06000101 - ENGLISH COMMUNICATION AND LIFE SKILLS-I

Course	Master of Science (M.Sc.)	**Semester - 1**
Type of Course	Ability Enhancement Compulsory Course	
Prerequisite	-	
Course Objective	1. To provide an overview of Prerequisites to Communication. 2. To put in use the basic mechanics of Grammar. 3. To provide an outline to effective Organizational Communication. 4. To underline the nuances of Business communication.	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	Total Marks
Lecture	Tutorial	Lab	Credit	SEE	CIA		
3	-	0	3.00	70	30		100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**English grammar** • Parts of speech • Clauses • Formation of sentence • Tenses	13	25
2	**Business Communication** • Concept of business communication & business correspondences • Classification of communication – interpersonal, intrapersonal, Oral, written, non-verbal, etc. • Principles of effective writing • Introduction to business letters	15	25
3	**Introduction To Soft Skills** • Meaning, introduction to soft skills & hard skills • Interdependence and differences between soft skills & hard skills • Merits of possessing soft skills • Significant Soft skills and ways to develop Soft skills such as Time Management & Stress Management	8	25
4	**Presentation Skill** • Presentation styles • Structure and guideline for making a presentation • Common flaws and overcoming them • Body language and tips for giving a presentation & Presentation tips • Personality development • Interview Skills: Gestures, Body Languages, Pre-interview preparation, Do & Don't at Interview	9	25
	Total	30	100

Suggested Distrbution Of Theory Marks Using Bloom's Taxonomy				
Level	Remembrance	Understanding	Analyze	Create
Weightage	20	40	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Apply Verbal and Non-Verbal Communication Techniques in the Professional Environment
CO2	write correctly and properly with special reference to Letter writing
CO3	Prepare and present effective presentations aided by ICT tools
CO4	Contribute positively to the overall growth of the organization

Reference Books

1.	**High School English Grammar & Composition (TextBook) (TextBook)** Wren & Martin; Blackie
2.	**High School English Grammar & Composition (TextBook) (TextBook)** Wren Martin; Tata McGraw Hill
3.	**Learn English vocabulary at a Glance (TextBook) (TextBook)** Dr. RakeshBharadwaj; Evincepub Publishing
4.	**High School English Grammar & Composition (TextBook) (TextBook)** Wren & Martin; Blackie

06100101 - ORGANIC CHEMISTRY-I

Course	Master of Science (M.Sc.)	**Semester - 1**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	1. To provide the basic and advanced knowledge of very useful concepts of organic chemistry 2. To provide the basic knowledge of stability of reactive intermediate. 3. To understand the mechanisms involved in aliphatic Nucleophilic substitution reactions. 4. To understand the basic name reaction.	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				SEE		**Practical Marks**	**Total Marks**
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	50	
3	-	2	3.00	70	30		150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Reactive intermediate** Carbocations (classical and non-classical): stability, structure, generation and fate. Carbanions: stability, structure, generation and fate. Carbenes: stability and structure, the generation and fate. Free radicals: stability, structure, generation and fate. Nitrene: stability, structure, generation, reactions.	**12**	**30**
2	**Aromticity** Huckel's rule and concept of aromaticity**.** Aromaticity and aromatic character, Frost circle diagram for cyclo-butadiene, benzene and other examples Stabilization energy and delocalization energy examples.	**9**	**15**
3	**Molecular rearrangements** General mechanistic considerations, nature of migration of following Carbon to Carbon migration of R, H and Ar: Pinacol-Pinacolone rearrangement, Favorskii rearrangement Carbon to Nitrogen migrations: Curtius rearrangement ,Schmidt rearrangement Carbon to oxygen migration of Ar :Baeyer- villager rearrangement	**12**	**25**
4	**Organic Named Reactions** Robinson Annulations' reaction, Stork- Enamine reaction ,Gilman reaction, Diels-Alder reaction, Wittig reaction, Ene reaction, Shapiro reaction,Organolithiation reaction, Wilkinson catalyst.	**12**	**30**
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	15	15	20	20	20	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Able to recognize either molecule is aromatic, non-aromatic or antiaromatic
CO2	To know the impact of organic chemistry on the fields of medicine, pharmacy and its impact on the global economy.
CO3	To know how to do organic nomenclature and its symbolism and can learn also the fundamental principles offunctional group conversion and organic synthesis
CO4	Able to describe mechanism of different aliphatic Nucleophilic substitution reactions

Reference Books	
1.	**Advanced Organic Chemistry Part –B** F.A.Careyand R.J.Sundberg; Plenum Press
2.	**Advanced Organic Chemistry** March Jerry; Wiley Eastern Ltd. New Delhi (1985).; 4
3.	**Organic Chemistry** Morrison and Boyd; Pearson Publication

List of Practical	
1.	**Organic Preparation** Synthesis of Acetanilide from aniline.
2.	**Aspirin from salicylic acid**
3.	**1-azo-phenyl , 2-napthol from β-napthol.**
4.	**7-hydroxy-4methyl coumarin from resorcinol**
5.	**Methyl Salicylate from salicylic acid**
6.	**Iodoform from acetone**
7.	**Dibenzalacetone from Benzaldehyde**

List of Tutorial	
1.	**Assignment-1**
2.	**Assignment-2**

06100111 - ANALYTICAL CHEMISTRY-I

Course	Master of Science (M.Sc.)	**Semester – 1**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	• To understand the concept of the analytical chemistry(Sampling, Volumetric Method of Analysis, Gravimetric Analysis) • To provide the basic knowledge of Instruments. • To learn method of calibration and detection limits of instruments. • To learn the types of electrodes and their uses.	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**Practical Marks**	**Total Marks**
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		
3	-	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** – Weightage

Sr.	**Topics**	**T**	**W**
1	**Concept involved in Analysis and Statistics** Scope of analytical chemistry(dyes, drugs, forensic, agriculture, food and nutrition), classification of analytical methods-classical and instrumental, types of instrumental analysis, selecting analysis method, Accuracy, Precision, errors and its causes and way for minimization, absolute error, relative error, Standard deviation, relative standard deviation, mean median, laboratory operations and practices, good laboratory practices (GLP), Volumetric glassware-cleaning and calibration of glassware, sample preparation–dissolution, selecting and handling reagents, laboratory notebooks, safety in the analytical laboratory, calibration and detection limits.	**15**	**35**
2	**Sampling and Calibration Methods** Sampling and sample preparation, general steps in chemical analysis, calibration of glasswares. Finding the best straight line-least square regression, correlation coefficient; Calibration curves, standard addition technique and internal standards	**9**	**20**
3	**Volumetric Method of Analysis** Primary and Secondary standards, Principles of volumetric analysis, Acid–base titration. Titration in non-aqueous solvents, Complex metric titrations, Precipitation titrations (Mohr's titration, Volhard's titration, adsorption indicators, Fajan's titration), Redox titrations, Theoretical aspects of titration curves and end point evaluation, Choice and suitability of indicator sin each case.	**12**	**25**
4	**Instrumental analysis** pH metry (Principle of instrumentation and mechanism of pH by glass electrode), Potentiometry, Conductometry and types of electrodes and explanation of the nature of titration curves	**9**	**20**
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	15	15	25	25	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Students can learn the basic analytical and technical skills to work effectively in the various fields of chemistry
CO2	To know and understand the issues of safety regulations in the use of chemicals in their laboratory work
CO3	Student can understand the concept of sampling, calibration and cleaning of glassware's.
CO4	Able to find the dissociation constant and solubility product

Reference Books	
1.	**Quantitative Chemical Analysis Daniel C. Harris W.H. Freeman and Company** Daniel C. Harris
2.	**Instrumental Methods of Chemical Analysis Galen W. Ewing International Student Edition** Galen W. Ewing
3.	**Analytical Chemistry Gary D. Christian John Wiley and Sons Inc.** Gary D. Christian

List of Practical	
1.	**Determine Chloride by Mohr method.**
2.	**To determine total dissolve solid in water sample**
3.	**To determine hardness of water**
4.	**Estimation of binary mixture by EDTA. (Zn+2 & Mg+2)**
5.	**Estimation of binary mixture by EDTA. (Ca+2 & Mg+2)**
6.	**Determine Rf value by Thin layer chromatography(TLC)**

List of Tutorial	
1.	**Assignment-1**
2.	**Assignment-2**

06100131 - INORGANIC CHEMISTRY-I

Course	Master of Science (M.Sc.)	**Semester – 1**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	1. To provide the basic knowledge of Organo metallic compounds. 2. To understand the concept of Co-ordination compounds. 3. To understand how metal ions interact with biological environments. 4. To explain the concept of transition metal complex	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**Practical Marks**	**Total Marks**
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		
3	-	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** – Weightage

Sr.	**Topics**	**T**	**W**
1	**Organometallic Compounds** Introduction of OMC, Classification of OMC, Hepticity of OMC, Denticity of OMC,Application of OMC, Fluxonial ligand, 18e rule, Formal charge on Ligand ,electron contribution of organo metallic compounds, Clusters, Types of clusters, calculation of number of M-M bonds in clusters	**15**	**25**
2	**Co-ordination Compounds** Introduction of Co-ordination compounds, Werner's co-ordination theory and its experimental verification or evidences , effective atomic number concept, chelates, types of chelates, nomenclature of co-ordination compounds	**9**	**25**
3	**Bio-Inorganic chemistry** Essential and trace elements in Biological processes, metal Porphyrins with special references to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ones with special reference to Ca+2. Nitrogen fixation	**12**	**25**
4	**Electronic Spectra of metal complexes** Electronic spectra of transition metal complex, laporte orbital and spin selection rules. Original energy level diagram of d5 and combined diagrams of	**9**	**25**
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Analyze	Evaluate
Weightage	40	40	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Predict geometry and structure of different molecules
CO2	Differentiate bonding nature of different compounds.
CO3	Justify definitions of the terms inert and labile and state which d-electron configurations are associated with inertness.
CO4	To understand the current problem in bio-inorganic chemistry
CO5	Examine electronic spectra of various metal complexes

Reference Books	
1.	**Introduction to quantam chemistry (TextBook)** A. K. Chandra Tata McGraw-Hill
2.	**Molecular Quantum Mechanics (TextBook)** P. W. Atkins and R. S. Friedman Oxford University Pres
3.	**Qualitative Inorganic Analysis (TextBook)** (A.I VOGEL) Svehla / Sivasankar Pearson Education India

List of Practical	
1.	**Introduction of instruments and safety rules.**
2.	**By qualitative analysis find out positive and negative radicals present in your given inorganic compound- pb^(+2),Al^(+2),Mg^(@+2),Cl^-,N□O_3□^-,S□O^(-2)□_4**
3.	**By qualitative analysis find out positive and negative radicals present in your given inorganic compound- CO^(+2),K^+,Ni^(+2),S□O^(-2)□_4,Br^-,N□O_3□^-**
4.	**By qualitative analysis find out positive and negative radicals present in your given inorganic compound - Fe^(+3),Ca^(+2),K^+,Cl^-,Cr□O_4□^-,C□O^(-2)□_3**
5.	**By qualitative analysis find out positive and negative radicals present in your given inorganic compound- CO^(+2),Ca^(+2),C□r^+□_3,Cl^-,N□O_3□^-**
6.	**By qualitative analysis find out positive and negative radicals present in your given inorganic compound- K^+, Al^(+2),Zn^(+2),Cl^-,Br^-,S□O^(-2)□_4**
7.	**By qualitative analysis find out positive and negative radicals present in your given inorganic compound- Na^+,Cu^(+2),Ni^(+2),Br^-,Cl^-,S□O^(-2)□_4**
8.	**Gravimetric analysis of Nickel**
9.	**Gravimetric anlaysis of copper**
10.	**Gravimetric analysis of aluminium**

06100141 - PHYSICAL CHEMISTRY-I

Course	Master of Science (M.Sc.)	**Semester – 1**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	To provide the basic knowledge of very important concepts of the physical chemistry i.e (chemical thermodynamics, surface chemistry) To learn about the concept of phase and derivation of phase rule. To evaluate most probable distribution state for all type of statics i.e. for Maxwell- Boltzmann. To understand the concept of distribution and thermodynamic probability.	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	Total Marks
Lecture	Tutorial	Lab	Credit	SEE	CIA		
3	-	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** – Weightage

Sr.	Topics	T	W
1	**Chemical Thermodynamics** Nernst heat theorem and its applications to gaseous system, Third law of thermodynamics and its application to evaluating absolute entropies of solids, liquids, and gases; Partial molar quantities and their determination, Gibbs-Duhem equation, Gibbs Duhem-Margules equation and its application, Chemical potential and its applications, Activity and activity coefficients, Methods of determination of activity and activity coefficients, Concept of Fugacity and its determination methods. Examples.	13	30
2	**Chemical Dynamics** Unimolecular reaction (Lindeman's Theory),Chain reactions and branched chain reactions, Chain reaction between hydrogen and bromine, Transition State Theory, Reaction Kinetics of Thermal and Photochemical Hydrogen-Bromine Reaction, Kinetics of Fast Method reaction(Flow &Flash photolysis),Enzyme catalyzed reactions, mechanism kinetics, Examples.(Arrhenius Equation)	10	25
3	**Surface Chemistry** Physical and Chemical adsorption, Adsorption isotherms, Multi molecular Theory O R B.E.T. Adsorption Isotherm, Gibbs Asorption Equation, Surface active agent OR Surfactants, Micellisation, Critical Micellar Concentration(CMC)	12	25
4	**Electrochemistry** Debye-Hackle Theory (Mathematical Derivation), Thermodynamics of electrified interfaces Lipmann's Equation, Determination of dissociation constant of mono basic acids by conductometry and potentiometry, Gouy-ChapmanTheory, Polarization and Overvoltage, Bulter-Volmer equation, Principle of polarography, Equation of polarographic wave, Ilkovic equation.	10	20
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Analyze	Evaluate
Weightage	50	25	25

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may

vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	To calculate changes in kinetic, potential , enthalpy and internal energy.
CO2	To understand the concept of distribution and thermodynamic probabiillty
CO3	To iunderstand the suspensions and isolations from solutions
CO4	To identify the anode, cathode, direction of flow, sign of electrodes, and direction of ion flow in salt bridge , from a redox reaction

Reference Books	
1.	**The Elements of Physical Chemistry** P. Atkins
2.	**An Introduction to Chemical Thermodynamics** R. P. Rastogi and P. R. Misra
3.	**Instrumental analysis** Skoog,holler and crouch

List of Practical	
1.	Introduction of instruments and safety rules
2.	To find the partition co-efficient of between Water and Chloroform
3.	To study the kinetics of the reaction between and
4.	To determine dissociation constant of weak acid by titration method using meter
5.	To determine dissociation constant of strong acid by titration method using meter
6.	To determine dissociation constant of strong base by titration method using meter
7.	To determine solubility and solubility product of separating solution salts by Conductometry
8.	To determine the concentration of and in the given mixture using 0.1 N HCl conductometrically
9.	To determine the concentration of Fe in solution by colorimetry
10.	To determine the concentration of Fe in solution by colorimetry

06000201 - ENGLISH COMMUNICATION AND LIFE SKILLS - II

Course	Master of Science (M.Sc.)	**Semester – 2**
Type of Course	Ability Enhancement Compulsory Course	
Prerequisite	06000101-English Communication and Life Skills-I	
Course Objective	- To develop and integrate the use of the four language skills, i.e. reading, listening, speaking, writing. - To understand the uses and the basic Business vocabulary. - To understand the utilizations of several preparation for interviews. - To provide the knowledge of Critical Thinking and Decision-Making techniques for further work field.	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**Practical Marks**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	-	**Total Marks**
3	-	-	3.00	70	30		100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** – Weightage

Sr.	**Topics**	**T**	**W**
1	**Written communication** • Types of written communication • Terms related to Formal communication • Informal communication	**13**	**25**
2	**Vocabulary** • Understanding terms • Idioms	**10**	**25**
3	**Interview** • Types of Interview • Preparation before the interview • Do's and Don'ts of interview	**10**	**25**
4	**Critical Thinking and Decision Making** • Characteristics of critical thinker • How to make decisions • Decision making techniques	**12**	**25**
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze
Weightage	30	30	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Use English effectively for study purpose across the curriculum.
CO2	Communicate effectively and appropriately in real-life situation.
CO3	Demonstrate knowledge of personal beliefs and values and a commitment to continuing personal reflection.
CO4	Students will analyze and develop accurate sense of self Management
CO5	Students can make proper decision line according to the requirements and resources by their actualization.

Reference Books	
1.	**Learn English vocabulary at a Glance (TextBook)** Dr. RakeshBharadwaj; Evincepub Publishing
2.	**High School English Grammar & Composition (TextBook)** Wren & Martin; Blackie
3.	**High School English Grammar & Composition (TextBook)** Wren & Martin; Blackie
4.	**Learn English vocabulary at a Glance (TextBook)** Dr. Rakesh Bharadwaj; Dr. Rakesh Bharadwaj

06100201- ORGANIC CHEMISTRY-II

Course	Master of Science (M.Sc.)	**Semester - 2**
Type of Course	Core Course	
Prerequisite	06100101 - Organic Chemistry-I	
Course Objective	To use the skills for correct stereochemical assignment and interpretation in rather simple organic molecules To formulate mechanistic study of organic reactions and synthesis To define the basic concepts, classification and biological significance of vitamins and amino acids To classify the reaction in organic chemistry	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	-	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Retro Synthesis** An introduction to synthons and synthetic equivalents. Disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemo selectivity, reversal of polarity, cyclisation reaction, amine synthesis. Principle of protection of alcohol, amine, carbonyl and carboxyl groups.	12	25
2	**Photochemistry & Basic of Photochemistry** Absorption, excitation, photochemical laws, quantum yield, electronically excited states- life times-measurements of the times Franck-Condon principle and photochemical stages-primary and secondary processes. Interaction of electromagnetic radiation with matter.	9	25
3	**Green chemistry** Brief introduction, principles, green catalysts-acid catalyst, basic catalyst, oxidation catalysts, polymer supported catalysts, photo catalyst, green synthesis-phase transfer catalyst, green synthesis of polycarbonates, paracetamol, ibuprofen, citral, urethane, adipic acid and styrene.	12	25
4	**Heterocyclic chemistry** **Nomenclature of Hetero cycles: Replacement and systematic:** Nomenclature for monocyclic, fused and bridged hetero cycles. **Aromatic Hetero cycles and Heterocyclic Synthesis:** General chemical behavior of aromatic hetero cycles, Classification of heterocyclic compounds, Principles of heterocyclic synthesis involving cyclization reactions and reactivity and tautomerism of aromatic, heterocyclic compounds and their mechanism containing two heteroatoms.	12	25
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	25	25	10	15	15	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Attain the skills for correct stereochemical assignment and interpretation in rather simple organic molecules.
CO2	Formulate mechanistic study of organic reactions and synthesis
CO3	Understand the basic concepts, classification and biological significance of vitamins and amino acids
CO4	Rearrangement reaction in organic chemistry.

Reference Books	
1.	**Designing Organic Synthesis** S. Warren. Wiley
2.	**Advanced Organic Chemistry: Reactions, Mechanisms and Structure** J. March. Wiley
3.	**Fundamentals of photo chemistry** K.K. Rothagi-Mukheriji, Wiley-Eastern.

List of Practical	
1.	**Sepration and Qualitative analysis of the organic mixure (trinary mixure)** **Benzoic acid , 2-Nephthol and Acetanilide.**
2.	**Separation and Qualitative analysis of the organic mixture (trinary mixture)** **Napthalene, p-Nitro Aniline, Oxalic acid**
3.	**Separation and Qualitative analysis of the organic mixture (trinary mixture)** 4-Nitro Benzoic Acid, 2-Nephthol, 4-chloroaniline
4.	**Separation and Qualitative analysis of the organic mixture (trinary mixture)** Cinnamic acid, 4-Chloroaniline and 4-Nitro Phenol
5.	**Separation and Qualitative analysis of the organic mixture (trinary mixture)** Thiourea, Phthelic acid and 2-Nitro Phenol
6.	**Separation and Qualitative analysis of the organic mixture (trinary mixture)** Methanol, Chlorobenzene and Aniline

06100231- PHYSICAL CHEMISTRY-II

Course	Master of Science (M.Sc.)	**Semester - 2**
Type of Course	Core Course	
Prerequisite	06100141 - Physical Chemistry-I	
Course Objective	• To provide the concept of Compare the penetrating power of alpha, beta, neutron, and gamma radiation. • To give the knowledge of the four major classes of macromolecules. • To acquire working knowledge of the zero and first law of thermodynamics. • To provide chemical and physical bonds, influence of the bonds on properties.	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**Practical Marks**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	-	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Nuclear Chemistry** Nuclear properties-nuclear radius, liquid drop model, magnetic moment, nuclear binding energy, nuclear models-shell model, Fermi gas model, collective model, radioactive decay, nuclear reactions, evaporation, fragmentation, fission and fusion reactions, accelarators, reaction cross section, use of radioisotopes as tracers.	**12**	**25**
2	**Macromolecules** Kinetics and Mechanism of Polymerisation, Molecular weight of Macromolecules (Number average and weight average Molecular weight), Methods of determining molecular weight of polymers, Properties of polymers and applications, Examples	**9**	**20**
3	**Statistical Thermodynamics** Concepts of distribution of molecules, thermodynamic probability, permutations and combinations, Boltzmann's most probable distribution, partition function- translational, vibrational, rotational, electronic nuclear partition functions, calculation of thermodynamics, properties in terms of partition function, Internal energy, Examples	**12**	**25**
4	**Solid State Chemistry** Bonding in solids and electronic structure in solids, bond theory of metals semiconductors and insulators, defects in crystals, calculation of schotky and Frenkel defects using statistical method, non-stoichiometry, solid electrolytes, diffusion in solids, electrical conductivity in solids, super conductivity.	**9**	**30**
	Total	**42**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Analyze	Evaluate
Weightage	30	30	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Use proper isotopic notation to write down and balance a nuclear reaction.
CO2	Experiment the basis of biological macromolecules' constitution and traits
CO3	Analyse the physical interpretation of distribution functions and discuss and show how these can be used in calculations of basic thermodynamic properties.
CO4	Provide the basic methods for characterization of solid matter

Reference Books	
1.	**Essentials of Physical chemistry Bahl Arun and Tuli S Chand, 2012 (TextBook)** Bahl Arun and Tuli S Chand
2.	**Essentials of Physical chemistry Bahl Arun and Tuli S Chand, 2012 (TextBook)** Bahl Arun and Tuli S Chand
3.	**The Elements of Physical Chemistry (TextBook)** P. Atkins

List of Practical	
1.	**To determine the strength of strong acid & weak acid in a given mixture using pH-meter.**
2.	**To determine the vinyl alcohol by viscosity measurement.**
3.	**Determine the distribution co-efficient of organic liquid such as ccl_4 & water etc.**
4.	**Rate constant of hydrolysis of ester (methyl acet.) energy activation reaction.**
5.	**Kinetics of Saponification ethyl ester by NaOH.**
6.	**To determine the strength of S.A & W.A using Potentiometry.**
7.	**To determine the strength of S.A & W.A by Conductometry.**
8.	**To determine conc. Of nitrite in given solution to use of colourimeter.**
9.	**To determine the Conc. Of KCl & the solubility product of AgCl (Potentiometry).**

06100241- INORGANIC CHEMISTRY-II

Course	Master of Science (M.Sc.)	**Semester - 2**
Type of Course	Core Course	
Prerequisite	06100131 - Inorganic Chemistry-I	
Course Objective	• To study about the different types of substitution reactions & also about the mechanism of reactions of Transition metal complexes • To understand about the different theories of bonding in metal complexes and application • To Characterization techniques are central to synthesis of inorganic molecules • To understand the concept of d-configuration.	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	-	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Mossbauer Spectroscopy** Basic applications of Mossbauer spectroscopy, hyperfine structure, quadruple splitting, instrumentation and applications of Mossbauer spectroscopy, problems related to Mossbauer spectra.	9	25
2	**Organometallic compounds-II** Catalytic Aspects, Biological Applications and Environmental Aspects of Oregano metallic Compounds -Introduction , Synthetic & Catalytic Aspects of OMC ,Synthetic Applications of Main Groups of Organ metallic Compounds -Organ metallic In Medicines -Organ metallic compounds In Agriculture and Horticulture -Organ metallic In Industry -Environmental Aspects of Organometallic Compounds	25	30
3	**d1-d9 spectra** Selection rule for transition, factor affecting an electronic spectrum, or gel diagram with example d1-d9, d2-d8, d3-d7, d4-d6, tanabe -surgeon diagram (d2), whole formalism	9	25
4	**Reaction mechanism of transition metal complexes** Reactivity of metal complexes , Kinetic application of VBT and CFT, Kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, Substitution reaction in square planar complexes, Out sphere type reaction, Cross reactions and Marcus-hush theory, Inner sphere type reactions.	12	25
	Total	55	105

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Application	Analyze	Evaluate	Create
Weightage	30	20	30	5	5

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Analyze data obtained from sophisticated equipments (MS) for structure elucidation and chemical analysis
CO2	Use the basic principles of descriptive chemistry and molecular orbital theory to describe chemical bonding and structure of organometallic compounds
CO3	Predict the chemical behavior and reactivity of organometallic compounds
CO4	Study the electronic spectrum and gel diagrams.
CO5	Acquire knowledge about the formation of complexes in solutions and their stability factors effecting the stability and HSAB principle

Reference Books	
1.	**Qualitative Inorganic Analysis(A.I VOGEL) Svehla / Sivasankar Pearson Education India (TextBook)** (A.I VOGEL) Svehla / Sivasankar Pearson Education India
2.	**Inorganic Pharmaceutical Chemistry (TextBook)** Anand & Chatwal; Himalaya Pub. House
3.	**Industrial Inorganic Chemicals: Production and Uses Edited by R. Thompson (TextBook)**

List of Practical	
1.	**Preparation of tetra-amine cupric sulphate Cu(II) from copper sulphate.**
2.	**Preparation of Tris(thiourea)Cu[3(CS(NH_2)_2]_2 SO_4.2H_2 O**
3.	**Preparation of Cis potassium oli oxalate diaques Cromate(III).**
4.	**Preparation of Hexamine nickel(II) chloride.**
5.	**Preparation Trans K[Cr(C_2 O_4).(H_2 O)_2].2H_2 O.**
6.	**To preparation of tris(acetylactonato)mangenes(III) Complex .**

06050211- ANALYTICAL CHEMISTRY-II

Course	Master of Science (M.Sc.)	**Semester - 2**
Type of Course	Core Course	
Prerequisite	06100111 - Analytical Chemistry-I	
Course Objective	• To understand structure of different compounds. • To give participants a deep knowledge of how particularly high resolution in IR used in Organic Chemistry • To give a practical knowledge to infrared (IR), ultraviolet (UV) spectroscopy, MS and NMR spectroscopy. • To understand the separation method.	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**Practical Marks**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
3	-	2	4.00	70	30	50	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Fundamentals of Spectrophotometer and UV-Visible Spectroscopy** Properties of light, absorption of light, interaction of light with matter and origin of spectra. Instrumentation of UV-Visible spectroscopy, Double beam and single beam instrumentation, The spectrophotometer-calibration, sources of light, mono chromators and =detectors. Beer's law in chemical analysis.	**15**	**25**
2	**Fundamentals of NMR Spectroscopy** Principal, basic of NMR (Peak hight, Peak signal, Chemical shift) instrumentation and applications of NMR, Criteria for a compound to be NMR active. Shielding- deshilding, splitting, TMS. Resolution and multiplicity	**9**	**25**
3	**Fundamental of IR Spectroscopy** Introduction, Principle, Types of vibrations: stretching and bending, Instrumentation, Adsorption of common functional groups, Application.	**12**	**20**
4	**Fundamentals of Chromatography** Introduction of chromatography, Types of chromatography, Principle of separation: Adsorption, Size exclusion, Ion exchange, partition, Affinity, mode of chromatography	**9**	**30**
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Application	Analyze	Evaluate
Weightage	30	20	30	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Students should have the ability to explain common terms in NMR spectroscopy such as chemical shift, coupling constant and anisotropy and describe how they are affected by molecular structure
CO2	Students are skilled to perform the most commonly used NMR experiments and to interpret and document their results.
CO3	Students are skilled to perform the most commonly used UV-VIS experiments and to interpret and document their results
CO4	have acquired some technical knowledge of, and some practical experience with, analyses in gas and liquid chromatography

Reference Books	
1.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,
2.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,
3.	**Analytical Chemistry Gary D. Christian John Wiley and Sons Inc. (TextBook)** Gary D. Christian

List of Practical	
1.	**Dissolve oxygen (winkler's) Iodometric method.**
2.	**Binary mixture Ca^(+2)& Mg^(+2).**
3.	**Estimation of Zn^(+2)&Mg^(+2).**
4.	**Find out the Saponification value of oil sample.**
5.	**Find out acid value of given oil sample.**
6.	**Find out ester value.**
7.	**Estimation of paracetamol by using colorimetry instrument.**
8.	**Numerical related to (IR, NMR, Mass, CMR)**

06100301- ORGANIC CHEMISTRY-III

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Discipline Specific Elective Course	
Prerequisite	06100101- Organic Chemistry-I	
Course Objective	1 To extend student's knowledge of synthetic organic chemistry 2 Conservation of orbital symmetry and what conrotatory and disrotatory mean 3 Distinguish net reactions from elementary reactions (steps) 4 To understand the concept of rearrangement reaction	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	Total Marks
Lecture	Tutorial	Lab	Credit	SEE	CIA	-	
4	-	-	4.00	70	30		100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**One Group C-C Disconnections** Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic Nitro compounds in organic synthesis	12	25
2	**Two Group C-C Disconnections** Diels-Alder Reaction, 1,3-difunctionalised compounds, α,β-unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds. Micheal addition and Robinson annulation	9	25
3	**Pericyclic Reactions** Pericyclic reactions, stereochemistry of pericyclic reaction, conservation of molecular orbital symmetry, electrocyclic reactions, cycloaddition, sigmatropic rearrangements, Mobius–Huckel analysis (PMO approach), correlation diagram method	12	25
4	**Reaction, mechanism and applications of Following Rearrangements** Beckmann Rearrangement, Benzilic Acid Rearrangement, Claisen Rearrangement, Fries Rearrangement, Dienone-phenol Rearrangement, Wagner Meerwin Rearrangement	9	25
	Total	42	100

Course Outcomes

At the end of this course, students will be able to:	
CO1	Ability to apply such knowledge and understanding to the solution of problems related to the synthesis of organic target molecules
CO2	Ability to demonstrate knowledge and understanding of essential facts, concepts, principles and theories relating to retrosynthetic analysis
CO3	Derive mechanism of a reaction
CO4	Analyze target compounds by retrosynthetic strategy to devise suitable anionic, cationic and radical synthons
CO5	Explain Rearrangement reaction

Reference Books	
1.	**Designing Organic Synthesis** S. Warren. Wiley
2.	**Advanced Organic Chemistry: Reactions, Mechanisms and Structure** J. March. Wiley
3.	**Some Modern Methods of Organic Synthesis.** W. carruthers,; Cambridge Univ.

06100302- ORGANIC CHEMISTRY-IV

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Discipline Specific Elective Course	
Prerequisite	06100241- Inorganic Chemistry-II	
Course Objective	1 To provide the basic and advanced knowledge of very useful concepts of Advanced Medicinal Chemistry 2 To understand the process of drug discovery and development 3 To provide the knowledge of computational methods used in drug discovery 4 To understand the current antibiotic discovery.	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
4	-	-	4.00	70	30		100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Medicinal Chemistry** History of Medicinal Chemistry, Important Terminology used in Medicinal Chemistry (Drug, Pharmaceutical chemistry, pharmacy, pharmacognocy, pharmacology, pharmacokinetics, pharmacodynamics, Toxicity, pharmacopeia, antimetabolite, bacteria, virus, fungi, vaccine, therapeutic index), Classification of Drugs(on the basis of Structure & Pharmacological effect) , Various routes of Drug Administration, Concept of Pro Drug, Soft Drug and Hard Drug	**15**	**30**
2	**Drug Design & Development** Lead discovery and lead Modification, QSAR, Physiochemical parameters[Lipophilicity (Hansch equation), Electronic parameters(The Hammett equation), Steric parameters(Taft equation)], Bio-isosterism	**9**	**20**
3	**Pharmacokinetics** Drug absorption, Drug distribution, drug metabolism, Drug elimination, Important pharmacokinetic parameters in defining drug disposition, Usages of pharmacokinetics in drug development process.	**9**	**25**
4	**Antibiotics** Broad classification of Antibiotics, **β-lactam antibiotics**: penicillin, Classification (early, resistant, broad spectrum, adverse effects of penicillins. SAR of penicillin, Synthesis: ampicillin, pivampicillins, **cephalosporins**: Classification and SAR Synthesis: cephalexin, 7- amino cephalosporonic acid	**12**	**25**
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	25	25	15	15	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Students can understand the historical and advance concept of medicinal chemistry and it's advantages
CO2	Describe the process of drug discovery and development
CO3	Gain a basic knowledge of computational methods used in drug discovery
CO4	Demonstrate their ability to work in teams and communicate scientific information effectively
CO5	Distinguish Knowledge of Anti-biotics

Reference Books	
1.	**Designing Organic Synthesis** S. Warren. Wiley
2.	**Advanced Organic Chemistry** March Jerry; Wiley Eastern Ltd. New Delhi (1985).; 4
3.	**Fundamentals of photo chemistry** K.K. Rothagi-Mukheriji, Wiley-Eastern.

06100303- ORGANIC CHEMISTRY-V

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	Introduction of major problems in indoor air pollution and control, regulations Outcomes Give recent statistics of indoor Water Pollutants To understand both soil and agriculture which are two facets of valuable resource necessary for our sustenance To facilitate the integration of courses in radiation protection and the safety of radiation sources into the curricula of educational institutions in Member States and to achieve both consistency and a common level in the technical content of such courses	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	Tutorial	Lab	Credit	SEE	CIA		Total Marks
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Air Pollution** Introduction/origin, Environmental Pollution disasters, Classification of pollutants. Air pollution, Composition of air, Chemical reaction in air due to sun light, Reactions in Troposphere, Stratosphere and mesosphere. Smog formation in air. Major sources of air pollution	15	25
2	**Water Pollutants And Their Properties** Introduction, Sources of water, Chemistry of water, Definition of water pollution, Types of water pollution including main point, Types of water pollution (four types), Types of water pollution based on sources and storages (Five types). Ground water pollution, Factor affecting the ground water pollution,	9	25
3	**Soil Pollution** Introduction, Importance and formation of soil, Composition of soil, Salt affected to soil, Sources of soil pollution, Soil erosion and its types, Agents of soil erosion, Mechanism of soil erosion, Factors affecting to soil erosion	9	25
4	**Radioactive Pollution** Introduction, How radioactive pollution differs from other pollution. Types and unit of radiation, Radiation chemistry, Interaction of ionising radiation with matter, Principal Types of radiation	9	25
	Total	42	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	30	30	10	10	20	0

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	1. Learn the environment functions and how it is affected by human activities
CO2	2. Evaluate by applying numerical and statistical methods
CO3	3. Understand the issues more visible and solve problems, particularly in relation to environmental problems and metal production
CO4	4. Recognize and describe the impact of soil pollution on the environment

Reference Books	
1.	**Environmental studies S.V.S Rana** S.V.S Rana
2.	**The Environment (Protection) Act, 1986**
3.	**The Handbook of Environmental Chemistry** S. Agbo et al.; Springer Heidelberg Dordrecht London New York

06100304-ORGANIC CHEMISTRY-VI

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	1 To provide the basic knowledge of Research & Methodology 2 To Learn about the main types of probability and non-probability sample designs 3 To familiarize participants with basic of research and the research process 4 To provide a basic understanding of data analysis using statistics and to use computational tools on problems of applied nature	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	-	**Total Marks**
4	-	-	4.00	70	30		100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Sample Designing** Census and sample survey, Implications of a sample design. Steps in Sampling design, Criteria of selecting a sampling procedure, Characteristics of good sample design. Different types of sample design, Random sample from an infinite universe.	15	25
2	**Measurement and scaling techniques** Measurement in research, Measurement research, Measurement scales, Sources of error in measurement, tests of sound measurement, technique of developing Measurement tools, Scaling, meaning of scaling, Scale classification bases, Important Scaling techniques, Scale construction techniques	9	25
3	**Methods Of Data Collection** Collection of primary data, observation method, Interview method, Collection of data through Questionnaires, Collection of data through schedules, collection of secondary data, selection of appropriate method for data collection12	12	25
4	**Processing and Data Analysis** Processing operations, statistics in research, measures of dispersion, measures of asymmetry, measures of relationship, Simple regression analysis, Multiple correlation and regression, Partial Correlation, Association in case of Attributes, Other measures.	9	25
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Application	Analyze	Evaluate	Create
Weightage	10	20	30	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	1. Categorizes and defines the sampling methods
CO2	Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling
CO3	3. Learn the methods to collect research data through different methods. Also understand role of computer in research
CO4	4. Gain the knowledge of processing data and understand the guidelines of thesis writing.
CO5	Evaluate Research data

Reference Books	
1.	**Research Methodology** C. R. Kothari; New Age International Publishers
2.	**Research Methodology** D K Bhattacharya; Excel Books, New Delhi.

06100305-ORGANIC CHEMISTRY PRACTICAL

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	-	
Prerequisite	-	
Course Objective	To prepare standard solutions To know about the Use of burettes, pipettes and other glass apparatus To know about the estimation of amount of unknown sample and the number of functional groups in an unknown organic compound. To develops the isolation techniques for organic molecules from their sources To understand the concept of chromatography	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	Tutorial	Lab	Credit				Total Marks
-	-	16	8.00			200	200

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** – Weightage

Sr.	Topics	T	W
1	**Organic Chemistry Practical SEM III**	**16**	**100**
	List of Practical: Organic Separation 1. **Salicylic acid, resorcinol,Benzamine** 2. **Succinic acid, O-nitro aniline, acetanilide** 3. **Acetone, Toluene, Benzaldehyde** 4. **Benzoic acid,chloro-form,Nitrobenzene** 5. **Succinic acid, B-napthol, Acetanilide** 6. **Thiourea, Benzoic acid, P-toludine.** **ORGANIC PREPARATION** 1. **To prepare anthranilic acid from phthalic acid** 2. **To prepare Organge-II from sulphanilic acid** 3. **To prepare eosine from phthalic acid** 4. **To prepare sulphanilic acid from aniline.** **Estimation** 1. **% Purity of the given sample Vit.C** **% Purity of the given sample glycine**		
	Total	**16**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	10	20	30	20	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Know calibration of pipettes and burettes, preparation of standard solutions
CO2	Understand the concept of titrimetric quantitative estimations
CO3	Prepare standard solutions
CO4	Develops the extraction techniques for organic molecules from plant materials.
CO5	Develops the separation techniques for a mixture of organic molecules and drug materials through chromatographic technique.

Reference Books	
1.	**Practical Organic Chemistry (TextBook)** Frederick George Mann, Bernard Charles Saunders; Longman
2.	**Practical Organic Chemistry (TextBook)** Frederick George Mann, Bernard Charles Saunders; Longman
3.	**Advanced Practical organic chemistry (TextBook)** N. K. Vishnoi; Vikas Publishing House,

List of Practical	
1.	**Organic Separation** **Salicylic acid, resorcinol,Benzamine**
2.	**Organic Separation** **Succinic acid, O-nitro aniline, acetanilide**
3.	**Organic Separation** **Acetone, Toluene, Benzaldehyde**
4.	**Organic Separation** **Benzoic acid, chloro-form, Nitrobenzene**
5.	**Organic Separation** **Succinic acid, B-napthol, Acetanilide**
6.	**Organic Separation** **Thiourea, Benzoic acid, P-toludine.**
7.	**ORGANIC PREPARATION** **To prepare anthranilic acid from phthalic acid**
8.	**ORGANIC PREPARATION** **To prepare Organge-II from sulphanilic acid**
9.	**Organic Preparation** **To prepare eosine from phthalic acid**
10.	**Organic Preparation** **To prepare sulphanilic acid from aniline.**
11.	**Estimation** **% Purity of the given sample Vit.C**

12.	**Estimation** **% Purity of the given sample glycine**

06100321-FUNDAMENTALS OF INDUSTRIAL CHEMISTRY

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	1. The aim of this course is to make students aware of different industrial processes in detail 2. This course is basically designed to understand the chemistry of the industrial processes like Purification techniques, handling of important gases, acids, bases, pollutants, Industrial effluent and water treatment 3. The analytical approach of this course is to enhance the reasoning and to understand the mechanical part of the industry 4. The aim of this course is that the students will learn the conventional and latest techniques used in the abatement of environmental pollution (air, water and industrial effluents).	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**Practical Marks**	**Total Marks**
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**	-	
4	-	-	4.00	70	30		100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Chemical Technology Basic principles of distillation** Solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry	**15**	**30**
2	**Industrial Gases and Inorganic Chemicals** (a) Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene. (b) Inorganic Chemicals: Industrial preparation with the help of flowchart, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate	**15**	**35**
3	**Environment** 1. a) Air Pollution: Pollutants and their sources, pollution by SO2, CO2, CO, NOx, H2S and other foul smelling gases. Methods of estimation of CO, NOx, SOx and their control procedures. Green house effect and global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and halogens, Removal of sulphur from coal. Particulate matter and its types. (b) Water pollution and Water Quality Standards: Pollutants and their sources, Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluent from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petro chemicals, agrochemicals, fertilizer. Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.	**15**	**35**
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy				
Level	Remembrance	Understanding	Analyze	Create
Weightage	20	20	40	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Analyze various purification techniques used in industries like distillation, absorption, adsorption and solvent extraction
CO2	Explain the production, storage and handling of important gases like-oxygen, argon, helium, hydrogen and acetylene
CO3	Develop efficacy in preparation of frequently used inorganic chemicals like acids, bases, oxidizing and disinfecting chemicals
CO4	Reframe the qualitative and quantitative measurements of water treatment, conservation and handling of industrial effluent
CO5	Analyze major causes of air pollution, its control and the alarming problems of global warming

Reference Books

1.	**Stocchi, E.(1990), Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK (TextBook)** Ellis Horwood Ltd. UK
2.	**Kent, J. A. (ed) (1997), Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi) (TextBook)** Kent J A
3.	**Pani, B. (2017), Textbook of Environmental Chemistry, I.K.International Publishing House (TextBook)** Pani,B.
4.	**De, A. K. (2012), Environmental Chemistry, New Age International Pvt, Ltd, New Delhi (TextBook)** De, A.K.
5.	**Chemical Technology: From Principles to Products, 2nd Edition**
6.	**Industrial Inorganic Chemicals: Production and Uses Edited by R. Thompson**

06100322-INDUSTRIAL SPECTROSCOPIC TECHNIQUES

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Discipline Specific Elective Course	
Prerequisite	-	
Course Objective	1. Spectroscopic methods of analysis 2. Atomic spectroscopy types and its applications 3. 1H NMR instrumentation and its applications	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
4	-	-	4.00	70	30		100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**An introduction to Spectroscopic Methods of Analysis** **Chromatography:** Classification, theories of chromatographic methods, principles and methods of chromatographic separation by paper, TLC, preparative TLC, HPTLC, column, HPLC, gas chromatography and ion-exchange chromatography. Instrumentation of HPLC and GC, types of columns and detectors for GC, Applications of chromatographic methods, an introduction to GC-MS, LC-MS technique.	15	30
2	**Atomic Absorption Spectroscopy (AAS)** Introduction, principle, instrumentation, detection limits, sensitivity, interferences, comparison of AAS with flame photometry, applications. **Fluorescence and Phosphorescence**: Basic principles filter fluorometer and double beam monochromator instruments, working, analysis of rare earths, pharmaceuticals, optical brightness, ultra trace analysis, new materials.	15	25
3	**Mass Spectrometry** Introduction, Ion formation, Mass spectral fragmentation of organic molecules, Mac-Lafferty, rearrangement of isotope ions, nitrogen rule the moss spectral fragmentation of organic molecule for structure determination. **Mössbauer Spectroscopy:** Introduction, principle, Mössbauer nuclides, parameters required for evaluation, instrumentation, applications.	15	20
4	**1H NMR Spectroscopy** Principle, Instrumentation, Factors affecting chemical shift (Electronegativity, Anisotropy, etc.), Spin-spin coupling, Coupling constant Applications: Deuterium exchange, effect of restricted rotation (e.g. DMF), identification of simple organic compounds using 1H NMR spectra along with IR spectral data	8	25
	Total	**53**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Application	Evaluate	Create
Weightage	40	20	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Explain the different types of spectroscopic methods of analysis
CO2	Designing of standard and blank solutions
CO3	Differentiate the calibration of Various instruments
CO4	Explain the instrumentation and the applications of the UV- Visible, Atomic, IR, 1H NMR spectrometry
CO5	Apply the knowledge of various spectroscopic techniques for the structure determination

Reference Books	
1.	**Kemp, W. (1991), Organic Spectroscopy, Palgrave Macmillan (TextBook)** Kemp, W. (1991),
2.	**Dyer, J.R.(1978),Applications of Absorption Spectroscopy of Organic Compounds, Prentice Hall (TextBook)** Dyer, J.R.(1978),
3.	**Banwell, C.N. (2006),Fundamentals of Molecular Spectroscopy,Tata McGraw-Hill Education (TextBook)** Banwell, C.N. (2006)
4.	**Chromatography: Concepts and Contrasts Author(s): James M. Miller** James M. Miller
5.	**Atomic Absorption Spectrometry ; Author(s):. Dr. Bernhard Welz, Dr. Michael Sperling** Dr. Bernhard Welz, Dr. Michael Sperling
6.	**Interpretation of Mass Spectra by Fred W. McLafferty, Frantisek Turecek (Contributor), John Choi (Illustrator)** W. McLafferty, Frantisek Turecek (Contributor), John Choi (Illustrator)

06100323-SYNTHETIC DYES AND POLYMER CHEMISTRY

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	1. The primary objective of this paper is to help the student to know about the synthesis. 2. The Properties and applications of polymers and Industrial Dyes. 3. Understand the basics behind the coloring agents and brighteners 4. Know the various applications of polymers	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**Practical Marks**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
4	-	-	4.00	70	30		100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Introduction & Near Infrared Absorption (NIR) dyes:** Important Chemical chromophores of dyes. Classification of dyes. Description of individual class and principle applications of each class. **Near Infrared Absorption (NIR) dyes** Introduction, Cyanine type chromophores, donor-acceptor chromophores, applications	**15**	**30**
2	**Synthesis of functional dyes Fluorescent brightening agents** Molecular orbital design. Characteristics and synthesis of functional dyes for electro-optical applications. Characteristics of brightening agents and its applications	**9**	**25**
3	**Industrial Polymers** **A. Basic Concepts of Polymers** History, Trends, and General Polymer Background, Concept of functionality and reactivity, Degree of polymerization. **B. Techniques of Polymerization** Bulk, Solution, Emulsion, Suspension and Interfacial polymerization, addition, condensation, mechanism of polymerization – free radical, ionic (anionic and cationic), co-ordination polymerization, initiators, inhibitors.	**12**	**20**
4	**General Chemistry, Technology of Production, Properties and Applications of Chain growth polymers**	**12**	**25**

	a. Polyethylene (HDPE, MDPE, LDPE, LLDPE, UHMWPE, chlorinated PE), b. Polypropylene (PP) c. Polyisobutylene (PIB) d. Acrylics (PMMA & PAN) e. Polyvinyles (PVC, PVDC & CPVC) f. Polystyrene & copolymer (HIPS, SBR, SAN & ABS) g. Poly(vinyl acetate)		
		Total	**48**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy					
Level	Understanding	Application	Analyze	Evaluate	Create
Weightage	20	20	20	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Classify dyes based on the functional groups
CO2	Explain Fluorescent brightening agents
CO3	Differentiate polymeric materials and their history
CO4	Apply different mechanisms of polymerization and polymerization techniques
CO5	Compare between polymers and copolymers

Reference Books

1.	**S.V.S Rana, Colour Chemistry: Synthesis, properties and applications of organic dyes and pigments (TextBook)**
2.	**S.V.S Rana, Colour Chemistry: Synthesis, properties and applications of organic dyes and pigments A.T. Peters and H. S. Freeman, Springer Netherlands (TextBook)**
3.	**Poly. Synthesis - Stanley R. Sandler, Wolf Karo, Vol. 1, Academic Press, Inc., California, 1994 (TextBook)**

06100324-PROCESS DEVELOPMENT IN CHEMICAL INDUSTRIES

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Discipline Specific Elective Course	
Prerequisite	-	
Course Objective	1. The course covers the chemical process industries 2. Manufacturing of various chemicals 3. Fermentation and vulture development of various micro-organisms 4. Awareness of electro -thermal industries among the students	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**Practical Marks**	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
4	-	-	4.00	70	30		100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Overview of Chemical Industries** Introduction, classification of chemical industries, material of construction, process instrumentation, safety, fire protection and waste disposal	**10**	**25**
2	**Acid industries** Manufacture, history ,properties and uses of acetic acid, formic acid, benzoic acid, phthalic acid and oxalic acid **Fermentation industries** Introduction, culture development, inoculums preparation, nutrients for microorganism, toxic effects on culture. Manufacture, properties and uses of Industrial alcohol, absolute alcohol, butyl alcohol, glycerol, ethylene glycol and propylene glycol	**15**	**25**
3	**Industrial sodium compounds** Manufacture, properties and uses of sodium thiosulfate, sodium bromide, sodium sulfate and sodium sulfite **Halogens and chlorinated compounds** Introduction, manufacture, properties and uses of fluorine, bromine, iodine, chlorine, methyl chloride, dichloromethane, chloroform and carbon tetrachloride	**15**	**25**
4	**Electro-thermal industries** Introduction, classification and advantages of electric furnace. Manufacture of silicon carbide, calcium carbide, graphite and carbon electrodes **Industrial solvents** Synthesis and properties of dimethylformamide (DMF),dimethyl sulfoxide (DMSO), tetrahydrofuran, dimethyl ether and diethyl ether	**10**	**25**
	Total	**50**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Analyze	Evaluate	Create
Weightage	20	20	20	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Explain the synthesis, industrial manufacturing and safety of various compounds
CO2	Explain the synthesis, industrial manufacturing and safety of various compounds
CO3	Summaries the process of fermentation and its products
CO4	Analyze Various applications of industrial sodium compounds, halogens and chlorinated compounds and industrial solvents
CO5	Distinguish the electro-thermal industries with chemical industries and introduction of various furnaces

Reference Books	
1.	**R1: - Industrial Chemistry: Being a Series of Volumes Giving a Comprehensive Survey of the Chemical Industries**
2.	**:- Chemistry, Process Design, and Safety for the Nitration Industry Editor(s): Thomas L. Guggenheim1**
3.	**The 100 Most Important Chemical Compounds: A Reference Guide Richard L. Myers**
4.	**Industrial microbiology by A.H.Patel (TextBook)**

06100325-INDUSTRIAL CHEMISTRY PRACTICAL

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	-	
Prerequisite	-	
Course Objective	-	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	Tutorial	Lab	Credit	SEE	CIA		Total Marks
-	-	12	6.00	-	-	150	150

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

List of Practical	
1.	**Determination of dissolved oxygen in water.**
2.	**Determination of Chemical Oxygen Demand (COD)**
3.	**Determination of Biological Oxygen Demand (BOD)**
4.	**Percentage of available chlorine in bleaching powder**
5.	**Measurement of chloride, sulphate and salinity of water samples by simple titration method. (AgNO3 and potassium chromate)**
6.	**Estimation of total alkalinity of water samples (CO32-, HCO3-) using double titration method.**
7.	**Isolation of compound using solvent extraction method**
8.	**Verification of Lambert-Beer's law using UV-Vis spectrophotometer for CuSO4 solution**
9.	**Determination of Acidity of water sample**
10.	**Determination of Acidity of water sample**

06100326 - PROJECT WORK / INTERNSHIP (PW)

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Project Work	
Prerequisite	-	
Course Objective	To train students to conduct independent studies on a topic of relevance and deliver a seminar To choose a topic of relevance and conduct an independent study. To submit a report and present the same	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	SEE	CIA			Total Marks
-	-	4	2.00	-	-	50	-	50

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Selection of industry/Organisation** Choose a relevant industry/business organisation/research organisation/ University		
2	**Internship** Undergo internship		
3	**Making Report** Prepare a scientific report and give a presentation on the same topic		
	Total		

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Application	Analyze	Evaluate	Create
Weightage	30	20	30	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Write a report on experiences during internship
CO2	Make a presentation to a panel of examiners

Reference Books

1. **Research methodology (TextBook)**
   Kothari C R; NAIP; 2, 2004
2. **How to research (TextBook)**
   Blaxter Loraine; Viva book; 2nd, 2002

List of Practical

06100311-ANALYTICAL CHEMISTRY-III

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Discipline Specific Elective Course	
Prerequisite	-	
Course Objective	To investigate the mixtures and spectroscopic methods To understand the concepts of solute, solvent, compound, element, and mixture based on their chemical and physical properties. To Define Fundamentals of Mass Spectrometry To learn the analysis of metals in solution using spectroscopic technique by Flame adsorption To learn the concept of emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation.	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	Tutorial	Lab	Credit	SEE	CIAs		Total Marks
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Atomic Absorption Spectrometry** Introduction, Basic Principles, Instrumentation, Interferences, Techniques for Quantification of Elements, Recent Developments, Applications	12	25
2	**ICP (Inductive coupled Plasma)** ICP-AES, ICP-MS, Operation and Applications	9	20
3	**MASS Spectroscopy** Theory, instrumentation and modifications; Unit mass and molecular ions; Important terms-singly and doubly charged ions, meta stable peak, base peak, is otropic mass peaks, relative intensity, etc.; Recognition of M+ion peak; General fragmentation rules: Fragmentation of various classes of organic molecules, including compounds containing oxygen, sulphur, nitrogen and halogens; α-, β-, allylic and benzylic cleavage	15	30
4	**Lasers** Principle of laser operation; Stimulated emission Population inversion, Single level and multi level laser systems, Properties of laser light and its general and analytical applications; ruby laser, nitrogen laser, dye laser, Use of laser radiation in absorption and fluorescence spectroscopic methods	9	25
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Application	Analyze	Evaluate
Weightage	10	30	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Students can describe the principles of lasers
CO2	Apply skill to find the wavelength of spectral lines using plane diffraction grating
CO3	Describe and explain the principle of operation of modern chromatographic instrumentation
CO4	Distinguish the methods of polarization by reflection, refraction and scattering
CO5	Students can explain the principle and applications of atomic spectroscopy

06100312-ANALYTICAL CHEMISTRY-IV

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Discipline Specific Elective Course	
Prerequisite	-	
Course Objective	1. Separation techniques are the basis of instrumental analysis widely applied in industry, chemistry, biochemistry, environment science. 2. To describe the methods used in the analysis of compounds. 3. To explain the chemistry behind the methods of analysis of compounds. 4. To identify which method is more effective for the analysis of compounds.	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**Practical Marks**	**Total Marks**
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIAs**		
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Chromatography-1** TLC, HPTLC, Paper Chromatography. (Basic information, Working Applications in separation, Instrumentation, purification and identification)	**15**	**25**
2	**Chromatography-2** HPLC, Gas Liquid Chromatography (types of columns, packed columns**,** Capillary columns, Bonded phase columns**,** Advanced applications)	**9**	**25**
3	**Chromatography -3** Column Chromatography, Sixe Exclusion Chromatography, Ion Exchange Chromatography	**12**	**25**
4	**Electrophoresis** Basic Principles, Agarose Gel Electrophoresis – Gel, Instrumentation, separation of molecules and analysis, Polyacrylamide and SDS-polyacrylamide gel electrophoresis- Gel, Instrumentation, Separation of molecules and analysis., Isoelectric focusing gel electrophoresis	**9**	**25**
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Application	Analyze	Evaluate	Create
Weightage	10	20	30	30	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	1. Provide theoretical as well as a practical introduction to principles and techniques of chromatography
CO2	2. Explain the principles of the most important liquid and gas chromatographic as well as electro-migration techniques
CO3	3. Evaluate strengths and limitations of the most important chromatographic separation and detection methods in relation to the properties of the sample and of the analysis task
CO4	4. Understand principles and their practical application in publications describing chromatography or electro-migration techniques
CO5	Examine the experiment of chromatographic and electrophoresis technique

Reference Books	
1.	**Analytical Chemistry Gary D. Christian John Wiley and Sons Inc. (TextBook)** Gary D. Christian
2.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,
3.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,

06100313-ANALYTICAL CHEMISTRY-V

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	To understand the environment functions To analyze the statistical data for environment To understand the environmental problems To describe the impact of soil pollution on the environment	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIAs**		**Total Marks**
4	-	-	4.00	70	-	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Air Pollution** Introduction/origin, Environmental Pollution disasters, Classification of pollutants. Air pollution, Composition of air, Chemical reaction in air due to sun light, Reactions in Troposphere, Stratosphere and mesosphere. Smog formation in air. Major sources of air pollution	15	25
2	**Water Pollutants And Their Properties** Introduction, Sources of water, Chemistry of water, Definition of water pollution, Types of water pollution including main point, Types of water pollution (four types), Types of water pollution based on sources and storages (Five types). Ground water pollution, Factor affecting the ground water pollution	9	25
3	**Soil Pollution** Introduction, Importance and formation of soil, Composition of soil, Salt affected to soil, Sources of soil pollution, Soil erosion and its types, Agents of soil erosion, Mechanism of soil erosion, Factors affecting to soil erosion	12	25
4	**Radioactive Pollution** Introduction, How radioactive pollution differs from other pollution. Types and unit of radiation, Radiation chemistry, Interaction of ionising radiation with matter, Principal Types of radiation	9	25
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Analyze	Evaluate
Weightage	10	30	20	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	1. Learn the environment functions and how it is affected by human activities
CO2	2. The environmental data is evaluated by applying numerical and statistical methods
CO3	3. Understand the issues more visible and solve problems, particularly in relation to environmental problems and metal production.
CO4	4. Recognize and describe the impact of soil pollution on the environment.

Reference Books	
1.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,
2.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,
3.	**Analytical Chemistry Gary D. Christian John Wiley and Sons Inc. (TextBook)** Gary D. Christian

06100314-ANALYTICAL CHEMISTRY-VI

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	5 To provide the basic knowledge of Research & Methodology 6 To Learn about the main types of probability and non-probability sample designs 7 To familiarize participants with basic of research and the research process 8 To provide a basic understanding of data analysis using statistics and to use computational tools on problems of applied nature	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIAs**		**Total Marks**
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Sample Designing** Census and sample survey, Implications of a sample design. Steps in Sampling design, Criteria of selecting a sampling procedure, Characteristics of good sample design. Different types of sample design, Random sample from an infinite universe	15	25
2	**Measurement and scaling techniques** Measurement in research, Measurement research, Measurement scales, Sources of error in measurement, tests of sound measurement, technique of developing Measurement tools, Scaling, meaning of scaling, Scale classification bases, Important Scaling techniques, Scale construction techniques	9	25
3	**Methods of data collection** Collection of primary data, observation method, Interview method, Collection of data through Questionnaires, Collection of data through schedules, collection of secondary data, selection of appropriate method for data collection.	12	25
4	**Processing and analysis of data** Processing operations, statistics in research, measures of dispersion, measures of asymmetry, measures of relationship, Simple regression analysis, Multiple correlation and regression, Partial Correlation, Association in case of Attributes, Other measures	9	25
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Analyze	Evaluate
Weightage	10	30	30	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Categorizes and defines the sampling methods

CO2	Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling
CO3	Students can learn the methods to collect research data through different methods. Also understand role of computer in research
CO4	Student will gain the knowledge of processing data and understand the guidelines of thesis writing

06100315-P - ANALYTICAL CHEMISTRY PRACTICAL

Course	Master of Science (M.Sc.)	**Semester - 3**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	To identify the accurate analytical method for a given sample to be analyzed. To analyze the principles, instrumentation and applications of spectroscopic methods To illustrate the principles and applications of chromatographic techniques To describe the different analytical methods and their applications in analysis of hazardous chemicals	

Teaching Scheme (Contact Hours)				**Examination Scheme**				
				Theory Marks		**Practical Marks**		
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIAs**	**SEE**	**CIAs**	**Total Marks**
-	-	16	8.00	-	-	200	-	200

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Analytical Chemistry Practical** **List of Practical:** 1. To determine the Saponification value of given sample of oil (coconut oil). 2. To determine the percentage purity of given sample of aspirin (estimation of Aspirin). 3. To separate the peracetamol and salicylic acid by TLC. 4. To determine the Saponification value of given sample of oil (castor oil). 5. To determine the amount of calcium in the given sample of milk powder. 6. To determine acid value of a given oil sample (coconut oil). 7. To determine acid value of a given oil sample (castor oil). 8. To isolate caffeine from commercial product by TLC	**16**	**100**
	Total	**16**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	20	20	20	30	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Identify the accurate analytical method for a given sample to be analysed.
CO2	Declare the principles and applications of different wet chemical methods.
CO3	Analyze the principles, instrumentation and applications of spectroscopic methods
CO4	Illustrate the principles and applications of chromatographic techniques.

CO5	State the principles and instrumentation of different extraction techniques
CO6	Describe the different analytical methods and their applications in analysis of hazardous chemicals

Reference Books	
1.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,
2.	**Analytical Chemistry Gary D. Christian John Wiley and Sons Inc. (TextBook)** Gary D. Christian

List of Practical	
1.	**To determine the Saponification value of given sample of oil (coconut oil).**
2.	**To determine the percentage purity of given sample of aspirin (estimation of Aspirin).**
3.	**To separate the peracetamol and salicylic acid by TLC.**
4.	**To determine the Saponification value of given sample of oil (castor oil).**
5.	**To determine the amount of calcium in the given sample of milk powder.**
6.	**To determine acid value of a given oil sample (coconut oil).**
7.	**To determine acid value of a given oil sample (castor oil).**
8.	**To isolate caffeine from commercial product by TLC**

06100401-ORGANIC CHEMISTRY-VII

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Discipline Specific Elective Course	
Prerequisite	-	
Course Objective	To explain why enzymes are good biological catalysts To understand the use of enzymes. To provide the basic knowledge of metabolic reaction To describe the features that fats bring to foods.	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**Practical Marks**	**Total Marks**
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIAs**		
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Proteins and Nucleic acids** Amino acids, structure, peptide bond, chemical bonds in protein structure, protein configuration (primary, secondary, tertary and quaternary structure of protein) Nucleic acid: types, sugar, bases and phosphates in DNA & RNA, DNA: internucleotide linkages, double helicle structure, types of DNA RNA: types of RNA (m RNA, t RNA, r RNA), difference between DNA & RNA	**15**	**30**
2	**Lipids** Definition, Fatty acids and its nomenclature, Saturated and unsaturated fatty acids, hydroxy fatty acids, cyclic fatty acids, biological role of lipids. Simple lipids: Fats, oils & waxes Compound lipids: Phospholipids, Glycolipids.	**9**	**20**
3	**Enzymes** Definition, nomenclature and classification, Isoenzymes, Biological role of enzymes, Chemical nature and characteristics of enzymes, Colloidal Nature, Catalytic nature, Specifity of enzyme action, Thermolability, Reversibility of reaction, pH sensitivity, Michaelis Menten equation, Fischers lock & key model, Koshlands Induced fit model	**12**	**25**
4	**Metabolism and Metabolic Reaction** Catabolism, Anabolism, Metabolism of Carbohydrates (Glycolysis, Kerbs Cycle, oxidative phosphorylation, oxidative photophosphorylation) Metabolism of proteins(Urea cycle)	**9**	**25**
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze
Weightage	10	30	20	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Describe the different levels of protein structure and their interdependence
CO2	Understand the different composition and roles of nucleic acids in the cell and their interactions with each other and with agents that cause DNA damage
CO3	Be able to describe the basic properties of enzymes.
CO4	Be able to describe the stages of the cell cycle.

Reference Books	
1.	**A Textbook of Organic chemistry (TextBook)** Arun Bahl, B.S. Bahl; S. Chand Publication
2.	**Advanced Organic Chemistry (TextBook)** March Jerry; Wiley Eastern Ltd. New Delhi (1985).; 4
3.	**Advanced Organic Chemistry: Reactions, Mechanisms and Structure (TextBook)** J. March. Wiley
4.	**Advanced Organic Chemistry Part –B (TextBook)** F.A.Careyand R.J.Sundberg; Plenum Press

06100402-ORGANIC CHEMISTRY-VIII

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Discipline Specific Elective Course	
Prerequisite	-	
Course Objective	• To provide the basic and advanced knowledge of very useful concepts of Advanced Medicinal Chemistry. • To learn the main differentiating property, use or side effect for the Nonsteroidal aspirin substitutes. • To understand concerns for toxicity of NSAIDs in those with compromised renal or liver function • To provide the knowledge of epidemiology, causes, and management of febrile seizures.	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	Total Marks
Lecture	Tutorial	Lab	Credit	SEE	CIAs		
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction, classification, synthesis and SAR of old and new drugs**	15	30
	Sedatives, Hypnotics and Anxiolytics: Phenobarbital, diazepam, bromazepam, **Anticonvulsants:** Hydantoins, vigabatrin, progabide, sodium valproate, denzimol, zonisamide		
2	**Miscellaneous CNS drugs**	12	20
	Levodopa, carbidopa, mefanicin, baclofen, milameline, ecopizil. **Diuretics:** Acetazolamide, methazolamide		
3	**Antihyperlipidemics**	9	25
	Fluvastatine, benzafibrate **Antihypertensive:** methyldopa, propranolol		
4	**Antipyretics and NSAIDS**	9	25
	Aspirin, salsalate, diflunisil, paracetamol **Narcotic Analgesics:** Levallorphan, mepiridine		
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Application	Analyze	Evaluate
Weightage	30	30	30	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Students can understand the historical and advance concept of medicinal chemistry and its advantages.
CO2	Provide information on acute, chronic and post-surgical pharmacological pain relief using a multidisciplinary approach.
CO3	provide a review of pharmacological options and their uses for effective relief of acute or chronic pain
CO4	Provide the fundamental principles of molecular structure and shape as they relate to organic molecules having a medicinal properties and their application to human anatomy

Reference Books	
1.	**A Textbook of Organic chemistry (TextBook)** Arun Bahl, B.S. Bahl; S. Chand Publication
2.	**"The organic Chemistry of Drug Design and Drug Action" (TextBook)** Silverman R.B; Academic Press New York
3.	**Advanced Organic Chemistry (TextBook)** March Jerry; Wiley Eastern Ltd. New Delhi (1985).; 4
4.	**Advanced Organic Chemistry Part –B (TextBook)** F.A.Careyand R.J.Sundberg; Plenum Press

06100403-ORGANIC CHEMISTRY-IX

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	• To develops the skills needed to design separation and heat transfer processes and to size/optimize related equipment. • Understand general design considerations involving process design development • To impact knowledge about biological and biochemical technology, with a focus on biological products, the design and operation of industrial practices. • To explain the major difference between organic and inorganic chemistry.	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	SEE	CIAs	SEE	CIAs	Total Marks
4	-	-	4.00	70	30	-	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Unit Processes & Unit Operations** Introduction, Nitration, Helogenation, Amination by reduction sulfonation and sulfation, hydrogenation	9	20
2	**Fermentation** Introduction, conditions favorable for fermentation, characteristics of enzymes. Manufacture of beer, Fermentation of Wort, Manufacture of Spirit, manufacture of wine, manufacture of vinegar, manufacture of power alcohol, Ethyl alcohol from molasses.	9	25
3	**Synthetic Dyes** Introduction, nomenclature Dyeing, Basic operations in dying, Due intermediates. Classification of dyes,Acid dyes, Basic dyes, Direct dyes, Mordant dyes, Lakes, Vat dyes, Ingrain dyes, sulphur dyes, pigment dyes, solvent or spirit soluble dyes, food dyes. -Methyl Orange, Diphenyl methane dyes, Mordant, azodyes. Thiazole dyes, Anthraquinone dyes, Indigoids, Xanthene dyes, stilbere dyes. Application Of Dyes	15	25
4	**Reactions Of Alkanes And Cycloalkanes** Petroleum refining reactions. Catalytic alkylation, catalytic isomerization, Catalytic reforming, catalytic cracking, hydrocracking, Petrochemical processes Thermal cracking for alkenes, Acetylene processes Catalytic reforming for aromatics, steam reforming	12	30
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy			
Level	Understanding	Analyze	Evaluate
Weightage	40	10	50

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes	
At the end of this course, students will be able to:	
CO1	Understand the basic concepts of process design development and general design considerations
CO2	Evaluate factors that contributes in enhancement of cell and product formation during fermentation process
CO3	Understand the basics of dyestuff industry in terms of raw materials utilized.
CO4	Know the various technology and safety aspects for reactions.

Reference Books	
1.	**A Textbook of Organic chemistry (TextBook)** Arun Bahl, B.S. Bahl; S. Chand Publication
2.	**Advanced Organic Chemistry Part –B (TextBook)** F.A.Careyand R.J.Sundberg; Plenum Press
3.	**Advanced Organic Chemistry: Reactions, Mechanisms and Structure (TextBook)** J. March. Wiley
4.	**Organic Chemistry (TextBook)** P. L. Soni; Sultan Chand & Sons

06100404-ORGANIC CHEMISTRY-X

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	• To provide the basic knowledge of Research & Methodology • Students should know why educational research is undertaken, and the audiences that profit from research studies. • To identify the overall process of designing a research study from its inception to its report • To know the primary characteristics of quantitative research and qualitative research.	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	Total Marks
Lecture	Tutorial	Lab	Credit	SEE	CIAs		
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Methods of Data Collection** Collection of primary data, observation method, Interview method, collection of data through questionnaires, collection of data through schedules, difference between questionnaires and schedules, some other method of data collection, collection of secondary data, selection of appropriate method for data collection, role of computer in research	15	25
2	**Processing And analyzing data** Processing operations, solving problems in processing, types of analysis, statistics in research, measures of central tendency, measures of dispersion, measures of asymmetry, measures of relationship, simple regression analysis, multiple correlation and regression, partial correlation, association in case of attributes, significance of writing thesis, different types of research writing, guidelines of writing good thesis.	15	25
3	**Research Methodology** Meaning of research, Objectives of research, motivation in research, Types of research, Research Approaches, significance of research, research method vs methodology, research and scientific method, importance of knowing how research is done, research process, criteria of good research, problems encounter by researchers in india	15	25
4	**Defining Research Problem** What is research problem?, selecting the problem, necessity of defining the problem, Technique involved in defining a problem, an illustration, conclusion Research Design: Meaning of research design, need for research design, features of good design, important concepts relating to research design, different research designs, basic principles of experimental design	15	25
	Total	60	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy				
Level	Remembrance	Understanding	Application	Analyze
Weightage	10	40	20	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Learn the basic Introduction of Objective of research
CO2	Learn to define a research problem.
CO3	Analyze the method of data collection
CO4	Understand the concept of how to write a research report and thesis.

Reference Books

1.	**Advanced Organic Chemistry: Reactions, Mechanisms and Structure (TextBook)** J. March. Wiley
2.	**Hand book of Research Method (TextBook)** Sproull; Scarecrow Press, 1998

06100405 - MAJOR PROJECT

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Project	
Prerequisite	-	
Course Objective	This course provides the primary window of research to each and every student. Students get acquainted with basics of research. Ethics and methodology of research are also taught to students	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	Total Marks
Lecture	Tutorial	Lab	Credit	SEE	CIAs		
-	-	16	8.00	-	-	200	200

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Guidelines** Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage. The file is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation. In general, the File should be comprehensive and include ● A short account of the activities that were undertaken as part of the project; ● A statement about the extent to which the project has achieved its stated goals. ● A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project; ● Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project; ● Any problems that have arisen that may be useful to document for future reference. ● The guidelines and format for dissertation is given in 2nd Module		
2	**Dissertation Guidelines**		

Course Content	**T** - Teaching Hours | **W** - Weightage		
Sr.	**Topics**	**T**	**W**
	1. GENERAL : The manual is intended to provide broad guidelines to the M.Sc. candidates in the preparation of the dissertation report. In general, the project report shall report, in an organised and scholarly fashion an account of original research work of the candidate leading to the discovery of new facts or techniques or correlation of facts already known. 2. NUMBER OF COPIES TO BE SUBMITTED: Students should submit three copies to the Head of the Department concerned on or before the specified date. 3. ARRANGEMENT OF CONTENTS OF DISSERTATION: Dissertation material should be arranged as follows: 1. Cover Page & Title page 2. Declaration 3. Certificate 4. Abstract (Hindi and English) 5. Acknowledgements 6. Table of Contents 7. List of Tables 8. List of Figures 9. List of Symbols, Abbreviations and Nomenclature (Optional) 10. Chapters 11. References 12. Appendices 13. One page CV The Tables and Figures shall be introduced in the appropriate places. 4. PAGE DIMENSIONS AND MARGIN: The dimensions of the dissertation should be standard A4 size paper may be used for preparing the copies, standard margin with 1.5 line spacing.		
3	**Manuscript preparation**		

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	The general text of thesis shall be typed in font style Times New Roman and font size 12. Same quality of the paper should be used for the preparation of the entire report/thesis; except figure, photos are shown. 1 Cover Page & Title Page - A specimen copy of the Cover page & Title page for report/thesis 2 Certificate-The Bonafide Certificate as per the format 3 Abstract: Abstract should be an essay type (HINDI and ENGLISH) of narration not exceeding 500 words outlining the research problem, the methodology used for tackling it and a summary of the findings, typed in 1.5line spacing. 4 Acknowledgements: The acknowledgements shall be brief and should not exceed onepage. The student's signature shall be made at the right bottom above his / her name typed in capitals. 5 Table of contents - The table of contents should list all material following it as wellas any material which precedes it. The title page, Bonafide Certificate and Acknowledgment will not find a place among the items listed in the Table of Contents but the page numbers in lower case Roman letters are to be accounted for them. One and a half spacing should be adopted for typing the matter under this head. A specimen copy of the Table of Contents for report / thesis is given in Annexure III. 6 List of Table - The list should use exactly the same captions as they appear above thetables in the text and the caption shall follow 'sentence case'. One and a half spacing should be adopted for typing the matter under this head. 7 List of Figures - The list should use exactly the same captions as they appear belowthe figures in the text and the caption shall follow 'sentence case'. One and a half spacing should be adopted for typing the matter under this head 8 List of Symbols, Abbreviations and Nomenclature - One and a half spacing shouldbe adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used. 9 Chapters - The chapters may include: Chapter I – Introduction Chapter II - Literature Review Chapter III –Materials and Methods Chapter IV- Results and Discussion 10. Research output/outcome if any published or presented in a conference/ seminar/symposium may be included. 11. List of References - Any works of other researchers, if used either directly orindirectly, should be indicated at appropriate places in the report/thesis. The citation may assume any one of the following forms. APA Style. APA in-text citation style uses the author's last name and the year of publication, for example:(Field, 2005). Example:Derwing, T. M., Rossiter, M. J., & Munro, M. J. (2002). Teaching native speakers to listen to foreign-accented speech. Journal of Multilingual and Multicultural Development, 23(4), 245-259.		
	Total		

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Create
Weightage	10	30	30	15	15

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Identifying appropriate research question and applying suitable research designs
CO2	Execution of independent research experiments

CO3	Application of knowledge and skills previously gained for selected research problem
CO4	Establishing links between theory and methods in selected area of research
CO5	Understand and apply ethical standards of conduct in the collection and evaluation of data and other resources

Reference Books

1. **BIOSTATISTICS AND RESEARCH METHODOLOGY (TextBook)**
   Dr. Ashok A. Hajare; Nirali Prakashan ,April, 2022
2. **How to research (TextBook)**
   Blaxter Loraine; Viva book; 2nd, 2002
3. **Research Methodology (TextBook)**
   C. R. Kothari; New Age International Publishers

List of Practical

06100421-CHEMICAL INDUSTRIES

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	To make students aware of different industrial process To understand the industrial manufacturing process in dyes, pigments, intermediates, perfumes, oils To provide facilities for the development and application of fragrances To identify different types of natural products, their occurrence, structure, biosynthesis and properties	

Teaching Scheme (Contact Hours)				**Examination Scheme**			
				Theory Marks		**Practical Marks**	**Total Marks**
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	**Topics**	**T**	**W**
1	**Dyes, Pigments and Intermediates** 1. a) Classification of Dyes 2. b) Preparation of important dye intermediates 3. c) Methods of preparation of commercial dyes of different classes with suitable examples. Typical manufacturing processes of few dyes d) Fluorescent brightening agents. e) Special dyes: Photosensitive dyes, dyes as food additives, natural dyes	**15**	**25**
2	**Perfumery** Compounds used in perfumery and their classification. Methods of preparation and importance, phenyl – ethanol. Yara yara. Ionone musk ketone, musk ambrette, musk xylene. Phenyl acetic acid and its esters, benzyl acetate, synthetic musks, jasmine. **Essential oils**: Source, constituents, isolation and uses. **Cosmetics**: Detailed study of formulations and manufacturing of cream and lotions, Lipstick and nail polish, Shampoos, hair dyes and tooth pastes.	**15**	**25**
3	**Oils, soaps and Detergents** Refining of edible oils, n , Detergents, Liquid Soaps. Manufacturing of fatty Acids and glycerol, greases from fatty acids, turkey – red oil **Paints, Varnishes and Inks:** Constitutions, examples of preparation and applications	**15**	**25**
4	**Isolation of Natural Products of commercial importance** Methods used. Isolation of nicotine from tobacco waste, Citric from lemon grass, Neem extract and eucalyptus oil. **Synthesis of Natural Products:** Mono and Sesqui – Terpenes.	**15**	**25**

Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy					
Level	Understanding	Application	Analyze	Evaluate	Create
Weightage	20	10	30	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Explain various industrial processes
CO2	Summarize the preparation of dyes and pigments in Dyes industry
CO3	Justify how to make perfumes, essential oils and cosmetics in industry And many more
CO4	Formulate the biosynthesis, isolation of new natural products, rational structural modifications of known natural products

Reference Books	
1.	**Chemical Technology: From Principles to Products, 2nd Edition (TextBook)**
2.	**'Vogel's Textbook of Quantitative Chemical analysis' (TextBook)** G. H. Jeffery, J. Bassett, J. Mendham & R. C. Denney 5/E, ELBS (English Language Book Society) Longm; 5/E, ELBS (English Language Book Society) Longman
3.	**Instrumental Methods of Chemical Analysis (TextBook)** B.K Sharma; Krishna Prakashan Media
4.	**R1: - Industrial Chemistry: Being a Series of Volumes Giving a Comprehensive Survey of the Chemical Industries (TextBook)**

06100422-PHARMACEUTICAL INDUSTRIES AND IPR

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Discipline Specific Elective Course	
Prerequisite	-	
Course Objective	To make students aware of intellectual property rightsTo understand the various acts To know sailent features and impact of International treatiesTo promote the creation of IPR	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Intellectual Property Rights** Introduction, Types of Intellectual Property Rights (Patents,	15	25
2	**Patent System** History of Indian Patent Protection, Rationale behind Patent System, Objectives and Advantages of Patent System, and future challenges. Indian Patents Act 1970, Definitions and Key Terminology, Types of Patent applications, Inventions not patentable (section 3 and 4). Patent filing procedure in India (Patent Prosecution), Specifications (Provisional and Complete), Claims- types of claims and legal importance of claims, Grant of patent, Rights of Patentee and co-owners Opposition- pre-grant opposition and post-grant opposition, Anticipation, Infringement, Compulsory Licensing, revocation of patents, and power of Controller. Patent filing procedure under PCT, advantages, patent search and literature	15	25
3	**Salient features Of National And International Patents** Salient features of Indian Patents (Amendments) Act 1999, 2002 and 2005. US and European Patent System, Background, Salient Features and Impact of International Treaties / Conventions like 1. Paris Convention, Berne convention 2. World Trade Organization (WTO) 3. World Intellectual Property Organization (WIPO) 4. Trade Related Aspects of Intellectual Property Rights (TRIPS) 5. Patent Co-operation Treaty (PCT), Madrid Protocol	15	25
4	**Patent Validation** PCT Application procedure and review procedure, National phase application procedure for US& EU, Patent prosecution procedure in US and EU, WIPO and its role in IPR, Hatch- Waxman provision for IPR Patent in validation process in India, US and Europe, IPR related to copyright, trade mark, trade secret and geographical indication, Patent application writing, Claim construction and claims.	15	25
	Total	60	100

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Suggested Distribution Of Theory Marks Using Bloom's Taxonomy				
Level	Understanding	Application	Analyze	Create
Weightage	30	10	40	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Implement the various Acts of patent filing
CO2	practice the Objectives and Advantages of Patent System, and future challenges.
CO3	check Patent filing procedure under PCT, advantages, patent search and literature.
CO4	develop innovative ideas into profit-making assets

Reference Books

1.	**Intellectual Property and Bioethics – An Overview Consultation Draft (TextBook)**
2.	**Stocchi, E.(1990), Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK (TextBook)** Ellis Horwood Ltd. UK
3.	**R1: - Industrial Chemistry: Being a Series of Volumes Giving a Comprehensive Survey of the Chemical Industries (TextBook)**
4.	**Kent, J. A. (ed) (1997), Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi) (TextBook)** Kent J A

06100423-NATURAL PRODUCTS

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Discipline Specific Elective Course	
Prerequisite	-	
Course Objective	To understand occurrence, synthesis, nomenclature and physiological actions of various biomolecules To understand the mechanism of steroid action To provide students with an introduction of different types of plant pigment	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIA**		**Total Marks**
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Terpenoids and Caretenoids** Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule, structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules (only two) : B-Carotene a-Terpeneol, Home assignment: stereochemistry, biosynthesis and synthesis of citral, Geraniol, Menthol, Farnesol, Zingiberene, Santonin, phytol, and abietic acid	**15**	**25**
2	**Alkaloids** Definition, nomenclature and physiological action, occurrence, isolation, general methods of strucutre elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants, Structure, stereochemistry, synthesis and biosynthesis of the following : Atropine, ajmaline Home assignment stereochemisry, synthesis & biosynthesis of Ephedrine, (+)- coniine, Nicotine, Quinine, Morphine, reserpine, Vinea alkaloids.	**15**	**25**
3	**Steroids** Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Cholesterol and Testosterone, Biosynthesis of steroids, Synthesis of Bile acids, Androsterone, Estrone, Progestrone, Aldosterone, estradiol	**15**	**25**
4	**Plant Pigments** Occurrence, nomenclature and general methods of structure detrmination. Isolation and synthesis of Apigenin and Myrcetin, biosynthesis of Flavonoids: Acetate pathway and shikimic acid pathway Home assignment: structure determination. Isolation and synthesis of Luteolin, Quercetin, Quercetin-3-glucoside, Vitexin, Diadzein, Butein, Aureusin, Cyanidin-7-arabinoside, Cyanidin, Hirsutidin Porphyrins: Structure and synthesis of Haemoglobin and Chlorophyl	**15**	**25**
	Total	**60**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Understanding	Analyze	Evaluate	Create
Weightage	30	30	30	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Explain the roles of caotenoids and tepenoids in biochemistry
CO2	Justify the nomencalture, occurrence, isolation of various alkaloids
CO3	Justify the occurrence, nomenclature, and basic skeleton of steroids
CO4	Analyse the structurs, biosynthesis, ipmortance and applications of important plant and pigments planted hormones

Reference Books	
1.	**Industrial chemistry, Goel publishing house, B.K.Sharma (TextBook)** B.K.Sharma
2.	**Kent, J. A. (ed) (1997), Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi) (TextBook)** Kent J A
3.	**Stocchi, E.(1990), Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK (TextBook)** Ellis Horwood Ltd. UK

06100424 - DISSERTATION

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Dissertation	
Prerequisite	-	
Course Objective	This course provides the primary window of research to each and every student. Students get acquainted with basics of research. Ethics and methodology of research are also taught to students	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIAs**	**SEE**	**CIAs**	**Total Marks**
-	-	24	12.00	-	-	300	-	300

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Guidelines** Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage. The file is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation. In general, the File should be comprehensive and include ● A short account of the activities that were undertaken as part of the project; ● A statement about the extent to which the project has achieved its stated goals. ● A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project; ● Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project; ● Any problems that have arisen that may be useful to document for future reference. ● The guidelines and format for dissertation is given in 2nd Module		
2	**Dissertation Guidelines**		

Course Content	**T** - Teaching Hours | **W** - Weightage		
Sr.	**Topics**	**T**	**W**
	1. GENERAL : The manual is intended to provide broad guidelines to the M.Sc. candidates in the preparation of the dissertation report. In general, the project report shall report, in an organised and scholarly fashion an account of original research work of the candidate leading to the discovery of new facts or techniques or correlation of facts already known. 2. NUMBER OF COPIES TO BE SUBMITTED: Students should submit three copies to the Head of the Department concerned on or before the specified date. 3. ARRANGEMENT OF CONTENTS OF DISSERTATION: Dissertation material should be arranged as follows: 1. Cover Page & Title page 2. Declaration 3. Certificate 4. Abstract (Hindi and English) 5. Acknowledgements 6. Table of Contents 7. List of Tables 8. List of Figures 9. List of Symbols, Abbreviations and Nomenclature (Optional) 10. Chapters 11. References 12. Appendices 13. One page CV The Tables and Figures shall be introduced in the appropriate places. 4. PAGE DIMENSIONS AND MARGIN: The dimensions of the dissertation should be standard A4 size paper may be used for preparing the copies, standard margin with 1.5 line spacing.		
3	**Manuscript Preparation**		

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	The general text of thesis shall be typed in font style Times New Roman and font size 12. Same quality of the paper should be used for the preparation of the entire report/thesis; except figure, photos are shown. 1 Cover Page & Title Page - A specimen copy of the Cover page & Title page for report/thesis 2 Certificate-The Bonafide Certificate as per the format 3 Abstract: Abstract should be an essay type (HINDI and ENGLISH) of narration not exceeding 500 words outlining the research problem, the methodology used for tackling it and a summary of the findings, typed in 1.5line spacing. 4 Acknowledgements: The acknowledgements shall be brief and should not exceed onepage. The student's signature shall be made at the right bottom above his / her name typed in capitals. 5 Table of contents - The table of contents should list all material following it as wellas any material which precedes it. The title page, Bonafide Certificate and Acknowledgment will not find a place among the items listed in the Table of Contents but the page numbers in lower case Roman letters are to be accounted for them. One and a half spacing should be adopted for typing the matter under this head. A specimen copy of the Table of Contents for report / thesis is given in Annexure III. 6 List of Table - The list should use exactly the same captions as they appear above thetables in the text and the caption shall follow 'sentence case'. One and a half spacing should be adopted for typing the matter under this head. 7 List of Figures - The list should use exactly the same captions as they appear belowthe figures in the text and the caption shall follow 'sentence case'. One and a half spacing should be adopted for typing the matter under this head 8 List of Symbols, Abbreviations and Nomenclature - One and a half spacing shouldbe adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used. 9 Chapters - The chapters may include: Chapter I – Introduction Chapter II - Literature Review Chapter III –Materials and Methods Chapter IV- Results and Discussion 10. Research output/outcome if any published or presented in a conference/ seminar/symposium may be included. 11. List of References - Any works of other researchers, if used either directly orindirectly, should be indicated at appropriate places in the report/thesis. The citation may assume any one of the following forms. APA Style. APA in-text citation style uses the author's last name and the year of publication, for example:(Field, 2005). Example:Derwing, T. M., Rossiter, M. J., & Munro, M. J. (2002). Teaching native speakers to listen to foreign-accented speech. Journal of Multilingual and Multicultural Development, 23(4), 245-259.		
	Total		

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	10	20	30	20	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Identifying appropriate research question and applying suitable research designs
CO2	Execution of independent research experiments

CO3	Application of knowledge and skills previously gained for selected research problem
CO4	Establishing links between theory and methods in selected area of research
CO5	Understand and apply ethical standards of conduct in the collection and evaluation of data and other resources

Reference Books	
1.	**BIOSTATISTICS AND RESEARCH METHODOLOGY (TextBook)** Dr. Ashok A. Hajare; Nirali Prakashan ,April, 2022
2.	**How to research (TextBook)** Blaxter Loraine; Viva book; 2nd, 2002
3.	**Research Methodology (TextBook)** C. R. Kothari; New Age International Publishers

List of Practical

06100411-ANALYTICAL CHEMISTRY-VII

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Discipline Specific Elective Course	
Prerequisite	-	
Course Objective	• Be able to use a test chromatogram to determine the status and quality of the system • To obtain a good overview of the HPLC components, the properties of the types of injectors and detectors, the mobile phases and the most common of the HPLC column • To determine the hyperfine parameters, recoil energy , quadrupole splitting and chemical shift / isomer shift by using Mossbauer spectroscopy • The goal of the course is expanding the theoretical and practical knowledge and understanding in the field of chromatography	

Teaching Scheme (Contact Hours)				Examination Scheme				
				SEE		Practical Marks		
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIAs**			**Total Marks**
4	-	-	4.00	70	30	-	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**UHPLC** Principle, theory, instrumentation and applications of ultrahigh performance liquid chromatography (UHPLC) and Comparison with HPLC.	12	23
2	**SFC** Principle, theory, instrumentation and applications of supercritical fluid chromatography (SFC).Comparison with HPLC	9	25
3	**LC-NMR** Principle, theory, instrumentation and applications of liquid Chromatography –nuclear magnetic resonance (LC-NMR) and Comparison with NMR.	9	25
4	**LC-MS** Introduction of chromatography, Types of chromatography, Principle of separation: Adsorption, Size exclusion, Ion exchange, partition, Affinity, mode of chromatography	15	25
	Total	45	98

Suggested Distribution Of SEE Using Bloom's Taxonomy

Level	Understanding	Application	Analyze	Create
Weightage	25	25	25	25

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Understand the importance and notice the difference between different modes of chromatographic separation
CO2	Construct splitting diagrams and be able to measure coupling constants an NMR spectrum, or predict coupling constants and structure
CO3	Apply mass spectroscopy (exact mass, and fragmentation patterns) to organic structural analysis
CO4	Clearly and accurately analyze and interpret the results of chromatographic analysis

Reference Books	
1.	**Chromatography: Concepts and Contrasts Author(s): James M. Miller (TextBook)** James M. Miller
2.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,
3.	**Analytical Chemistry Gary D. Christian John Wiley and Sons Inc. (TextBook)** Gary D. Christian

06100412-ANALYTICAL CHEMISTRY-VIII

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Discipline Specific Elective Course	
Prerequisite	-	
Course Objective	• To understand the theoretical and practical knowledge and understanding in the field of chromatography, as one of the most modern analytical separation techniques • To provide the Knowledgeable of current electro analytical techniques • To identify the most appropriate electro analytical technique for a specific analysis • To use basic principles of thermodynamics to solve thermal problem	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIAs**		**Total Marks**
4	-	-	4.00	70	30		100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Specialized Chromatographic Techniques** Flash/ ICE, Counter Current Chromatography	15	30
2	**Extraction Techniques** Sample preparation techniques (Working, Methodology and Applications) LLE, SPE, SPME, Protein precipitation	9	30
3	**Electro Analytical Techniques** Chemiluminiscence , Flourescence , Phosphorescence	12	20
4	**Thermal Methods of Analysis** Principle, theory, instrumentation and applications of TGA, DTA, DSC	9	20
	Total	45	100

Suggested Distribution Of SEE Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate
Weightage	20	20	20	20	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand the significance of course content for thermo-fluid problems
CO2	Demonstrate the independence of the appropriate optimization of chromatographic systems
CO3	The students will be able to describe the common methods of spectroscopic and chromatographic analysis, and discuss how they can be applied to pharmaceuticals

CO4	Able to detect the chemical compounds in various solutions

Reference Books	
1.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,
2.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,
3.	**Analytical Chemistry Gary D. Christian John Wiley and Sons Inc. (TextBook)** Gary D. Christian

06100413-ANALYTICAL CHEMISTRY-IX

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Core Course	
Prerequisite	-	
Course Objective	To perform qualitative and quantitative analysis To understand the factors influencing chromatographic separation. To provide knowledge in the discipline of clinical chemistry To provide knowledge on the specificities of sampling and preparing biological samples, as well as about methods of bioanalytical chemistry	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	Tutorial	Lab	Credit	SEE	CIAs		Total Marks
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Automation and Flow injection analysis** Principles of automation, automatic and automated devices, Process control: off-line, at-line and on-line analysis. Continuous and discrete analyzers, feedback mechanism. Flow injection analysis, Applications of FIA, stopped flow measurements and gradient FIA.	15	30
2	**Clinical Chemistry** Composition of blood, collection and preservation of samples, common determinations- serum electrolytes, blood glucose, blood urea nitrogen, uric acid. Principles of immunoassays, radioimmunoassay, fluorescence immunoassay, enzyme immunoassay	9	25
3	**Bioanlytical Chemistry** Components of bioanalytical methodology: extraction from biological matrices, chromatography and detection systems. Bioanalytical method validation parameters: sensitivity, selectivity, accuracy and precision, linearity (calibration curves), recovery, matrix effect and stability. USFDA guidelines for bioanalytical method validation and the acceptance criteria.	12	25
4	**Electrogravimetry and coulometry** Introduction, Electrogravimetric analysis, types of electrogravimetric method: constant current electrolysis, constant potential electrolysis, coulometry, types of coulometric methods: controlled potential coulometry, constant current coulometry	9	20
	Total	45	100

Suggested Distribution Of SEE Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze
Weightage	10	40	20	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	Define and explain the theory underpinning chromatography
CO2	Able to identify and explain the factors influencing chromatographic separation in terms of resolution and specificity
CO3	Identify the factors influencing different sample injection techniques and be able to discuss the advantages and disadvantages of each type
CO4	Identify the factors influencing different analyze detection systems and be able to discuss the advantages and disadvantages of each type
CO5	Develop an understanding of the range and uses of analytical methods in chemistry

Reference Books	
1.	**Analytical Chemistry Gary D. Christian John Wiley and Sons Inc. (TextBook)** Gary D. Christian
2.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,

06100414-ANALYTICAL CHEMISTRY-X

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Core	
Prerequisite	-	
Course Objective	• Upon completion of this program the student will have fundamental knowledge in preparing conventional dosage forms • To provide the basic knowledge of very important concepts of the Analytical chemistry. • To understand the very important concept of Nanotechnology • To provide the basic knowledge for food analysis.	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE**	**CIAs**		**Total Marks**
4	-	-	4.00	70	30	-	100

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Pharmaceutical Analysis** Instrumental and titrimetric assays for anti-diabetic, anti-cancer, anti-tuberculosis, anti- malarial, anti-hypertensive and anti-HIV drugs based on USP/BP/IP. Heavy metal ion, Dissolution, Loss on drying and Karl fisher analysis in pharmaceuticals	**9**	**20**
2	**Introduction And Classification Of Nanotechnology** Nanotechnology, Classification of Nanostructured materials – Nanoscale Architecture. Synthesis of Nanomaterials: Top down – ball milling; Bottom up – co-precipitaion – sol-gel – electrodeposition – using natural nanoparticles. The Carbon Nanotube – Types of Nanotubes – Formation of Nanotubes – Uses for nanotubes – Biological Applications	**15**	**30**
3	**Analysis of pesticides, soaps and detergents, fertilizers** Classification of pesticides. Analysis of different pesticides by classical and instrumental methods. Classification of soaps and detergents with suitable examples. Characterization of soaps and detergents. Types of fertilizers and analysis of different elements like, nitrogen, phosphates, calcium, sodium, potassium and ammonia.	**12**	**25**
4	**Food Analysis** Introduction to food analysis, regulations and international standards related to food analysis, nutritional labeling, sample and sample preparation, compositional analysis of foods for moisture, proteins, fat, fiber, ash, vitamins and minerals. Adulteration of fats and oils; milk and milk products.	**9**	**25**
	Total	**45**	**100**

Suggested Distribution Of SEE Using Bloom's Taxonomy

Level	Understanding	Application	Analyze	Evaluate
Weightage	25	25	25	25

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes	
At the end of this course, students will be able to:	
CO1	This study is useful to furnish students with the advanced technical skills and knowledge base that is required in the field of instrumental analysis and which will enable them to pursue careers as analysts in the chemical and/or pharmaceutical industry
CO2	Understand the essential concepts used in nanotechnology, syntheses and fabrication
CO3	Appreciate the development of modern nanotechnology
CO4	Understand, identify and analyze a problem related to food industry and ability to find an appropriate solution for the same

Reference Books	
1.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,
2.	**Analytical chemistry principles (TextBook)** John H. Kennedy; Saunders College Pub.,
3.	**Analytical Chemistry Gary D. Christian John Wiley and Sons Inc. (TextBook)** Gary D. Christian

06100415 - MAJOR PROJECT

Course	Master of Science (M.Sc.)	**Semester - 4**
Type of Course	Project	
Prerequisite	-	
Course Objective	This course provides the primary window of research to each and every student. Students get acquainted with basics of research. Ethics and methodology of research are also taught to students	

Teaching Scheme (Contact Hours)				Examination Scheme			
				Theory Marks		Practical Marks	
Lecture	Tutorial	Lab	Credit	SEE	CIAs		Total Marks
-	-	16	8.00	-	-	200	200

***SEE** - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Guidelines** Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage. The file is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation. In general, the File should be comprehensive and include A short account of the activities that were undertaken as part of the project; A statement about the extent to which the project has achieved its stated goals. A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project; Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project; Any problems that have arisen that may be useful to document for future reference. The guidelines and format for dissertation is given in 2nd Module		
2	**Dissertation Guidelines**		

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W

	1. GENERAL : The manual is intended to provide broad guidelines to the M.Sc. candidates in the preparation of the dissertation report. In general, the project report shall report, in an organised and scholarly fashion an account of original research work of the candidate leading to the discovery of new facts or techniques or correlation of facts already known. 2. NUMBER OF COPIES TO BE SUBMITTED: Students should submit three copies to the Head of the Department concerned on or before the specified date. 3. ARRANGEMENT OF CONTENTS OF DISSERTATION: Dissertation material should be arranged as follows: 1. Cover Page & Title page 2. Declaration 3. Certificate 4. Abstract (Hindi and English) 5. Acknowledgements 6. Table of Contents 7. List of Tables 8. List of Figures 9. List of Symbols, Abbreviations and Nomenclature (Optional) 10. Chapters 11. References 12. Appendices 13. One page CV The Tables and Figures shall be introduced in the appropriate places. 4. PAGE DIMENSIONS AND MARGIN: The dimensions of the dissertation should be standard A4 size paper may be used for preparing the copies, standard margin with 1.5 line spacing.		
3	**Manuscript preparation**		

Course Content		**T** - Teaching Hours | **W** - Weightage	
Sr.	Topics	T	W

	The general text of thesis shall be typed in font style Times New Roman and font size 12. Same quality of the paper should be used for the preparation of the entire report/thesis; except figure, photos are shown. 1 Cover Page & Title Page - A specimen copy of the Cover page & Title page for report/thesis 2 Certificate-The Bonafide Certificate as per the format 3 Abstract: Abstract should be an essay type (HINDI and ENGLISH) of narration not exceeding 500 words outlining the research problem, the methodology used for tackling it and a summary of the findings, typed in 1.5line spacing. 4 Acknowledgements: The acknowledgements shall be brief and should not exceed onepage. The student's signature shall be made at the right bottom above his / her name typed in capitals. 5 Table of contents - The table of contents should list all material following it as wellas any material which precedes it. The title page, Bonafide Certificate and Acknowledgment will not find a place among the items listed in the Table of Contents but the page numbers in lower case Roman letters are to be accounted for them. One and a half spacing should be adopted for typing the matter under this head. A specimen copy of the Table of Contents for report / thesis is given in Annexure III. 6 List of Table - The list should use exactly the same captions as they appear above thetables in the text and the caption shall follow 'sentence case'. One and a half spacing should be adopted for typing the matter under this head. 7 List of Figures - The list should use exactly the same captions as they appear belowthe figures in the text and the caption shall follow 'sentence case'. One and a half spacing should be adopted for typing the matter under this head 8 List of Symbols, Abbreviations and Nomenclature - One and a half spacing shouldbe adopted for typing the matter under this head. Standard symbols, abbreviations etc. should be used. 9 Chapters - The chapters may include: Chapter I – Introduction Chapter II - Literature Review Chapter III –Materials and Methods Chapter IV- Results and Discussion 10. Research output/outcome if any published or presented in a conference/ seminar/symposium may be included. 11. List of References - Any works of other researchers, if used either directly orindirectly, should be indicated at appropriate places in the report/thesis. The citation may assume any one of the following forms. APA Style. APA in-text citation style uses the author's last name and the year of publication, for example:(Field, 2005). Example:Derwing, T. M., Rossiter, M. J., & Munro, M. J. (2002). Teaching native speakers to listen to foreign-accented speech. Journal of Multilingual and Multicultural Development, 23(4), 245-259.		
	Total		

Suggested Distribution Of SEE Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	10	30	30	10	10	10

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:

CO1	Identifying appropriate research question and applying suitable research designs
CO2	Execution of independent research experiments
CO3	Application of knowledge and skills previously gained for selected research problem
CO4	Establishing links between theory and methods in selected area of research
CO5	Understand and apply ethical standards of conduct in the collection and evaluation of data and other resources

Reference Books	
1.	**BIOSTATISTICS AND RESEARCH METHODOLOGY (TextBook)** Dr. Ashok A. Hajare; Nirali Prakashan ,April, 2022
2.	**How to research (TextBook)** Blaxter Loraine; Viva book; 2nd, 2002

List of Practical