UNIVERSITY

School of Engineering and Technology

M.Sc. Chemistry- (Part Time)

Year: First Year **Semester: I**

Course: Laboratory-II **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
0	-	2	4					50			50
Max. Time,End Semester Exam (Theory) -3Hrs.											

Prerequisite	1. Introduction and basic concepts of organic chemistry 2. Basic concept and equations of analytical chemistry

Course Objectives	
1	To study analytical techniques.
2	To perform single stage preparation
3	To learn various instrumental methods.
4	To learn various titration methods.
5	To study analytical techniques.
6	To perform single stage preparation

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**Techniques (Any Two)** Crystallization, Sublimation, Distillation, Steam Thin Layer Chromatography.	
2	I	**Single Stage Preparation**	
3	I	Benzilic acid from benzoin	
4	I	Benzanilide	
5	I	Benzotriazole	
6	I	2- and 4-nitrophenols	

7	I	Cyclohexanol from cyclohexanone	
8	I	4-Methyl benzophenone	
9		**Volumetry**: Estimation of iron from the given drug sample.	
10		**Gravimetry**: Estimation of barium as barium sulphate.	
11		**Titrimetric Analysis** : Determination of the total Hardness of Water	
12		**Separation Technique**: Qualitative separation of metal ions by paper chromatography.	
		Total No. of Hrs	

Beyond the Syllabus
Thermodynamics of equilibrium

Course Outcome	
Students should able to	
CO1	Students will be able to perform analytical techniques.
CO2	Students will be able perform single stage organic preparation
CO3	Student will able to perform chemical analysis using instrumental methods.
CO4	Student able to perform various titration methods.
CO5	Students will be able to perform analytical techniques.

SANDIP UNIVERSITY

School of Engineering and Technology

M.Sc Chemistry (Part Time)

Year: First Year **Semester: II**

Course: Organic Chemistry-II **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
4	0	0	4	20	20	10		-	100	-	100
Max. Time, End Semester Exam (Theory) -3Hrs.											

Prerequisite	3. **Advance Organic Chemistry** 4. **Organic reaction Mechanism**

Course Objectives
1. To learn a chemistry of various oxidizing and reducing reagents
2. To study a rearrangement reactions
3. To understand basic principles of various spectroscopic techniques related to organic chemistry
4. To learn UV, IR and NMR spectroscopy and their applications.
5. To study problems in UV, IR and NMR

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**Oxidation and Reduction** **Oxidizing Agents**: CrO_3 (Jones reagent), PDC, PCC, $KMnO_4$, Swern oxidation, SeO_2, $Pb(OAc)_4$, OsO_4, *m*CPBA, HIO_4. **Green Oxidant**: O_3, O_2, H_2O_2.. **Reducing Agents** : Pd/C, Pd/$CaCO_3$, Boranes & Hydroboration reactions, MVP, Wilkinson's catalyst, $NaCNBH_3$, Bu_3SnH, NH_2NH_2, DIBAL etc.	8

2	I	**A. Rearrangements** Introduction to Reactive intermediates, Carbocations, carbanions, carbenes, nitrenes. **Rearrangements:** Beckmann, Hofmann, Curtius, Schmidt, Lossen, Wolf, Baeyer–Villiger, Sommelet, Favorskii, Pinacole–Pinacolone, Benzil–Benzillic acid, Claisen and Cope Rearrangements, Fries Migration. **B. Phosphorous, Nitrogen and Sulphur Ylids**: Synthesis and Applications.	8
3	I	**Spectroscopy** **A. Ultraviolet (U. V.) Spectroscopy** Electronic transitions, Chromophores, Auxochromes, Bathochromic and hypsochromic shifts, Solvent effects, Woodward–Fieser Rules for dienes, enones and aromatic compounds, Applications of U.V., instrumentation B. **Infrared (IR) Spectroscopy** Vibrational Transitions, Important group frequencies, Factors affecting IR group frequency, Applications of I.R., Instrumentation.	8
4	I	**Nuclear Magnetic Resonance (NMR) Spectroscopy** Elementary ideas of NMR Integration, Chemical shifts, Factors affecting, Chemical shifts, Coupling (First order, analysis), Instrumentation. NMR spectra of different organic compounds	10
5	I	Numerical problems on Ultraviolet (U. V.) Spectroscopy, Infrared (IR) Spectroscopy and Nuclear Magnetic Resonance (NMR) Spectroscopy. Combined problems on UV, IR, NMR and mass spectroscopy	6
		Total No. of Hrs	40

Beyond the Syllabus
NMR study of complex compounds

Course Outcome	
Students should able to	
CO1	Students will be able to understand oxidizing and reducing reagents chemistry and their applications.
CO2	Students will increase a better understanding of rearrangement reactions.
CO3	Students will understand spectroscopic techniques and its importance.

CO4	Students will gain good knowledge about UV, IR and NMR spectroscopy and their applications.
CO5	Students will be able to identify structures of organic molecule using UV, IR and NMR spectroscopy.

RecommendedResources	
Text Books	2. Organic Chemistry by J. Clayden, N.Greeveset. al. 3. Stereochemistry by Eliel. 4. Stereochemistry of Organic Compounds by D. Nashipuri, 5. Spectroscopy of Organic Compounds by Pavia.
Reference Books	4. Adv. Organic Chemistry by Carey and Sundberg, Edition III, Part B. 5. Synthetic Organic Chemistry by H.O. House. 6. Mechanis and Structure in Organic Chemistry by E. S. Gould. 7. Organic Chemistry by R. O. C. Norman. 8. Advanced Organic Chemistry by J. March, Edition IV. 9. Spectrometric Identification of Organic Compounds by Silversteine and Basser. 10. Organic Spectroscopy by Kalsi. 11. Infrared spectra of Complex molecules by J. Bellamy. 12. Organic Spectroscopy by I Fleming.
E-Resources	https://onlinecourses.nptel.ac.in

SANDIP UNIVERSITY

School of Engineering and Technology

M.Sc. Chemistry- (Part Time)

Year: First Year **Semester: II**

Course: Inorganic Chemistry-II **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
4	-		4	20	20	10			100		100
Max. Time,End Semester Exam (Theory) -3Hrs.									**End Semester Exam (Lab) – 2Hr**		

Prerequisite	3. **Understanding of coordination Chemistry** 4. **Complex chemistry of inorganic compounds**

Course Objectives	
1	To understand the basic concepts of co-ordination chemistry
2	To learn the electron spectroscopy of various complexes

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**Introduction to Coordination Chemistry** Concept & Scope of Ligand Fields, splitting of d orbital octahedral and tetrahedral complexes, Energy levels of transition metal ions, free ion terms, term wave functions, spin-orbits coupling. Effect of ligand field on energy levels of transition metal ions, weak cubic ligand field effect on Russell-Saunders terms, strong field effect	10
2	I	**Electronic spectra of complexes** Band intensities, band energies, band width & shapes, spectra of 1st , 2nd & 3rd row ions and rare earth ion complexes, spectrochemical&nephlauxetic series, charge transfer & luminescence, spectra, calculations of Dq, B, βparameters. correlation diagrams, Tanabe- Sugano Diagrams, Spin-Pairing energies.	8
3	I	**Magnetic properteis of complexes-** Paramagnetism, dimagnetism, ferrimagnetism, ferromagnetism. 1st & 2nd Ordered Zeeman effect, quenching of orbital angular momentum by Ligand	8

		fields, Magnetic properties of A, E & T ground terms in complexes, spin free spin paired equilibria, selection rules.	
4	I	**Bioionrganic chemistry I** Overviews of Bioniorganic Chemistry, Principles of Coordination Chemistry related to Bioionorganic – Protein, Haemoglobin, Haemocyanin, hemerythrin, Nucleic acids and other metal binding biomolecules	8
5	I	**Bioionrganic chemistry II** Choice, uptake and assembly of metal containing units in Biology, Control and utilization of metal ion concentration in cells. Binding of metal ions and complexes to bimolecular active centers.	6
		Total No. of Hrs	40

Beyond the Syllabus
Symmetry of materials

Course Outcome	
Students should able to	
CO1	Explain the basic concept of coordination chemistry
CO2	Analyze the electronic spectra of metal complex
CO3	Describe the magnetic properties various coordination compounds
CO4	Explain the basic concept of bioinorganic chemistry
CO5	Explain the splittind of d orbital.

RecommendedResources	
Text Books	8. Chemical Application and Group Theory by F.A. Cotton, 3rd edition, **1999**. 9. Advanced Inorganic Chemistry by F. A. Cotton, G. Wilkinson, C.A. Murillo and M.Bochmann, 6th edition, 2003.
Reference Books	1. Inorganic Electronic spectroscopy by A.B . P. Level, Elsevier Science Publishers New York, 2nd edition **1984**. 2. Biological Chemistry of the Elements by R. J. P. Williams and F. R. Desalvia, Oxford University Press, **1991**. 3. Bioinorganic Chemistry: Inorganic elements in the Chemistry of life: An introduction & guide by W. Kaim and B .Schwederski, VCH, **1991**.
E-Resources	https://onlinecourses.nptel.ac.in

SANDIP UNIVERSITY

School of Engineering and Technology

M.Sc. Chemistry- (Part Time)

Year: First Year **Semester: II**

Course: General Chemistry **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
4	0		4	20	20	10			100		100
Max. Time,End Semester Exam (Theory) -3Hrs.									**End Semester Exam (Lab) – 2Hr**		

Prerequisite	3. Basic concept of instrumental techniques 4. Fundamentals of analytical chemistry

Course Objectives	
1	To Understand the basic concept of analytical chemistry
2	To learn chromatographic techniques
3	To study the basic concept of organic chemistry & Inorganic chemistry
4	To learn the basic concept of qualitative Analysis of organic concept

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**General Chemistry:** Extra-nuclear Structure of atoms: Bohr's theory for hydrogen atom (simple mathematical treatment), atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, *Aufbau*principle and its limitations. Radioactivity and Nuclear Structure of Atoms: Natural radioactivity; radioactive disintegration series, group displacement law, law of radioactive decay, half-life of radio elements. Atomic Nucleus: Stability of atomic nucleus, n/p ratio, nuclear binding energy, mass defect. Nuclear reactions: fission, fusion, transmutation of elements.	6

		Chemical Periodicity: classification of elements on the basis of electronic configuration: general characteristics of s-, p-, d- and f-block elements. Positions of hydrogen and noble gases. Atomic and ionic radii, ionization potential, electron affinity, and electronegativity; periodic and group-wise variation of above properties in respect of s- and p-block elements.	
2	I	**<u>Principles of organic qualitative Analysis:</u>** Reactions involving the detection of special elements N, S and Cl in an organic compound (only Lassaigne's test). Reactions involving the detection of the following functional groups: Aromatic primary amino group (Diazo-coupling reaction); Nitro group (MullikenBarker's test); Carboxylic acid group (reaction with NaHCO3); Phenolic OH (FeCl3 test); Carbonyl (aldehyde and ketone) group (DNP Test, etc.).	8
3	I	**<u>Basic organic chemistry:</u>** **Unit I**. Basic organic chemistry I Inductive effect, resonance and resonance energy. Homolytic and heterolytic bond breaking, electrophiles and nucleophiles; carbocations, carbanions and radicals (stability and reactivity) Stereochemistry of carbon compounds: Different types of isomerism, geometrical and optical isomerism, optical activity, asymmetric carbon atom, elements of symmetry (plane and centre), chirality, enantiomers and diastereomers, R and S nomenclature, E and Z nomenclature, D and L nomenclature, Fischer projection formula of simple molecules containing one and two asymmetric carbon atoms. Alkanes, alkenes and alkynes: Synthesis and chemical reactivity of alkanes, mechanism of free-radical halogenation of alkanes, general methods of synthesis of alkenes, electrophilic addition reaction, mechanism of bromination and hydrohalogenation, Markownikoff's addition, peroxide effect, hydroboration, ozonideformation, polymerization reaction of alkenes (definition and examples only), general methods of synthesis, acidity, hydration and substitution reactions of alkynes. Aromatic Hydrocarbons: Structure of benzene, general mechanism of electrophilic substitution, reactions of benzene, synthesis of aromatic	8

		compounds using nitration, halogenation, Friedel-Craft's reactions. **Unit II**. Basic organic chemistry II Aldehydes and ketones: the nature of carbonyl group, methods of synthesis, physical properties, Cannizzaro reaction, relative reactivities and distinction of aldehydes and ketones, Aldol condensation (with mechanism), Perkin reaction, Benzoin condensation, Claisen condensation, Oxidation and reduction reactions. Alkyl and Aryl halides: SN1, SN2, E1 and E2 reactions (elementary mechanistic aspects), Saytzeff and Hoffmann elimination reactions. Nucleophilic aromatic substitution.	
4	I	**<u>Basic Inorganic chemistry:</u>** **Unit I.** Basic inorganic chemistry Ionic bonding: General characteristics of ionic compounds, sizes of ions, radius ratio rule and its limitation. Lattice energy, Born Haber cycle. Covalent bonding: General characteristics of covalent compounds, valence-bond approach, directional character of covalent bond, hybridization involving s-, p-, dorbitals, multiple bonding, Valence Shell Electron Pair Repulsion (VSEPR) concept, shapes of simple molecules and ions (examples from main group chemistry). Bond moment and dipole moment, partial ionic character of covalent bonds, Fajan's rules. Hydrogen bonding and its effect on physical and chemical properties. Coordinate bonds and Coordination compounds: complex salts and double salts, Warner's theory of coordination, chelate complexes, stereochemistry of coordination numbers 4 and 6. IUPAC nomenclature of coordination complexes (mononuclear complexes only). **Unit II.** Basic inorganic chemistry II Comparative study of p-block elements: Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important compounds in respect of the following groups of elements: i) B-Al-Ga-In-Tl ii) C-Si-Ge-Sn-Pb iii) N-P-As-Sb-Bi iv) O-S-Se-Te v) F-Cl-Br-I	6
5	I	**<u>Analytical Chmistry:</u>** **UNIT I:** Errors and Evaluations Systematic and random errors, Effects of errors on analytical results, Accuracy, precision, Absolute and	12

		Relative errors, Significant figures, mean, mean deviation and median, standard deviation, variance, confidence limits, application of statistics, Reliability and rejection of results, Q test, Analysis of variance. UNIT II Types of Titrations Redox titration: Redox potentials, theory and feasibility of redox titration, calculation of potentials at different stages of titrations, redox indicators, their choice and applications. Precipitation titrations: Theory and types, Mohr, Volhard and Fajan's methods. Adsorption indicators: theory, choice and applications. Complexometric titrations: Theory, Stepwise and overall formation constants, Titrations involving chelates (EDTA). Metallochromic indicators: Theory and Choice, Masking and demasking methods and applications. **A) High Performance Liquid Chromatography :** HPLC theory and instrumentation, Adsorption chromatography, Liquid-Liquid partition techniques, Microbore and capillary chromatography, Affinity techniques, Size exclusion, ion paitsepartions, Chiral and Isotope separations, Applications and problems. **B) Hyphenated Techniques :** Mass spectrometry principle, Instrumentation, Ionization methods–EL, CI, FAB, arc & spark, photoionization, thermal ionization, FI & FD, laser induced, Photoelectic ionization, SIMS, Mass analyzers – Magnetic, Double foucusing, Time of flight, Quadrupolar, Ion cyclotron resonance analyzer. Coupled techniques, GC- FTIR, GC- MS (Use of stable isotopes), HPLC-MS.	
		Total No. of Hrs	40

Beyond the Syllabus
advance organic and inorganic chemistry

Course Outcome	
Students should able to	
CO1	Students will be able to understand analytical chemistry.
CO2	Students will be able to understand chromatographic techniques.
CO3	Students will be able to understand basic concept of organic chemistry.
CO4	Students will be able to understand basic concept of Inorganic chemistry.

RecommendedResources	
Text Books	1. Analytical Chemistry by G. D. Christian, Wiley, 6th edition. 2.Computational Chemistry by G. Grant and W. Richards, Oxford University press. 3. Computer Programming in Fortran 77 and Fortran 90 by V. Rajaraman, Prentice Hall India. 4.Practical Aspects of Gas chromatography/ Mass spectrometry. 5. G. M . Message, John Wiley & Sons, New York, **1984**. 6.Inorganic Electronic spectroscopy by A.B . P. Level, Elsevier Science
Reference Books	3. **Spring International, 3rd Edition, New Delhi, StudentsEdn, 1994.** 4. HPLC: Analytical Chemistry by Open Learning, John Wiley & Sons, New York, **1991**.
E-Resources	https://nptel.ac.in

SANDIP UNIVERSITY

School of Engineering and Technology

M.Sc. Chemistry- (Part Time)

Year: First Year **Semester: II**

Course: Physical Chemistry-II **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
4	-	-	4	20	20	10		-	100	-	100
Max. Time,End Semester Exam (Theory) -3Hrs.											

Prerequisite	3. Introduction and basic concepts of physical chemistry 4. Basic concept and equations of thermodynamics

Course Objectives	
1	To understand the fundamental of the various Spectroscopic techniques with Physical aspects
2	To Learn the principle behind the various spectroscopic techniques.
3	To study the detail idea about Nuclear chemistry and its application.
4	To learn the detail concept on radioactivity and its medical applications.
5	To understand the various phenomena related to the radioactivity.
6	To understand the fundamental of the various Spectroscopic techniques with Physical aspects

Course Content			
Unit No.	Module No.	Content	Hours

1	I	**Molecular Spectroscopy** Width and intensity of spectral transitions, Fourier transform, microwave spectroscopy, rotation spectra of di – and poly- atomic molecules, Harmonic and enharmonic oscillator, vibrational spectra of di– and poly- atomic molecules. Introduction, Rotational Raman spectra, vibrational Raman Spectra, polarization of light and Raman effect, structure elucidation from combined Raman and IR spectroscopy, applications in structure elucidation.	10
2	I	**Electronic Spectroscopy of Molecules** Born – Oppenheimer approximation, Electronic spectra of diatomic molecules, Dissociation energy and dissociation products, electronic structure of diatomic molecules, molecular photoelectron spectroscopy, application, ESR and Mossbauer Spectroscopy Applications. Principles of NMR & Chemical applications of NMR in structure elucidation.factors affecting coupling constant, simplification of complex spectra, nuclear magneticdouble resonance, spin decoupling	8
3	I	**Nuclear and Radiation Chemistry** Radioactive decay, Decay Kinetics, Detection & measurement of radiation (G.M. & Scintillation counter). Radiation chemistry, Interaction of radiation with matter, Units for measuring radiation, Radiolysis of water, Radiolysis of some aqueous solution.	6
4	I	**Nuclear Reactor** The fission energy, The Natural uranium reactor, The classification of reactor. Reactor power, Critical size of thermal reactor, The Breeder reactor, Natural nuclear reactor. The Indians nuclear energy Programme. Recovery of Uranium & Plutonium, Nuclear waste management, Isotopes for Nuclear Reactors, Isotope separation, separation of selected isotopes, plutonium	8
5	I	**Applications of Radioactivity** Preparation of radioisotopes: ^{3}H, ^{14}C, ^{22}Na, ^{32}P, ^{35}S and ^{137}I. General	8

		principles of using radioisotopes. Analytical applications- neutron activation analysis, dilution analysis, radiometric titration. Industrial applications– radiation gauging, friction and wear out, gamma radiography.	
		Total No. of Hrs	40

Beyond the Syllabus
Rare earth metals and advance radioactivity

Course Outcome	
Students should able to	
CO1	Students able to understand the concept of various spectroscopic phenomena with physical aspects
CO2	Students able to understand the application of spectroscopic techniques in various fields
CO3	Students able to explain concept regarding IR, Raman, Uv-Vis, ESR, NMR
CO4	Students able to understand the radioactivity and its application in various fields
CO5	Students able to understand the energy and various phenomena related to nuclear reactor

RecommendedResources	
Text Books	1. Physical Chemistry by P.W. Atkin, Julio de Paula, ELBS, 4th Edition. 2.Physical Chemistry by R. J. Silbey, R. A. Alberty, M. G.Bawendi, Wiley 4th edition, 2005 3. Physical Chemistry by G. M. Barrow, Tata Mc – Graw Hill, 1988. 4. Quantum Chemistry by I . Levine, Prentice Hall, 5th edition, 1999. 5. Physical Chemistry by Thomas Engel and Philip Reid, 3rdedition. Principles of Physical chemistry by S. H. Maron and C .F .Pruton, 4th edition.
Reference Books	1. Chemical Applications of Radioisotopes by H. J. M . Brown Buffer & Jammer Ltd. 2. Fundamentals of Molecular Spectroscopy by C.N. Banewell and E.Mc. Cash, 4th edition. 3. Elements of Nuclear Chemistry by H. J. Arnikar, Wiley Estern Ltd, 4th edition. 4. Source Book of Atomic Energy by S. Glasstanc, D. Van Norton company.
E-Resources	https://nptel.ac.in

SANDIP UNIVERSITY

School of Engineering and Technology

M.Sc. Chemistry- (Part Time)

Year: First Year **Semester: II**

Course: Laboratory –III (physical and inorganic chemistry practical) **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
4	-	4	4	20	20	10		50		50	100
Max. Time,End Semester Exam (Theory) -3Hrs.											

Prerequisite	3. Introduction and basic concepts of physical chemistry 4. Basic concept of inorganic chemistry

Course Objectives	
1	To study the various chemical reactions using instrumental methods
2	To learn inorganic synthesis
3	To learn synthesis of inorganic complexes
4	To learn nano-material synthesis
5	To study the various chemical reactions using instrumental methods
6	To learn inorganic synthesis

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**Conductometry** : Hydrolysis of NH_4Cl or CH_3COONa or aniline hydrochloride	

2	I	**Potentiomerty** : Solubility of a sparingly soluble salt(AgCl)	
3	I	**Potentiomerty**: Determine the stability constant silver-ammonia complex	
4	I	**pH metry** : Determination of the acid and base dissociation constant of an amino acid and hence the isoelectric point of the acid	
5	I	**pH metry** : Determine the dissociation constant of tribasic acid	
6	I	**Colorimetry: Determine the composition of complex between Fe and salicyclic acid by Job's continuous variation method**	
7	I	**Non- Instrumental**: Statistical treatment of experimental data.	
8	I	**Inorganic Synthesis** : To prepare Tris(acetylacetonato) iron(III)	
9	I	**Inorganic Synthesis :** To preparebis-ethylene diamine copper (II) sulphate	
10	I	Synthesis of potassium trisoxalato chromate (III) trihydrate	
11	I	**Nano-Chemistry**: Synthesis and Characterization of graphene oxide	
12	I	**Table Work :** Characterization of metal ligand bonding using IR spectroscopy	
		Total No. of Hrs	

Beyond the Syllabus
Advance nanochemistry

Course Outcome	
Students should able to	
CO1	Students are able toanalyze the various chemical reactions using instrumental methods
CO2	Students are able to perform the various inorganic synthesis
CO3	Students are able to perform synthesis of various inorganic complexes
CO4	Students are able to perform the nano material synthesis
CO5	Students are able toanalyze the various chemical reactions using instrumental methods

RecommendedResources	
Text Books	1. Physical Chemistry by P.W. Atkin, Julio de Paula, ELBS, 4th Edition. 2.Physical Chemistry by R. J. Silbey, R. A. Alberty, M. G.Bawendi, Wiley 4th edition, 2005 3. Physical Chemistry by G. M. Barrow, Tata Mc – Graw Hill, 1988.
Reference Books	1. Chemicals Kinetics by K.J. Laidler, Tata Mc. Graw Hill, **1998**. 2. Basic Chemical Thermodynamics by E. Brian Smith, ELBS, **1990**.
E-Resources	https://nptel.ac.in

SANDIP UNIVERSITY

School of Engineering and Technology

M.Sc. Chemistry- (Part Time)

Year: First Year **Semester: II**

Course: Laboratory-IV **Course Code:**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA)					End Semester Examination		Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**		**Lab**	**Theory**	**Lab**	
4	-	4	4	20	20	10		50		50	100
Max. Time,End Semester Exam (Theory) -3Hrs.											

Prerequisite	3. Introduction and basic concepts of organic chemistry 4. Basic concept and equations of analytical chemistry

Course Objectives	
1	Isolation of natural products.
2	To perform single stage preparation.
3	To learn analytical techniques
4	Isolation of natural products.
5	To perform single stage preparation.
6	To learn analytical techniques

Course Content			
Unit No.	Module No.	Content	Hours
1	I	**Isolation of Natural products**	
i)	I	Caffeine from tea leaves	
ii)	I	Lycopene from tomatoes	
iii)	I	Cinnamaldehyde from cinnamom	
2	I	**Single Stage Preparation**	
i)	I	Quinoline from aniline	
ii)	I	Ethyl cinnamate from benzaldehyde	
iii)	I	p-nitrobenzoic acid from p-nitrotoluene	
iv)		Benzalacetophenone	
3		**pHMetry:** To titrate the solution of Na_2CO_3 against HCl pH-metrically and hence to select appropriate indicators for two equivalence point.	
4		**Spectrophotometry:** Spectrophotometric analysis of potassium permanganate solutions.	
5		**Potentiometric titrations:** Determination of strength of commercial phosphoric acid by potentiometric titrations using standard solution of sodium hydroxide.	
6		**To learn chemistry related software's:**Chem Draw, Chem-Sketch, ISI–Draw, Draw the structure of simple aliphatic, aromatic, heterocyclic compounds with different subsistent. Get the correct IUPAC name and predict the 1H NMR signals.	
		Total No. of Hrs	

Beyond the Syllabus
Advance spectroscopy

Course Outcome	
Students should able to	
CO1	Students will be able to perform analytical techniques.
CO2	Students will be able to isolate of natural products.
CO3	Student will be able to perform analysis of given samples using various analytical techniques.
CO4	Students will be able to perform analytical techniques.
CO5	Students will be able to isolate of natural products.

SANDIP UNIVERSITY