Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce, and Science College Ahmednagar

(Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

National Education Policy (NEP)
Choice Based Credit System (CBCS)

Programme Skeleton and Syllabus of
M.Sc. Chemistry

Implemented from

Academic Year 2023-24

9.2 Distribution of credits

Type of Courses	Total Credits	Credits/ Semester
Discipline-Specific Core Courses (DSC)	54	14 /12
Discipline Specific Elective Courses (DSE)	16	04
Research Methodology (RM)	04	Semester I only
On-Job Training/ Internship (OJT/I	04	Semester II only
Project (PR)	10	Semesters III and IV only
Total	88	22

9.3 Master of Science (M.Sc.) Course Distribution

Class	Semester	Subjects	Courses	DSC		DSE		RM/OJT/ Internship etc.		Project*	Total Credits
				T	P	T	P	T	P		
M. Sc. I	I	01	09	03	03	01	01	01*		00	22
M. Sc. I	II	01	09	03	03	01	01	00	01	00	22
M. Sc. II	III	01	07	02	02	01	01	00	00	01	22
M. Sc. II	IV	01	07	02	02	01	01	00	00	01	22

* RM: Theory and Practical credits in RM paper shall be decided by the Department. The final marks/grade point shall be calculated by considering theory and practical marks.

9.4 Master of Science (M. Sc.) Credit Distribution

Class	Semester	Subjects	Courses	DSC		DSE		RM/OJT/ Internship etc.		Project*	Total Credits
				T	P	T	P	T	P		
M. Sc. I	I	01	09	08	06	02	02	04*		00	22
M. Sc. I	II	01	09	08	06	02	02	00	04	00	22
Exit Option: PG Diploma											

M. Sc. II	III	01	07	08	06	02	02	00	00	04	22
M. Sc. II	IV	01	07	08	04	02	02	00	00	06	22
				32	**20**	**08**	**08**	**02**	**06**	**12**	**88**

9.5 Master of Science (M. Sc.) Distribution of Courses

Class	Semester	Course and their credits in the bracket			
		DSC	DSE	RM/OJT/ Internship etc.	Project *
M. Sc. I	I	DSC -01 (03)	DSE -01 (02)	RM-01(04)	NA
M. Sc. I	I	DSC -02 (03)	DSE -02 (02)		
M. Sc. I	I	DSC -03 (02)			
M. Sc. I	I	DSC -04 (02)			
M. Sc. I	I	DSC -05 (02)			
M. Sc. I	I	DSC -06 (02)			
M. Sc. I	II	DSC -07 (03)	DSE -03 (02)	OJT-01 (04)	NA
M. Sc. I	II	DSC -08 (03)	DSE -04 (02)		
M. Sc. I	II	DSC -09 (02)			
M. Sc. I	II	DSC -10 (02)			
M. Sc. I	II	DSC -11 (02)			
M. Sc. I	II	DSC -12 (02)			
M. Sc. II	III	DSC -13 (04)	DSE -05 (02)	NA	PR-01(04)
M. Sc. II	III	DSC -14 (04)	DSE -06 (02)		
M. Sc. II	III	DSC -15 (03)			
M. Sc. II	III	DSC -16 (03)			
M. Sc. II	IV	DSC -17 (04)	DSE -07 (02)	NA	PR-02(06)
M. Sc. II	IV	DSC -18(04)	DSE -08 (02)		
M. Sc. II	IV	DSC -19 (02)			
M. Sc. II	IV	DSC -20 (02)			

Programme Framework (Courses and Credits): M. Sc. Chemistry

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	6.0	DSC-01	MS-CH111T	Inorganic Chemistry-I	03
2.	I	I	6.0	DSC-02	MS-CH112T	Organic Chemistry-I	03
3.	I	I	6.0	DSC-03	MS-CH113T	Physical Chemistry-I	02

4.	I	I	6.0	DSC-04	MS-CH114P	Inorganic Chemistry Practical-I	02
5.	I	I	6.0	DSC-05	MS-CH115P	Organic Chemistry Practical-I	02
6.	I	I	6.0	DSC-06	MS-CH116P	Physical Chemistry Practical-I	02
7.	I	I	6.0	DSE-01	MS-CH117T	Chemical Kinetics and Reaction Dynamics OR Chemical Biology	02
8.	I	I	6.0	DSE-02	MS-CH118P	Chemical Biology Practical OR Bioanalytical Techniques	02
9.	I	I	6.0	RM-01	MS-CH119T/P	Research Methodology	04
10.	I	II	6.0	DSC-07	MS-CH121T	Inorganic Chemistry-II	03
11.	I	II	6.0	DSC-08	MS-CH122T	Organic Chemistry-II	03
12.	I	II	6.0	DSC-09	MS-CH123T	Physical Chemistry-II	02
13.	I	II	6.0	DSC-10	MS-CH124P	Inorganic Chemistry Practical-II	02
14.	I	II	6.0	DSC-11	MS-CH125P	Organic Chemistry Practical-II	02
15.	I	II	6.0	DSC-12	MS-CH126P	Physical Chemistry Practical-II	02
16.	I	II	6.0	DSE-05	MS-CH127T	Heterocyclic Chemistry OR Nuclear and Radiation Chemistry	02
17.	I	II	6.0	DSE-06	MS-CH128P	Analytical Chemistry Practical OR Interpretation and Analysis of Spectra	02
18.	I	II	6.0	OJT-01	MS-CH129P	On Job Training	04
M. Sc. II Inorganic Chemistry							
19.	II	III	6.5	DSC-13	MS-IC131T	Bioinorganic and Medicinal Inorganic Chemistry	04
20.	II	III	6.5	DSC-14	MS-IC132T	Inorganic Reaction Mechanism and Photochemistry and Reactions of Coordinated Ligands	04
21.	II	III	6.5	DSC-15	MS-IC133P	Advanced Methods of Inorganic Analysis Practical -I	03
22.	II	III	6.5	DSC-16	MS-IC134P	Inorganic Instrumental analysis and Computer applications Practical-I	03
23.	II	III	6.5	DSE-05	MS-IC135T	Material Science – I OR Inorganic Polymer	02

24.	II	III	6.5	DSE-06	MS-IC136T	Organometalic Chemistry OR Inorganic MagnetoChemistry	02
25.	II	III	6.5	PR-01	MS-IC137P	Research Project	04
26.	II	IV	6.5	DSC-17	MS-IC141T	Heterogeneous Catalysis and its Applications in Organic Synthesis	04
27.	II	IV	6.5	DSC-18	MS-IC142T	Inorganic Nanomaterial and Organometallic Chemistry.	04
28.	II	IV	6.5	DSC-19	MS-IC143P	Advanced Methods of Inorganic Analysis Practical- II	02
29.	II	IV	6.5	DSC-20	MS-IC144P	Inorganic Instrumental analysis and Computer applications Practical -II	02
30.	II	IV	6.5	DSE-07	MS-IC145T	Material Science - II OR Homogeneous Catalysis	02
31.	II	IV	6.5	DSE-08	MS-IC146T	Advanced Technique in Inorganic Chemistry Or Industrial Applications of Inorganic Chemistry	02
32.	II	IV	6.5	PR-02	MS-IC147P	Research Project	06
M.Sc. II Organic Chemistry							
33.	II	III	6.5	DSC-13	MS-OC131T	Organic Reaction Mechanism	04
34.	II	III	6.5	DSC-14	MS-OC132T	Structure Determination of Organic Compounds by Spectroscopic Methods	04
35.	II	III	6.5	DSC-15	MS-OC133P	Solvent Free Organic Synthesis	03
36.	II	III	6.5	DSC-16	MS-OC134P	Organic Synthesis by Named Reactions	03
37.	II	III	6.5	DSE-05	MS-OC135T	Asymmetric Synthesis OR Carbohydrates Chemistry	02
38.	II	III	6.5	DSE-06	MS-OC136T	Stereochemistry of Carbon Compounds OR Protection - De-protection, Chiron Approach	02
39.	II	III	6.5	PR-01	MS-OC137P	Research Project	04
40.	II	IV	6.5	DSC-17	MS-OC141T	Chemistry of Natural Products	04
41.	II	IV	6.5	DSC-18	MS-OC142T	Advanced Synthetic Methods in Organic Chemistry	04
42.	II	IV	6.5	DSC-19	MS-OC143P	Convergent and Divergent Organic Syntheses	02
43.	II	IV	6.5	DSC-20	MS-OC144P	Ternary Mixture Separation	02

44.	II	IV	6.5	DSE-07	MS-OC145T	Concepts and Applications of Medicinal Chemistry OR Introduction to Medicinal Chemistry	02
45.	II	IV	6.5	DSE-08	MS-OC146T	Designing Organic Synthesis OR Supramolecular and Green Chemistry	02
46.	II	IV	6.5	PR-02	MS-OC147P	Research Project	06
M.Sc. II Drug Chemistry							
47.	II	III	6.5	DSC-13	MS-DC131T	Analytical Methods in Structure Determination	04
48.	II	III	6.5	DSC-14	MS-DC132T	Drug Discovery and Development	04
49.	II	III	6.5	DSC-15	MS-DC133P	Two Stage Preparation	03
50.	II	III	6.5	DSC-16	MS-DC134P	Practicals in Enzymology and Microbiology	03
51.	II	III	6.5	DSE-05	MS-DC135T	Asymmetric Synthesis OR Supramolecular and Green Chemistry	02
52.	II	III	6.5	DSE-06	MS-DC136T	Stereochemistry OR Carbohydrates Chemistry	02
53.	II	III	6.5	PR-01	MS-DC137P	Research Project	04
54.	II	IV	6.5	DSC-17	MS-DC141T	Advanced Medicinal Chemistry	04
55.	II	IV	6.5	DSC-18	MS-DC142T	Drug Design and Development	04
56.	II	IV	6.5	DSC-19	MS-DC143P	Drug Intermediate Synthesis	02
57.	II	IV	6.5	DSC-20	MS-DC144P	Green Chemistry Practical	02
58.	II	IV	6.5	DSE-07	MS-DC145T	Advanced Synthetic Methods in Chemistry OR Bioinformatics, Biostatistics in Drug Discovery	02
59.	II	IV	6.5	DSE-08	MS-DC146T	Chemistry of Organometallic Compounds OR Protection - De-protection, Chiron Approach	02
60.	II	IV	6.5	PR-02	MS-DC147P	Research Project	06

M.Sc. II Analytical Chemistry							
61	II	III	6.5	DSC-13	MS-AC131T	Electrochemical and Thermogravimetric Methods of Chemical Analysis	04
62	II	III	6.5	DSC-14	MS-AC132T	Analytical Method Development and extraction Techniques	04
63	II	III	6.5	DSC-15	MS-AC133P	Basics of Instrumental Methods of Chemical Analysis Practical-I	03
64	II	III	6.5	DSC-16	MS-AC134P	Modern Analytical Chemistry Practical-I	03
65	II	III	6.5	DSE-05	MS-AC135T	Advanced Chromatographic Methods of Analysis-I OR Analytical Methods for Food Analysis	02
66	II	III	6.5	DSE-06	MS-AC136T	Analysis of Controlled Substance OR Bioanalytical Techniques	02
67	II	III	6.5	PR-01	MS-AC137P	Research Project	04
68	II	IV	6.5	DSC-17	MS-AC141T	Advanced Analytical Spectroscopic Techniques	04
69	II	IV	6.5	DSC-18	MS-AC142T	Chemical Methods of Pharmaceutical Analysis	04
70	II	IV	6.5	DSC-19	MS-AC143P	Basics of Instrumental Methods of Chemical Analysis Practical-II	02
71	II	IV	6.5	DSC-20	MS-AC144P	Modern Analytical Chemistry Practical-II	02
72	II	IV	6.5	DSE-07	MS-AC145T	Agricultural Analytical Chemistry OR Analytical Chemistry of Polymer and detergents	02
73	II	IV	6.5	DSE-08	MS-AC146T	Advanced Chromatographic methods of Analysis-II OR Laboratory Automation Techniques	02
74	II	IV	6.5	PR-02	MS-AC147P	Research Project	06

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Board of Studies in Chemistry

Sr. No.	Name	Designation
1.	Dr. A. E. Athare	Chairman
2.	Asso. Prof. P. S. Mutkule	Member
3.	Asso. Prof. S. B. Dare	Member
4.	Dr. S. J. Takate	Member
5.	Asst. Prof. A. V. Karande	Member
6.	Dr.B.B.Shingate (BAMU, Aurangabad)	Academic Council Nominee
7.	Dr.S.S.Kolekar(Shivaji Uni., Kolhapur)	Academic Council Nominee
8.	Dr. N. R. Dhatrak (SPPU)	Vice-Chancellor Nominee
9.	Dr. P. C. Mhaske (S. P. College, Pune)	Alumni
10.	Dr. D. N. Sawant (NCL, Pune)	Industry Expert

Prologue/ Introduction of the Programme:

Academics and research in India are a priority which depends upon the quality of education. Quality higher education includes innovations that can be useful for efficient governance of higher education institutions, systems and society at large. Fundamental approach to learning outcome-based curriculum emphasizes upon demonstration of understanding, knowledge, skills, attitudes and values in particular programmes of study. This approach is intended to follow flexibility and innovation in design of the programme, its assessment and expected graduate attributes demonstrating the level of learning outcome. It is expected to provide effective teaching – learning strategies including periodic review of the programme and its academic standard. The learning outcome-based curriculum for B.Sc. degree in Chemistry is designed to address the needs of the students with chemistry as the core subject of study. The curriculum is expected to assist in the maintenance of the standard of chemistry degrees/programmes and periodic programme review within a broad framework of agreed/expected graduate attributes qualification descriptors, programme learning outcomes and course-level learning outcomes. The framework is intended to allow flexibility and innovation in programme design, syllabi development, teaching-learning process and quality assessment of students' learning levels.

This curriculum for the bachelor-level program in Chemistry is developed keeping in view the student centric learning pedagogy, which is entirely outcome-oriented and curiosity-driven. To avoid rote-learning approach and foster imagination, the curriculum is

more leaned towards self-discovery of concepts. The curriculum focuses on pragmatist approach whereby practical application of theoretical concepts is taught with substantial coverage of practical and field works. The platform aims at equipping the graduates with necessary skills for Chemistry-related careers, careers with general graduate-level aptitude and for higher education in Chemistry and allied subjects. Augmented in this curriculum are graduate attributes including critical thinking, scientific reasoning, moral ethical reasoning, qualification descriptors that are specific outcomes pertinent to the discipline of chemistry, learning outcomes for individual courses, pedagogical methods and assessment methods. While designing syllabus, emphasis is given on the objectively measurable teaching-learning outcomes to ensure employability of the graduates. In line with recent trends in the education sector, this syllabus fosters implementation of modern pedagogical tools and concepts such as flip-class, hybrid learning, MOOCs and other e- learning platforms. The framework is designed in such a way to enable the learners implementing the concepts to address the real-world problems. The curriculum focuses on issues pertinent to India and also of the west; for example, green chemistry and biomaterials etc. Curriculum are holistic and aim to mold responsible Indian citizens to have reflective thinking, scientific temper, and digital literacy in order to acquire requisite skill to be self-employed entrepreneurial.

2. Programme Outcomes (POs)

1.PO-1: **Disciplinary knowledge and skill:** A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding both theoretical and practical knowledge in all disciplines of Chemistry. Students can solve their subjective problems very methodically, independently and finally draw a logical conclusion. Further, the student will be capable of applying modern technologies, handling advanced instruments and Chemistry related

soft-wares for chemical analysis, characterization of materials and in separation technology.

PO-2: **Skilled communicator:** The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

PO-3: **Critical thinker and problem solver:** The course curriculum also includes components that can be helpful to graduate students to develop critical thinking and to design, carry out, record and analyze the results of chemical reactions. Students will be able to think and apply evidence based comparative chemistry approaches to explain chemical synthesis and analysis.

PO-4: **Sense of inquiry:** It is expected that the course curriculum will develop inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.

PO-5: **Team player:** The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field-based situations and industry.

PO-6: **Skilled project manager:** The course curriculum has been designed in such a manner as to enable a graduate student to become a skilled project manager by acquiring knowledge about chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

PO-7: **Digitally literate:** The course curriculum has been designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, use of chemical simulation software and related computational work.

PO-8: **Ethical awareness:** A graduate student requires understanding and developing ethical awareness or reasoning which is adequately provided through the course curriculum.

PO-9: **Environmental Awareness:** As an inhabitant of this green planet a Chemistry graduate student should have many social responsibilities. The course curriculum is designed to teach a Chemistry graduate student to follow the green routes for the synthesis of chemical compounds and also find out new greener routes for sustainable development. The course also helps them to

understand the causes of environmental pollution and thereby applying environmentally friendly policies instead of environmentally hazard ones in every aspect.

PO-10: **Lifelong learner:** The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available e-techniques, e-books and e-journals for personal academic growth.

PO-11: **Analytical skill development and job opportunity:** The course curriculum is designed in such a way that Chemistry graduate students can handle many chemistry-based software, decent instruments and advanced technologies to synthesize, characterize and analyze the chemical compounds very skillfully. Such a wonderful practice in the graduate level will bring a good opportunity to the students for getting jobs in industries besides academic and administrative works.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: Inorganic Chemistry-I								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-1	MS-CH111T	03	00	03	45	30	70	100

Learning Objectives:

1. Students should visualize/ imagine molecules in 3 dimensions.
2. To understand the concept of symmetry and be able to pass various symmetry elements through the molecule.
3. Understand the concept and point group and apply it to molecules.
4. Student should understand the detail chemistry of S and P block elements w.r.t. their compounds, their reactions and applications.
5. To learn the advanced chemistry of boranes, fullerene, zeolites, polymers etc.

Course Outcomes (Cos)

1. Students will be familiar with the basic technology, definitions and principles of point group theory.
2. Students will be able to determine symmetry elements and point groups of as given molecule.
3. Students will gain proficiency in using character tables to analyze the symmetry properties of molecular vibrations, electronic transition.
4. Students will be able to understand periodic trends.
5. Students will be able to organize main group elements in different families based on their different properties.

Detailed Syllabus:

Unit I: Molecular Symmetry and Symmetry Groups (10)

Symmetry elements and operations, Symmetry planes, inversion centre, proper axes and proper rotations, improper axes and improper rotation, products of symmetry operations, equivalent symmetry elements and equivalent atoms, general relations among symmetry elements and symmetry operations, classes of symmetry operations, symmetry elements and optical isomerism, symmetry point groups, classification of molecular point groups. Defining properties of a group, group multiplication table, some examples of group, subgroups and classes.

Unit II: Representations of Group (06)

Matrix representation and matrix notation for geometric transformation, The Great Orthogonality Theorem and its consequence, character tables (No mathematical part), wave function as basis for irreducible representations.

Unit III: Symmetry Adapted Linear Combinations (05)

Projection operators and their use of construct SALC (Construction of SALC for sigma bonding for molecules belonging point groups: $D_{2h,}$ D_{3h} D_{4h}, C_{4v}, Td., Oh., normalization of SALC, transformation properties of atomic orbital, MOs for sigma bonding, ABn molecules, tetrahedral AB_4 and Oh AB_6 cases.

Unit IV: Application of Group theory to Infrared Spectroscopy (03)

Introduction, selection rules, polyatomic molecules, possible vibrations in a linear molecule, bending modes, symmetry of vibrations and their IR activity, Group vibration concept and its limitations, IR spectra related to symmetry of some compounds, IR spectra of complex compounds.

Unit V: Chemistry of s-block elements: (04)

Introduction, Isotopes of Hydrogen, Ortho and Para Hydrogen, Classification of Hydrides, electron deficient, electron precise and electron rich hydrides.; PH_3, SbH_3, AsH_3, Selenides, Tellurides.Solutions in non - aqueous media, application of crown ether in extraction of alkali and alkaline earth metal, Cryptands.

Unit VI: Chemistry of p-block elements: (14)

Boron Hydrides, preparation, structure, properties and Bonding with reference to LUMO and HOMO, interconversion of lower and higher boranes, metalloboranes, carboranes, reactions of organoboranes, STYX rules and structure of higher boranes

Allotropes of carbon, Diamond, Graphite, Graphene, Fullerenes, Carbon nanotube with synthesis, properties, Structure- single walled and multi walled

and its application, Intercalation compounds of Graphite, Silicates including Zeolites.

Nitrogen activation, Boron nitride, Oxidation states of nitrogen and their interconversion, PN and SN Compounds, Applications of PN and SN compounds.

Metal Selenides and Tellurides, oxyacids, and oxoanions of Sulphur and nitrogen. Ring, Cage and Cluster compounds of p-block elements.

Halogens: Interhalogens, pseudohalogen, Synthesis, Properties and Applications, Structure, Oxyacids and Oxyanions of Halogens.

Noble Gases: Occurrence, Compounds of Xenon with fluorine and Oxygen and its uses.

Unit VII: Organometallic Compounds (03)

Organometallic Compounds of Li, Mg, Si, Pb, As, withClassification, Nomenclature Synthesis, Structure Properties and Uses.

Suggested Readings/Material:

1. Chemical Applications of Group Theory by F. A. Cotton
2. Symmetry and spectroscopy of molecules by K. Veera Reddy
3. Group Theory and its Chemical Application, P.K. Bhattacharya
4. Inorganic Chemistry by Shriver and Atkins
5. Concise Inorganic Chemistry by J. D. Lee
6. Inorganic chemistry: principle of structures and reactivity by Huheey, Keiter, Medhi
7. Organometallics by A Concise Introduction by Christoph Elschenbroich and Albrecht Salzer.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: Organic Chemistry-I								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-2	MS-CH112T	03	00	03	45	30	70	100

Learning Objectives:

1. To understand structure and reactivity.
2. Basics of stereochemistry.
3. To learn intermediates and rearrangements.
4. To study reactions of oxidizing and reducing agents.

Course Outcomes (Cos):

1. To understand some fundamental aspects of organic chemistry, to learn the concept aromaticity, to understand the various types of aromaticity
2. To study heterocyclic compounds containing one and two hetero atoms with their structure, synthesis and reactions.
3. To know stereochemistry of organic compounds
4. To study the reaction of intermediates, rearrangement reactions with specific mechanisms and migratory aptitude of different groups. and ylides
5. To understands the basis of redox reaction; acquire knowledge about the reagents which causes selective oxidation / reduction in various compounds; learn the basic mechanism of oxidation / reduction in organic compounds

Detailed Syllabus:

Unit I: Aromaticity (05)

Benzenoid and non-benzenoid compounds, Huckel's rule, antiaromaticity, Homoaromaticity, non-aromaticity. Application to carbocyclic and heterocyclic systems, annulenes, azulenes, current concepts of aromaticity.

Unit II: Stereochemistry (06)

Stereochemical principles, enantiomeric relationship, diastereomeric relationship, R and S, E and Z nomenclature in C, N, S, P containing compounds, Prochiral relationship, Re/Si faces, Selectivity: Types (Regioselectivity, Chemoselectivity, Stereoselectivity) emphasis on stereospecific and stereoselective reactions, Optical purity, Estimation of purity, Interpretation of ee/de, optical activity in Biphenyls, Spiranes, Helical compound (P/M System), Allenes, Topicity.

Unit III: **Ylides (04)**

Phosphorus, Nitrogen and Sulphur ylides

Unit IV: **Rearrangements (08)**

Migration of Group on **Nitrogen**- Hoffmann, Curtius, Lossen, Schmidt, Beckmann.
Migration of Group on **Carbon**- Wagner-Meerwein, Pinacol-pinacolone, Tiffeneau Demjanov, Wolff, Benzil-benzilic acid**,** Sommelet, Favorskii.
Migration of Group on **Oxygen**- Bayer-Villiger,
Migration of group from **N to C**- Stevens.

Unit V: Aliphatic Nucleophilic Substitution Reactions: (11)

The SN2, SN1, mixed SN1 and SN2 and SET mechanism. The neighboring group mechanism, The Neighboring group participation by π & σ bonds, anchimeric assistance, classical and non classical carbocations, phenonium ions, norbornyl system, carbocation rearrangements in neighboring group participation. The SNi mechanism. Nucleophile Substitution at an allylic, aliphatic trigonal and vinylic carbon. Reactivity effects of structure, attacking Nucleophile, leaving group and reaction medium, phase transfer catalyst, ambident nucleophile and regioselectivity.

Unit VI: Elimination and Addition Reactions: (11)

Elimination reactions: Types, E2, E1, E1cb Mechanisms, orientation, stereochemistry in elimination, reactivity effect of structure attacking and leaving groups, competition between substitution & elimination, syn eliminations.

Addition to Carbon – Carbon Multiple bonds: Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and Free radicals, Regio and chemoselectivity, orientation and reactivity, Michael reaction.

Self learning: Chemical bonding and basis of reactivity- Chemical bond, delocalization, conjugation, resonance, hyperconjugation, tautomerism, inductive effects. Acidity and basicity: various structural effects, hard and soft acid and base concept.

Suggested Readings/Material:

1. Organic Chemistry–by J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford).
2. Advanced Organic Chemistry –by J. March 6th Edition.
3. Advanced Organic Chemistry (Part A) –by A. Carey and R.J. Sundberg.
4. Stereochemistry of carbon compound-by E.L. Eliel.
5. Stereochemistry of organic compound-by Nasipuri.
6. Stereochemistry conformations and mechanism by P.S. Kalsi.
7. Modern Synthetic reactions- H.O. House.
8. Organic Synthesis – M.B. Smith.
9. Organic chemistry –by Cram, Hammond, Pine and Handrickson.
10. Mechanism and structure in Organic Chemistry – E. S. Gould.
11. IUPAC recommendations 2006 and 2008.

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New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: Physical Chemistry - I								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-3	MS-CH113T	02	00	02	30	15	35	50

Learning Objectives:

1. To learn the fundamentals of Physical Chemistry
2. To understand the concepts of Thermodynamics
3. To study the Approach of Quantum chemistry
4. To Solve Chemical Bonding problems with the help of quantum mechanics.

Course Outcomes (Cos)

1. Student will be able to understand laws of thermodynamics

2. Student will be exposed to different applications of quantum chemistry

3.They learn the fundamental of chemical bonding

4.Student will gain the conceptual knowledge about free energy changes

Detailed Syllabus:

Unit I: Thermodynamics (10)

State function, path function, exact differential and inexact differential, internal energy and enthalpy, temperature dependent internal energy and enthalpy, reversible and irreversible adiabatic expansion. The entropy of irreversible changes, the Helmholtz and Gibbs function, Entropy and entropy change in an ideal gas with temperature and pressure, Clausius inequality, chemical potential, chemical potential of a substance in a mixture, Thermodynamics of Gibbs function of mixing.

Unit II: Quantum Chemistry (10)

Applications of quantum chemistry- blackbody radiation, photoelectric effect, de Broglie hypothesis and uncertainty principle and its experimental evidence. Schrödinger wave equation, particle in one dimensional box, Postulates of quantum mechanics, Normalization and orthogonality of wave function, particle in three-dimensional box, hydrogen like atoms (no derivation). Operators: algebra of operators, commutative property, linear operators, commutator operator, the operator ∇ and ∇2.

Unit III: Chemical Bonding (10)

Valence bond theory, hybrid orbitals, geometry and hybridization, molecular orbital theory for di and tri atomic molecule, linear variation method, approximations underlying Huckel theory, applications to simple π-systems.

Suggested Readings/Material:

1. Physical Chemistry by P.W.Atkin and De Paul.

2. Physical Chemistry by T.Engel and P. Reid.

3. Physical Chemistry and molecular approach by D. Mequarie and J. Siman.

4. Physical Chemistry for biological sciences by Raymond Chang (Universal books, 2000).

5. Physical Chemistry by Merron and C.F. Prouton.

6. Physical Chemistry by G.M. Barrow.

7. Quantum Chemistry by I. Levine. 8. Quantum Chemistry by R.K. Prasad.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: Inorganic Chemistry practical I								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-4	MS-CH114P	00	02	02	60	15	35	50

Learning Objectives:

1.To understand the different techniques for analysis of ore and alloy.

2.To understand Gravimetric steps involved in analysis.

3. To know different chemical methods for synthesis of Nanoparticles.

4.To know Characterization techniques for synthesized nanoparticles.

Course Outcomes (Cos)

1. Students are trained in different methods in Inorganic chemistry like disintegration, digestion standardization
2. Students are made aware of safety techniques and handling of chemicals.
3. Students are made aware of carrying out different types of reactions and their workup methods.

Detailed Syllabus:

Unit I: Analysis (at least two of the following)

1. Determination of Silica and Manganese from Pyrolusite ore.

2. Determination of Aluminum and Silica from Bauxite ore.

3. Determination of silica and iron from Hematite ore.

4. Determination of copper and iron from Chalcopyrite ore.

Unit II: Alloy Analysis (at least two of the following)

5. Determination of tin and lead from Solder alloy.
6. Determination of iron and chromium from Stainless steel alloy.
7. Determination of copper and nickel from Cupranickel alloy.

Unit III: Synthesis of solid-state materials / nano-materials (any three)

8.Synthesis of ZnO from zinc oxalate - precursor method and determine band gap by absorption spectroscopy.

9. Synthesis of TiO_2 $TiCl_4$ or Ti-Isopropoxide by Sol-gel method and determine band gap by absorption spectroscopy**.**
10. Synthesis of Colloidal silver nanoparticles and determine band gap by absorption spectroscopy.
11. Synthesis of Fe_2O_3 nanoparticle sol-gelco-precipitation / hydrothermal (any one method).
12. ZnO, TiO_2, Fe_2O_3 nanoparticles powder XRD, SEM, TEM (at least one spectral analysis should be done).

Unit IV: Applications of Solid State Materials

1. Removal and kinetics of photocatalytic dyes, degradation (methylene blue) by ZnO TiO_2 photocatalysis.
2. Study of adsorption of phosphate ion on α-Fe_2O_3.

Suggested Readings/Material:

1. Text book of Quantitative Analysis by A.I. Vogel 3rd edition (1963)
2.Experimental Inorganic Chemistry by Mounir A. Malati, Horwood.
3. Nanotechnology by S. K. Kulkarni.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: Organic Chemistry Practical-I								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-5	MS-CH115P	00	02	02	60	15	35	50

Learning Objectives:

1. To learn Laboratory Safety approach.
2. To understand purification techniques.
3. To synthesis different compound by green chemistry approach.

Course Outcomes (Cos)

1. This course is designed to make students aware of how to handle organic compounds in laboratory and aware of safety techniques.
2. The synthesis of organic compounds /derivatives, will help them while working in research laboratory / in industry

3. This practical course is also designed to make student aware of green chemistry, role of green chemistry in pollution reduction and solvent free reaction with ecofriendly experimental procedures.
4. Students are trained in different purification techniques in organic chemistry like recrystallization, distillation, steam distillation and extraction.

Detailed Syllabus:

Unit I: Introduction to Laboratory Safety (compulsory)

Meaning of safety signs on container of chemicals, safety handling of chemicals, MSDS sheets: Detailed explanation at least for 4 different types of substances (e.g. nitric acid, benzene, potassium dichromate, bromine, etc.), Handling of glasswares and care to be taken, handling of organic flammable as well as toxic solvents in laboratory, use of safety goggles, shoes and gloves, fire extinguisher and its use, action to be taken in accidental cases e.g. cleaning of acid spill over, use eye wash station and bath station in emergency, etc.

Unit II: Purification Techniques (Compulsory) (8 Experiments)

1. Purification of **two** organic solids by recrystallization using solvents other than water.
2. Purification of **two** organic liquids by upward/downward/traditional distillation technique.
3. Column Chromatography technique should be performed for any one of the following preparations.
4. Sublimation Technique **one** Compound.
5. Thin Layer Chromatography technique **two mixtures.**

Unit III: Introduction to Green Chemistry (Compulsory 1 Practical)

Concept of green chemistry twelve principles of green chemistry, applications of green chemistry for sustainable development, Atom economy, Monitoring of reaction using TLC.

Unit IV: Green Chemistry Experiments (any two)

1. Preparation of Schiff's bases in aqueous medium.
2. Preparation of dihydropyrimidinone under solvent free conditions (Biginelli Reaction).
3. Preparation of acetanilide from aniline using Boric acid.

Suggested Readings/Material:

1. Vogel's Textbook of Practical Organic Chemistry, Fifth edition – Brian S Furniss, Antonny J Hannaford, Peter W G Smith and Austin R. Tatchell.
2. Comprehensive Practical Organic Chemistry by V.K. Ahluwalia and Renu Aggarwal.

3. Monograph on Green Chemistry Laboratory Experiments by Green Chemistry Task Force Committee, DST.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus

M.Sc. Chemistry

Title of the Course: Physical Chemistry Practical-I								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-6	MS-CH116P	00	02	02	60	15	35	50

Learning Objectives:

1.Student will learn how to handle instrument like colorimeter
2. The student will gain problem solving ability, data analysis skills.
3. The student will be able to learn the importance of time and temperature in chemical reactions.
4. They will learn the radioactive material practical.

Course Outcomes (Cos)

1.Student will get hands on instruments like colorimeter, pH meter, potentiometer etc.
2. The student will gain problem solving ability, data analysis skills.
3. The student will be able to understand the importance of time and temperature in chemical reactions.
4. They will understand the pros and cons of a radioactive material practical.

Detailed Syllabus:

Physical Chemistry Practical (12 Experiments)

Unit I: Chemical Kinetics: (Any three)

1. Kinetic decomposition of diacetone alcohol by dilatometry.

2. Determination of the order of a reaction.

3. Brönsted's primary salt effect.

4. Kinetics of oxidation of ethanol by K2Cr2O7

Unit II: Non-Instrumental: (Any Three)

5. Determination of surface excess of amyl alcohol or TX-100 surfactant by Capillary rise method.

6. Determination of molecular weight by steam distillation.

7. Glycerol radius by viscosity.

8. Partial Molar Volume (Polynometry) Determination of the densities of a series of solutions and to calculate the molar volumes of the components**.**

Unit III: Colorimetry and spectrophotometry (Any four)

9. Simultaneous determination of Ni and Co by spectrophotometry.

10. Simulations of the determination of KMnO4 and K2Cr2O7 by spectrophotometry.

11. To study the adsorption of certain dyes such as methyl violet, picric acid or malachite green on charcoal.

12. To determine the indicator constant of bromocresol purple by half height method

13. Estimation of Cu(II) by titration with Na2 EDTA by colorimetry.

Unit IV: Radioactivity (Any one)

14. Half-life of a radioactive nuclide and counting errors.

15. Determination of E-max of β radiation and absorption coefficients in Al.

Unit V: Data Analysis

16. Statistical treatment of experimental data (calculation of mean and standard deviation for given data and least square method for calibration curve method) (compulsory)

Suggested Readings/Material:

1. Practical Physical Chemistry, A. Findlay, T. A. Kitchner (Longmans, Green and Co.).
2. Experiments in Physical Chemistry, J. M. Wilson, K. J. Newcombe, A. R. Denko. R. M. W. Richett (Pergamon Press).
3. Senior Practical Physical Chemistry, B. D. Khosla and V. S. Garg (R. Chand and Co., Delhi.).
4. Experimental Physical Chemistry by D. P. Shoemaker, Mc. Growhill, 7th Edition, 2003.
5. Physical Chemistry by Wien (2001).
6. Advance Physical Chemistry Experiment, Gurtu and Gurtu, Pragati Publication (Meerut)
7. Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House.
8. Practical Physical Chemistry, B. Vishwanathan and P. S. Raghwan, Viva Books

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: A. Chemical Kinetics and Reaction Dynamics **OR** B. Chemical Biology								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-1	MS-CH117T	02	00	02	30	15	35	50

Elective Option-A: Chemical Kinetics and Reaction Dynamics

Learning Objectives:

1. To learn the fundamentals of chemical kinetics
2. To study the mechanism of gas phase reactions
3. To learn the concepts of molecular reaction dynamics
4. To study the enzyme catalysis of a reaction
5. To understand the molecular thermodynamics for mathematical aspect of thermodynamics

Course Outcomes (Cos)

1.Students will understand the fundamentals of chemical kinetics

2.They will be exposed to the mechanism of gas phase reactions

3.Student will be able to acquire the knowledge of energy changes during the reactions

4.They will know the role of enzyme as a catalyst of a reaction

5.Student will understand the mathematical aspect of thermodynamics

Detailed Syllabus:

Unit I: Rate Laws **(06)**

Recapitulations of basic concept, the temperature dependent reaction rates, reaction moving towards equilibrium, consecutive reaction, parallel reactions, pre-equilibria, unimolecular reactions.

Unit II: Kinetics of Complex Reactions **(04)**

Fast reactions: flash photolysis, flow technique, stopped flow technique, relaxation method, the steady state approximation, chain reactions - free radical polymerization reaction between H2 and Br2, explosive reaction.

Unit III: Molecular Reaction Dynamics (06)

Collision theory of bimolecular gas phase reactions, diffusion controlled and activation controlled reaction in solution, activated complex theory of reaction rate, transition-state theory.

Unit IV: Enzyme Catalysis (06)

Michaelis mechanism, effect of pH and temperature on enzyme catalyzed reactions, limiting rate, Line weaverburk and Eadie equation and plots, inhibition of enzyme action, competitive inhibition and non- competitive inhibition.

Unit V: Molecular Thermodynamics (08)

Molecular energy levels, Boltzmann distribution law, partition functions and ensembles, translational, rotational and vibrational partition function of diatomic molecules, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Suggested Readings/Material:

1. Physical Chemistry by P. W. Atkin and De Paul.
2. Physical Chemistry by T. Engel and P. Reid.
3. Physical Chemistry and molecular approach by D. Mequarie and J. Siman.
4. Physical Chemistry for biological sciences by Raymond Chang (Universal books, 2000).
5. Physical Chemistry by S. H. Maron and C. F. Prutton.
6. Physical Chemistry by G. M. Barrow.
7. Quantum Chemistry by I. Levine.
8. Quantum Chemistry by R. K. Prasad.

OR

Elective Option-B: Chemical Biology

Learning Objectives:

1. To understand the structure and purpose of cells and various cell organelles.
2. To describe diversity of microorganisms, bacterial cell structure and function, microbial growth and ways to control their growth by physical, chemical and biochemical agents.
3. To describe how enzymes catalyze reaction, why enzyme action is specific to a particular substrate.
4. To study the chemical composition of hormones and its action mechanism.
5. To summarize the site of production, regulation, and effects of the hormones of the different glands.

Course Outcomes (Cos)

1. Understand the structure of prokaryotic and eukaryotic cells.
2. Learn the functions of each component of the cell.
3. Learn the importance and kinetics of enzymes.
4. Understand the concept of immune system.
5. Knowledge of basics of microbiology.

Detailed Syllabus:

Unit I: Overview of biochemical concepts (08)

-Structure of prokaryotic and eukaryotic cells and subcellular components.
-Overview of cell metabolism.

- Biomolecules as potential drug targets.
-Chemistry of bio membranes: Structure, composition, properties and functions of membrane. types of membrane transport and transporter.

Unit II: General Microbiology (06)

The morphology, fine structure, cultivation, reproduction and growth of bacteria, techniques to prepare pure cultures, cultural characteristics. Gram negative and Gram-positive bacteria: structure and differences, physical, chemical and biochemical agents to control the growth of microorganisms.

Unit III: Innate and Cellular Basis of Immunity (06)

Innate immunity, mechanism barriers against infection and phagocytosis. Immunological memory, specificity, diversity, discrimination between self and non- self, cell mediated and humoral immune responses. Complement system (classical and alternate pathway). Structure of antibody, constant and variable regions, Fab, F(ab2) and Fc fragments, different classes of antibodies and their functions with fine structures of antibodies.

Unit IV: Enzymes (10)

Introduction to enzyme, properties and classification, enzyme kinetics, uni-substrate reaction (steady state assumption, equilibrium assumption, data significance of MM equation, types of inhibition, effect of pH, temperature and metal ions on enzyme activity) and bisubstrate reaction.

Suggested Readings/Material:

1. Biochemistry by Zubay (1983) Addison, Wesley Publ. Co.
2. Microbiology: Application Based Approach by M. J. Pelczar, E. C. S. Chan, N. R. Krieg (2009).
3. Principles of Biochemistry by Lehninger C., 7th edition (2017).
4. Biochemistry by L. Stryer, W.H. Freeman, San Francisco (2008).
5. Molecular Biology of the Cell by Bruce Alberts, J. D. Watson et al 4th edition (2002).
6. Cell and Molecular Biology by DeRobertis and Saunders, 8th edition (2017).
7. Fundamentals of Enzymology by Price and Stevens, 3rd edition (1999).
8. Essential Immunology by I. M. Roitt, 13th edition.
9. Immunology by J. Kuby, 8th edition.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course:	A. Chemical Biology Practical OR B. Bioanalytical Techniques							
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-2	MS-CH118P	00	02	02	60	15	35	50

Elective Option -A: Chemical Biology Practical

Learning Objectives:

1. To learn the fundamentals of concentration terms.
2. To study the mechanism of biomolecules
3. To learn the concepts of saponification value.
4. To study the concept of acid value.

Course Outcomes (Cos)

1**.** The students will gain experimental training for preparation of solutions of various concentrations and different buffers.

2. The students will gain experimental training for isolation of biomolecules from a variety of sources.

3. They will be able to qualitatively analyse different biomolecules such as proteins, carbohydrates, DNA, RNA, amino acids, etc.

Detailed Syllabus: Example

1. Calculation, preparation of normal, molar and percentage solutions.

2. Specific reactions for carbohydrates.

3. Specific reactions for amino acids.

4. Specific reactions for fatty acids.

5. Isolation of albumin and globulin from egg.

6. Isolation of cholesterol and lecithin from egg.

7. Isolation of casein by IpH precipitation from milk.

8. Isolation of starch from potato and its characterization.

9. Isolation of DNA from bacterial/plant/animal source.

10. Isolation of RNA from yeast/plant.

11. Determination of saponification value.

12. Determination of acid value.

Suggested Readings/Material:

1. A reference book of Biochemistry Practicals by Sadashivam.
2. Practical approach to biochemistry by Plummer.
3. Martin Holtzhauer, Basic Methods for the Biochemical Lab, First Edition, Springer.
4. Practical Biochemistry by J. Jayaraman

Elective Option -B: Bioanalytical Techniques

Learning Objectives:

1. To learn the fundamentals of pH and pOH
2. To study different chromatographic techniques.
3. To learn the electrophoresis techniques and its applications.
4. To study Lamberts-Beer's Law using a Colorimeter/Spectrophotometer.

Course Outcome:

1. Student will learn the preparation of buffer and measurement of pH.

2. Student will obtain hands on training in handling the electrophoresis unit.

3. Student will obtain hands on training in handling the paper chromatography and TLC.

4. Student will learn the difference between various separation techniques

Detailed Syllabus:

1. Determination of pH using pH meter and pH indicators.

2. Separation and detection of amino acids by using paper chromatography/TLC.

3. Separation plant pigments by using paper chromatography.

4. Separation carbohydrate mixture by using paper chromatography.

5. Separation of proteins by polyacrylamide gel electrophoresis.

6. Separation of DNA by agarose gel electrophoresis.

7. Separation/ Purification of biomolecules by using dialysis.

8. Verification of Lamberts-Beer's Law using Colorimeter/Spectrophotometer.

9. Absorption spectrum of proteins and determination of its λmax.

10. Absorption spectrum of nucleic acids and determination of its λmax.

11. To isolate, purify and determination of λmax of chlorophyll from spinach / β-carotene from carrot / betanine from beet root.

12. To determine quality of milk by Methylene blue reduction test (MBRT).

Suggested Reading:

1. Biochemical methods by S. Sadasivam and A. Manickam (Third edition).

2. Laboratory manual in Biochemistry by J Jayaraman (second edition).

3. Experimental Biochemistry A Student Compansion by Beedu Sashidhar Rao and Vijay Deshpande (first edition).

4. An introduction to practical Biochemistry by David T Plummer (Third edition).

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: Research Methodology								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
RM-1	MS-CH119T	04	00	04	60	30	70	100

Learning Objectives:

1. Knowledge of basic concepts of research methodology
2. Current trends in chemical research.
3. Acquiring the fundamental knowledge of various characterization techniques.
4. Application of XRD, SEM, TEM, UV, IR, NMR and Mass spectrometry in research.

Course Outcomes (Cos)

1. Identification and formulation of good research problems
2. Learn to develop research proposal
3. Application of various material characterization techniques.
4. Analysis of spectral data.
5. Identification of structure of unknown compounds.

Detailed Syllabus:

Unit-I : Research Methodology **(20)**

(Including quantitative methods, Computer Applications, research ethics, review of public research in relevant field, training, field work etc.).
Literature Survey: Print: Sources of information: Primary, secondary, tertiary sources; Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples. Digital:Web resources, E-journals, Journal access, TOC alerts, Hot articles, Citation index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, Preprint servers, Search engines, Scirus, Google Scholar,

ChemIndustry, Wiki- Databases, ChemSpider, Science Direct, PubMed, SciFinder, Mendeley, Scopus, Web of Science. Information Technology and Library Resources: The Internet and World Wide Web. Internet resources for chemistry. Finding and citing published information

Unit-II : Methods of Scientific Research and Writing Scientific Papers: (12)

Reporting practical and project work. Writing literature surveys and reviews. Organizing a poster display. Giving an oral presentation. Writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work. Writing ethics. Avoiding plagiarism.

Unit-III : Chemical Safety and Ethical Handling of Chemicals: (10)

Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.

Unit-IV : Data Analysis (12)

The Investigative Approach: Making and Recording Measurements. SI Units and their uses, Scientific method and design of experiments, Analysis and Presentation of Data: Descriptive statistics. Choosing and using statistical tests. Chemometrics. Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, r and its abuse, basic aspects of the multiple linear regression analysis.

Unit-V : Computer Basics and Application **(06)**

a. Introduction to basic software
i. MS Word,
ii. Power Point,
iii. Excel,
b. Introduction to Chemistry related software
i. Gaussian,
ii. Gaussview,
iii. ChemDraw / Chem Sketch

Suggested Readings/Material:

1.Practical Skills in Chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyers and A Jones, Pearson Education Ltd. [Prentice Hall] (2002)
2.Research Methodology. Methods and Techniques: C. R. Kothari.
3.Research Methodology: Tools and Techniques by Dr.Prabhat Pandey, Dr.Meenu Mishra Pandey.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
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Syllabus
M.Sc. Chemistry

Title of the Course: Inorganic chemistry II								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-7	MS-CH121T	03	00	03	45	30	70	100

Learning Objectives:

1.Students are able to find applications in explaining the electronic spectra and magnetic properties of coordination compounds.
2.To understand the concept of High spin and low spin complexes.
3.To understand the effect of ligand field
4.Develop an understanding of the role of metal ions in biological systems.
5.Understands the principles of metalloenzymes.

Course Outcomes (Cos)

1. Students should be able to find out the number of microstates and meaningful term symbols, and construct a microstate table for various configurations.
2.Student should understand inter electronic repulsion.
3. Students should know the concept of weak and strong ligand fields.
4.Students are able to find out splitting of the free ion terms in weak ligand field and strong ligand field.
5.To draw correlations diagrams for various configurations in Td an Oh ligand field.

Detailed Syllabus:

Unit I: Ligand Field Theory of Coordination Complexes: (10)

Quantum numbers, Free ion Configuration, Terms and States, Energy levels of transition metal ions, free ion terms, microstates, term wave functions, spin-orbit coupling.
Effect of ligand field on energy levels of transition metal ions, weak cubic ligand field effect on Russell- Saunders terms, Orgel diagrams, strong field effect, correlation diagrams, Tanabe-Sugano Diagrams, Spin-Pairing energies.

Unit II: Electronic spectra of Transition Metal Complexes (08)

Introduction, band intensities, band energies, band width and shapes, transition metal spectra of 1st, 2nd and 3rd row ions and complexes, electronic spectra of Lanthanide and Actinide,

spectrochemical and nephelauxetic series, charge transfer and luminescence spectra, calculations of Dq, B, β parameters, percentage of covalent character for metal complexes.

Unit III: Magnetic Properties of Coordination Complexes (05)

Origin magnetism, types of magnetism, Curie law, Curie-Weiss Law, Magnetic properties of complexes-Para magnetism, 1st and 2^{nd} Order Zeeman effect, quenching of orbital angular momentum by Ligand fields, Magnetic properties of A, E and T ground terms in complexes, spin free and spin paired equilibria, temperature dependence of magnetism.

Unit IV: Bioinorganic Chemistry (18)

Historical Background and current relevance, role of Cu, Fe, Mn and Mo in metalloprotein and metalloenzymes**.**

Thermodynamic aspects - HSAB concept, chelate effect and Irving-William series, pK_a values of coordinated ligands, Tuning of redox potential, Biopolymer Effects. Kinetic aspects: Electron transfer reaction, Electronic Substitution Reaction. Reactions of coordinated ligands and Template effect, concept of spontaneous self-assembly model compounds.

Role of: i) Ca in Blood coagulation ii) Magnesium in Photosystem I iii) Manganese in Photosystem II iv) Iron in Ferritin, Transferrin, Fe-S clusters, Porphyrin based system.

Unit V: Functions and Transport of Alkali and Alkaline Earth Metal Ions (04)

Importance of alkali and alkaline earth metals, Distribution of cationic and anionic electrolytes in blood plasma and intracellular fluid, Ionophores: Natural and Synthetic, Application of ionophores, Different mechanism involved in exchange of ions across cell wall, Na^+/K^+-ATPase ion pump for active transport of Na^+ and K^+.

Suggested Readings/Material:

1. Ligand field theory and its applications by B.N. Figgis and M.A. Hitachman.
2. Symmetry and spectroscopy of molecules by K. Veera Reddy.
3 Elements of Magneto chemistry by R. L. Datta and A. Syamal.
4. Principle of Bioinorganic Chemistry by S.J. Lippard and J. M. Berg
5. Bioinorganic Chemistry: Inorganic Elements in Chemistry of Life by W. Kaim and B. Schwederski.
6. An Introduction to Bioinorganic Chemistry by R. K. Sharma
7. Bioinorganic Chemistry by E. I. Ichiro ochiai.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: Organic Chemistry II								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-8	MS-CH122T	03	00	03	45	30	70	100

Learning Objectives:

1. Analyse the reaction by correlation diagram.
2. To understand the mechanism of thermal, photochemical and rearrangement reactions.
3. To learn the physical methods of structure determination.

Course Outcomes (Cos)

1. Students should be able to understand free radicals' formation, stability and reactivity and should also be able to use the basic understanding in writing probable reaction mechanisms.
2. To apply the acquired knowledge in the structure elucidation.
3. To incorporate this knowledge, in pursuit of research in various areas of the chemistry and life sciences in academia and industry.

Detailed Syllabus:

Unit I: Aromatic Electrophilic and Nucleophilic Substitution (08)

Aromatic Electrophilic Substitution: The SNAr, SN, Benzyne & The arenium ion mechanism, orientation and reactivity, energy profile diagram, The ortho/ para ratio ipso attack, orientation in other ring system,s Naphthalene, Anthracene, Diazonium coupling Vilsmeier reaction, Gattermann – Koch reaction, etc.

Aromatic Nucleophilic Substitution: SNR1, Mechanisms, Reactivity effect of substrate structure, leaving group and attacking nucleophile.

Unit II: Pericyclic Reactions (14)

Introduction, characteristics and classification of pericyclic reactions. Molecular orbitals: Bonding and symmetry properties. Woodward Hoffmann rules, Orbital analysis, Orbital Correlation Diagram, FMO approaches, PMO, Möbius–Hückel ATS concept and stereochemistry of electrocyclic reactions, cycloaddition reactions. Electrocyclic reaction: torquoselectivity, examples of electrocyclic reactions, Nazarov reaction. Cycloaddition Reactions: study of Diels-Alder reaction - orientation, stereochemistry, Cis rule, Alder's endo rule and regioselectivity; 1,3- dipolar cycloaddition, ketene addition, other examples v) Sigmatropic rearrangements:

stereochemistry, FMO and PMO approach, H and C sigmatropic migration, [1,3], [1,5], [1,7]. [3,3] sigmatropic rearrangements- Cope, Oxy- Cope, Aza-Cope, Claisen, and Aza Claisen rearrangements. Chelotropic reactions (Additions and Eliminations), group transfer, group elimination and ene reactions. Examples based on pericyclic reactions with other reactions.

Unit IV: UV and IR Spectroscopy **(08)**

U.V.: Electronic transitions, Chromophores, Auxochromes, Bathochromic and hypsochromic shifts, Solvent effects, Woodward – Fieser Rules for dienes. enones and aromatic compounds Applications of U.V., instrumentation of recording of spectra.

I. R: Spectra of important functional groups 1. With and without conjugation, 2. Ring size effect 3. Effect of H-bonding, 4. Resonance effect 5. Inductive effect.

Unit V: Nuclear Magnetic Resonance **(15)**

PMR Spectroscopy: Understanding of basic principle, chemical and magnetic nonequivalence, Homotopism, Enantiotopism, diastereotopism, chemical shifts and factors influencing chemical shift: electronegativity, NMR Purity, Selection of Internal Standards, NMR solvent polarity, temperature, anisotropic effect, chemical shifts of acidic protons, D_2O exchange, Multiplicity patterns and Coupling Constants: Pascal's triangle, understanding of tree diagram, complex splitting patterns in aromatic, vinylic, saturated monocyclic compounds, bicyclic compounds (fused and bridged rings), Integration: Problems based on PMR

Combined problems: Problems based on UV, IR, ^{1}H-NMR

Suggested Reading:

1. Advanced Organic Chemistry, Part A by F. A. Carey and R. J. Sundberg.
2. Excited states in Organic Chemistry by J.A. Barltrop and J. D. Coyle.
3. Organic photochemistry: A visual approach by Jan Kopecky.
4. Conservation of orbital symmetry by R. B. Woodward and R. Hoffmann.
5. Orbital Symmetry: A problem solving approach- R. E. Lehr and A. P. Marchand.
6. Pericyclic Reactions by A. P. Marchand, Roland E. Lehr.
7. Organic reactions and orbital symmetry, 2nd Ed. T. L. Gilchrist and R. C. Storr.
8. Molecular Orbitals and Organic Chemical Reactions by Ian Fleming.
9. Pericyclic Reactions by Ian Fleming.
10. Pericyclic Reactions by A Mechanistic and Problem-Solving Approach by Sunil Kumar Vinod Kumar S.P. Singh.
11. Essentials of Pericyclic and Photochemical Reactions by Dinda and Biswanath
12. Pericyclic Reactions - A Textbook: Reactions, Applications and Theory by S. Sankararaman, Roald Hoffmann (Foreword by)
13. Organic Chemistry–by J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford).
14. Mechanism and structure in Organic Chemistry – E. S. Gould.
15. Introduction to Spectroscopy by Donald L. Pavia and Gary M. Lampman.
16. Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams.
17. Spectroscopy of Organic Compounds by P. S. Kalsi.
18. Spectrometric Identification of Organic Compounds by Robert M. Silverstein, Francis X. Webster, David J. Kiemle, David L. Bryce.

19. Organic Structure Analysis-Phillip Crews, Rodriguez, Jaspars by Oxford University Press (1998).
20. Organic Structural Spectroscopy by Joseph B. Lambert, Shurvell, Lightner, Cooks, Prentice-Hall (1998).
21. Organic Structures from Spectra by Field L.D. Kalman J.R. and Sternhell S. 4th Ed. John Wiley and Sons Ltd.
22. Mass Spectrometry Basics by Christopher G. Herbert Robert A.W. Johnstone
23. Mass Spectrometry Principles and Applications by Edmond de Hoffmann and Vincent Stroobant.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: Physical Chemistry-II								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-9	MS-CH123T	02	00	02	30	15	35	50

Learning Objectives:

1. To learn the basic concept of Molecular Spectroscopy.
2. Evaluate Physical properties of material from Microwave, IR, Raman spectra.
3. To understand the principles and instrumentation of various spectroscopy.
4. To enhance numerical solving ability.

Course Outcomes (Cos)

1.Student will gain the basic knowledge about the principle of spectroscopic technique.
2.They will know the quantization concept of energy.
3.Student will be exposed to different instrumental components of the spectrophotometer
4.They will understand the electromagnetic spectrum and its various characteristics.
5. Student will be able to differentiate between various spectroscopic technique

Detailed Syllabus:

Unit I: Introduction to molecular spectroscopy (04)

Characterization of electromagnetic radiation, quantization of energy, regions of the spectrum, representation of spectra, basic elements of practical spectroscopy, Signal to Noise: Resolving power, width and intensity of spectral transitions.

Unit II: Microwave Spectroscopy (04)

Types of molecules on the basis of moment of inertia and rotational spectra of di- and poly-atomic molecules.

Unit III: Infra-red Spectroscopy (06)

The vibrating diatomic molecule, harmonic and Anharmonic oscillator, The diatomic vibrating rotator, breakdown of the Born-Oppenheimer approximation, The vibrations of polyatomic molecule, Fourier transform spectroscopy and its advantages, The carbon dioxide laser applications.

Unit IV: Raman Spectroscopy (06)

Quantum and classical theory of Raman effect, pure rotational Raman spectra, vibrational Raman spectra, polarization of light and Raman effect, structure determination from Raman and Infra-red spectroscopy, applications.

Unit V: Electronic Spectroscopy of molecules (06)

Electronic spectra of diatomic molecules - The Born- Oppenheimer approximation, Vibrational coarse structure, Frank- Condon principle, dissociation energy and dissociation product, Rotational fine structure of electronic-vibration transition.

Unit VI: Mossbauer Spectroscopy (04)

Principles, Instrumentation, and Applications of Mossbauer Spectroscopy.

Suggested Readings/Material:

1. Fundamentals of molecular spectroscopy by C. N. Banwell and E. M. McCash.

2. Atomic and molecular spectroscopy by V. K. Jain.

3. Fundamentals of Molecular spectroscopy by P. S. Shindhu.

4. Atomic and molecular spectroscopy – Basic concepts and application, Cambridge University press, 2015.

5. Molecular spectroscopy Jeanne L. McHale,2nd edition, CNC press.

6. Molecular spectroscopy by Jack D Graybeal, revised 1st edition.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: Inorganic Chemistry Practical II								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-10	MS-CH124P	00	02	02	60	15	35	50

Learning Objectives:

1.Students are able to understand synthetic methods.
2.Students are able to understand the chromatographic technique.
3.Students able to handle instrument spectrophotometers.

Course Outcomes (Cos)

1. Students are trained in different purification techniques in Inorganic chemistry
2. Students are made aware of safety techniques and handling of chemicals.
3. Students are made aware of carrying out different types of reactions and their workup methods.

Detailed Syllabus:

Unit I: Synthesis of coordination complexes (any three)

1. Synthesis and Purity of $[Mn(acac)_3]$.
2. Synthesis and Purity Chloropentaamminecobalt(III) chloride.
3. Synthesis and Purity Nitropentaamminecobalt(III) chloride.
4. Synthesis and Purity Bis[TrisCu(I)thiourea].

Unit II: Inorganic Conductometry (any two)

1. Structural determination of metal complexes by conductometric measurement.
2. To study complex formation between Fe(III) with sulfosalicylic acid by conductometry.
3. To verify the Debye Huckel theory of ionic conductance for strong electrolytes KCl, $BaCl_2$, K_2SO_4 and $[K_3Fe(CN)_6]$.
4. Determination of Pb(II) in solution with Na_2SO_4 solution and determination of solubility product of $PbSO_4$.

Unit III: Inorganic characterization techniques (any two of the following)

1. Determination of equilibrium constant of M – L systems Fe(III)– Sulphosalicylic acid or Fe(III)–β–salicylic acid by Job's continuous variation method.
2. Solution state preparation of $[Ni(en)_3]S_2O_3$, $[Ni(H_2O)_6]Cl_2$, $[Ni(NH_3)_6]Cl_2$. Record absorption spectra in solution of all three complexes and calculate 10 Dq. Arrange three ligands according to their increasing strength depending on your observations.
3. Determination of magnetic susceptibility (χg and χm) of mercury tetra thiocyanato cobalt or $Fe(acac)_3$ or Ferrous ammonium sulfate by Faraday or Gouy method.

Unit IV: Inorganic Kinetics Experiment (any two)

1. Synthesis and photochemistry of $K_3[Fe(C_2O_4)_3].3H_2O$.
2. Kinetics of substitution reaction of $[Fe(Phen)_3]^{2+}$
3. Kinetics of formation of Cr(III)-EDTA complex

Unit V: Ion – Exchange Chromatography

1. Separation of mixture of Zn(II) and Mg(II) using Amberlite IR400 A anionexchanger and quantitative estimation of separated ions Zn(II) and Mg(II).

Unit VI: Solvent Extraction and colorimetric (any one experiment)

1. Determination of Cu(II) by solvent extraction as Dithiocarbamate complex.
2. Determination of iron by solvent extraction techniques in a mixture of Fe(III) +Al(III) orFe(III) + Ni(III) using 8–hydroxyquinoline reagent.

Suggested Readings/Material:

1. Vogel's Textbook of Inorganic Quantitative analysis.
2. Experimental Inorganic Chemistry, Mounir A. Malati, Horwood Series in ChemicalScience (Horwood publishing, Chichester) 1999.
3. Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House.
4. General Chemistry Experiments, Anil. J Elias, University Press (2002).
5. Practical physical Chemistry, B. Vishwanathan and P. S. Raghwan, Viva Books.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: Organic Chemistry Practical-II								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-11	MS-CH125P	00	02	02	60	15	35	50

Learning Objectives:

a. Students are trained in different purification techniques in organic chemistry like recrystallization, distillation, steam distillation and extraction.
b. Students are made aware of safety techniques and handling of chemicals.
c. This course is designed to make students aware of how to perform organic compounds in the laboratory.

Course Outcomes (Cos)

a. The course includes synthesis of some derivatives and organic compounds, which will help them while working in a research laboratory in future.

b. Making derivatives of organic compounds will help them in industry or while doing research in medicinal chemistry for Drug development.

c. This practical course is also designed to make students aware of green chemistry and the role of green chemistry in pollution reduction.

d. The students learn how to avoid solvents and do solvent free reactions.

e. Also the work-up procedure in many experiments is made more eco-friendly to the environment.

Detailed Syllabus: Example

1. Base catalyzed aldol condensation using $LiOH.H_2O$ as a Catalyst.
2. Bromination of trans-stilbene using sodium bromide and sodium bromate
3. [4+2] cycloaddition reaction.
4. Benzil-Benzilic acid rearrangement under solvent free condition
5. Ecofriendly nitration of phenols and its derivatives using Calcium nitrate.
6. Bromination of acetanilide using ceric ammonium nitrate in aqueous medium.

7. Green approach for preparation of benzopinacolone from bezopinacol using iodine catalyst.
8. Preparation of 1, 1-bis-2-naphthol from 2-napthol.
9. Solvent free aldol condensation between 3, 4-dimethoxybenzaldehyde and 1-indanone.
10. Synthesis of Azalactone from Hippuric Acid.
11. Preparation of thioamide from benzaldehyde in water.
12. Alkyne-azide cycloadditon (click Chemistry).

Note: Students should perform a) Column chromatography. b) Spectroscopic interpretation. c) How to draw schemes and mechanism using Chemsketch/Chemdraw / ISIS Draw etc.

Suggested Readings/Material:

1. Comprehensive Practical Organic Chemistry by V.K. Ahluwalia and Renu Aggarwal.
2. Monograph on Green Chemistry Laboratory Experiments by Green Chemistry Task Force Committee, DST

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar

(Autonomous)

Syllabus

M.Sc. Chemistry

Title of the Course: Physical Chemistry Practical-II								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-12	MS-CH126P	00	02	02	60	15	35	50

Learning Objectives:

1.Student will learn how to handle for instruments like conductometer, Polarography, potentiometer.

2.Student will be study to perform graphical analysis.

3.They will learn to perform data analysis from the experimental data.

4.Students learn the working mechanism of the pH meter.

Course Outcomes (Cos)

1.Student will get hands on training for instruments like conductometer, Polarography

2.Student will be able to perform graphical analysis.

3.They will be able to perform data analysis from the experimental data.

4.Students will understand the working mechanism of the pH meter.

Detailed Syllabus:

Unit-I: Conductometry (Any three)

1. Hydrolysis of NH4Cl or CH3COONa or aniline hydrochloride.

2. Determination of $\lambda 0$ or $\lambda \alpha$ and dissociation constant of acetic acid.

3. Hydrolysis of ethyl acetate by NaOH.

4. Determination of ΔG, ΔH, and ΔS of silver benzoate by conductometry.

5. Determination of critical micellar concentration (CMC) and ΔG of micellization of sodium Lauryl Sulphate / Detergent

Unit-II: Polarography (any one)

6. Determination of half wave potential E1/2 and unknown concentration of Cu or Pb or Zn ion.

7. Amperometric titration of Pb(NO3)2 with K2Cr2O7.

Unit-III: Potentiometry: (Any three)

8. Stability Constant of a complex ion.

9. Solubility of a sparingly soluble salt.

10. To determine the ionic product of H2O

11. Estimation of halide in mixture.

Unit-IV: pH metry (any two)

12. Determination of the acid and base dissociation constant of an amino acid and hence the isoelectric point of the acid.

13. Determination of dissociation constants of tribasic acid (phospheric acid).

14. Construct pH curve for titration of strong base – strong acid, strong base - weak acid and predict the best indicator in these titrations (methyl orange, methyl orange, bromocresol green, phenolphthalein, etc.)

Unit-V: Table Work (any two)

15. Analysis of powder XRD of SrTiO3 and Ag metal or any two compounds. (Calculation d, constant, crystal volume and density, and assigning planes to peaks using JCPDS data)

19. Detailed interpretation of Raman spectra of diatomic molecules.

Suggested Readings/Material:

1. Practical physical chemistry, A. Findlay, T. A. Kitchner (Longmans, Green and Co.)

2. Experiments in Physical Chemistry, J. M. Wilson, K. J. Newcombe, A. R. Denko. R. M. W. Richett(Pergamon Press)

3. Senior Practical Physical Chemistry, B. D. Khosla and V. S. Garg (R. Chand and Co., Delhi.).

4. Experimental Physical Chemistry by D. P. Shoemaker, Mc. Growhill, 7th Edition, 2003.

5. Physical chemistry by Wien (2001)

6. Advance Physical Chemistry Experiment, Gurtu and Gurtu, Pragati Publication (Meerut)

7. Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House

8. Practical physical Chemistry, B. Vishwanathan and P. S. Raghwan, Viva Books

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar

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Syllabus

M.Sc. Chemistry

Title of the Course: Heterocyclic Chemistry								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-3	MS-CH127T	02	00	02	30	15	35	50

Learning Objectives:

1. Apply the rules of nomenclature to name various types of heterocyclic compounds.
2. Analyze the reactivity patterns of heterocyclic compounds and predict the outcome of key reactions, such as ring-opening, ring-closure, or functional group transformations.
3. Understand the relationship between structure and properties of heterocyclic compounds, including their physical and chemical properties, such as acidity, basicity, and stability..
4. Evaluate the applications of heterocyclic compounds in various fields, such as medicinal chemistry, materials science, and agrochemicals.

Course Outcomes (Cos)

1. Structure of heterocycles and its correct nomenclature.

2. Importance of heterocyclic moiety in medicinal chemistry.

3. Structural effects in heterocyclic chemistry and common methods in ring synthesis.

4. Synthesis reactions of heterocycles.

Detailed Syllabus: Example

Unit I: Nomenclature and Concept of Strain (06)

Systematic nomenclature (Hantzsch-Widman System) for monocyclic, fused and bridged heterocycles. Tautomerism in aromatic heterocycles. Strain-bond angle, torsional strains and their consequences in small ring heterocycles. (Ref. 3)

Unit II: Common Methods of Ring Synthesis (06)

Common Methods of Ring Synthesis of Aromatic Heterocyclic Systems: Typical ring synthesis involving C – Heteroatom, C – C bond formations, Electrocyclic processes in heterocyclic Synthesis: 1,3 -dipolar cycloadditions producing five – membered heterocycles, Nitrenes in heterocyclic synthesis, Palladium catalysis in the synthesis of Benzo - Fused heterocycles, Fischer synthesis, epoxidation, Use of Sulfur ylides, Azides for small rings.

(Ref.1,3 and 6)

Unit III: Synthesis, reactions and applications of heterocyclic rings (18)

1. Five and six membered heterocycles with one and two hetero atoms: Synthesis, reactivity, aromatic character and reactions of following heterocyclic compounds, Furan, Pyrrole, Thiophene, Pyridine, Pyrimidine.
2.Benzofuran, Oxazole, Isoxazole, Thiazole, Pyrazole, Imidazole, Benzothiazole and Benzimidazole. (Ref.1,3 and 5)
3. Six membered and benzo-fused six membered heterocycles: Pyrazine, Pyridazine, Chromones, Quinoline, Isoquinoline. (Ref. 1, 2, 3, 5 and 6)

Suggested Readings/Material:

1. Principles of Modern Heterocyclic Chemistry by A Paquette.

2. An Introduction to the Chemistry of Heterocyclic Compounds by RM Acheson.

3. Heterocyclic Chemistry by J. A. Joule and K. Mills.

4. Heterocyclic Chemistry by T. Gilchrist.

5. Heterocyclic Chemistry by J A Joule and Smith.

6. Handbook of Heterocyclic Chemistry by A R Katritzky.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Chemistry

Title of the Course: Analytical Chemistry Practical OR Interpretation and Analysis of Spectra								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-4	MS-CH128P	00	02	02	60	15	35	50

Elective Option -A: Analytical Chemistry Practical

Learning Objectives:

1.Students are trained in different purification techniques in organic chemistry like TLC and column chromatography.

2. Students are made aware of IR, NMR techniques and their applications.

3.Students are made aware of calorimetry, pH metry, flame photometry.

4.Student gets familiar with the Polarimetry, Conductometry, viscometry etc.

Course Outcome:

1. This course is designed to give an idea about understanding the composition of mixture using TLC

2. Student gets familiar with the Study of IR for analysis

3. This course is designed to understand the quality checking process of water and evaluation of quality of water samples

4. Students will get an idea about analysis of vitamins and adulteration of food products and their determination.

5. Student understand the detail working and use of instruments like FES, Polarimeter, Colourimeter, Conductometer, pH meter for analysis of different samples

Detailed Syllabus:

Time allotted: One practical Session of 4 hours per week for one semester total

11 practicals to be conducted.

1. Analysis of composition of mixtures of nitroanilines by TLC.
2. Study of characteristic infrared absorption frequencies.
3. Determination of buffering capacity of water by pH metry.
4. Determination of anionic detergents in water samples by methylene blue method.
5. Calibration of volumetric glasswares.
6. Spectrophotometric determination of iron in vitamin supplement/spinach leaves.
7. Determination of saponification value of oil.
8. Adulteration test for food and food products.
9. Determination of amount of glucose and sucrose in honey by polarimetry in honey sample.
10. Determination of ionisation constant of bromophenol blue.
11. Determination of percentage of hydrogen peroxide in ear drops by redox titration.
12. Determination of dissolved form of chromium in water sample by colorimetry.
13. Determination of calcium in dolomite sample by flame photometry.
14. Determination of nitrite in fertilizer/water sample spectrophotometrically.
15. Determination of molecular mass by viscometry measurements.
16. Determination of concentration of sulphuric acid, acetic acid and copper sulphate by Conductometric titration with sodium hydroxide.

Suggested Readings/Material:

1. Vogel's Textbook of inorganic quantitative analysis, A. I. Vogel, 3rd edition.
2. Standard methods of chemical analysis, Welcher.
3. An introduction to practical biochemistry, David T. Plummer, Tata McGraw-Hill Publishing Company Ltd.
4. Standard methods for the examination of water and waste water, 23rd Ed. Jointly published by.
5. American Public Health Association, American water work association, water environmental federation 2017

Elective Option-B: Interpretation and Analysis of Spectra

Learning Objectives:

1. Students are trained in different spectroscopic techniques in organic chemistry like UV, IR, NMR, Mass etc
2. Students are made aware of IR, NMR techniques and their applications..
3. Students are made aware of importance of SEM and TEM instructure determination

4. Student gets familiar with TGA and DTA. Magnetic susceptibility

Course Outcome:

After having completed the practical course, the student should be able to -

1. Use of Woodward and Fieser rule, relationship between conjugation and λmax, Effect of Chromophore, Extent of conjugation, Distinction between conjugated and conjugated compounds, Study of Geometric isomerism.

2. Identification of functional groups or some significant bands in Infrared operator.

3. Recognition of different protons and carbons, chemical shift position, multiplicity of the signal and value of J, equivalent and non-equivalent protons.

4. SEM and TEM analysis provides information surface morphology, crystalline structure, stress internal fractures, contaminants and more.

5. Decomposition study of complexes by thermal method like TGA and DTA. Magnetic susceptibility measurement by Gouy method.

Detailed Syllabus:

Time allotted: One practical Session of four hour per week for a semester

Total 11 practical to be conducted

1. Comparison of calculated value with observed values of λmax of differently substituted organic compounds.

2. Interpretation and Comparison of infrared spectrums of various known and unknown compounds.

3. Identification of proton and carbon magnetic resonance spectrum and its Interpretation.

4. Interpretation of mass spectrum and prediction of fragmentation in different compounds.

5. Use of two dimensional spectroscopy in determination of unknown compound.

6. Identification and Interpretation of Scanning electron microscopy micrograph.

7. Interpretation of Transmission electron microscopy image.

8. Separation and analysis study of mixture using Gas Chromatogram.

9. Decomposition study of complexes by the use of Thermogram from Thermo gravimetric analyser.

10. Analysis of Differential Thermal Analysis curve

11. Surface topography by using atomic force microscopy images.

12. Study of changes in the nuclear environment of the atoms by Mossbauer spectrum.

13. Use of Gouy method is Magnetic Susceptibility measurement.

14. Study and importance of x-ray diffraction diagram to determine the complicated structure.

15. Electron Spin Resonance Spectroscopy of metal complexes or organic radicals.

16. Concentration study of metallic elements in different materials through the analysis of atomic Absorption/Emission spectra.

Suggested Readings/Material:

1. Vogel's Textbook of Quantitative Chemical Analysis, Sixth edition – J Mendham, R C Denney, J D Barnes, M Thomas and B Sivasankar, Peterson.

2. Ultraviolet and Visible Spectroscopy – Michael Thomas, Wiley India Ed

3. Spectroscopy of Organic Compounds – P S Kalsi, New Age Int. Ltd.

4. Introduction to Instrumental Analysis – Robert D Braun.

5. Fundamentals of Molecular Spectroscopy – Colin N Banwell and Elaine M McCash

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Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar

(Autonomous)

Syllabus

M.Sc. Chemistry

Title of the Course: On Job Training								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
OJT-1	MS-CH129P	00	04	04	120	30	70	100

Learning Objectives:

1. On Job Training will provide experiential learning to students.
2. Students will acquire the practical skills required for the workplace related to their subject. On Job Training/Internship report serves as an archival evidence of OJT/internship experience.
3. It provides opportunity to the students to develop their report writing skill by relating the classroom theory with workplace practice.
4. The report should describe the work, a student has undertaken during his/her internship, the techniques he/she has learnt, the acquired skills, the contributions he/she has made to work environment and the conclusion drawn from work experience.

Course Outcome:

1. To lean about various sections of industries.
2. Hands on experience on industrial instruments.
3. Acquire ethical knowledge about industrial behavior.
4. To understand industrial SOPs.

Detailed Syllabus:

Guidelines –

1. Job training should be of 30 days.

2. Students should submit report and completion certificate.

Details of the Report

1. The organization of the Final Report should be in sequence and it should help the reader to obtain a clear understanding of the detailed points presented in the report.

2. Topics within the report should be coherent, clear and concise. Discussions should be work-oriented.

3. The report can be illustrated with appropriate tables, diagrams and graphs wherever necessary and should be properly labeled.

4. Any facts and figures about the company where the training was completed should be supported by references, internal company reports, etc.

5. The report should be a minimum of 20 pages and not more than 40 pages.

6. The report should describe the students' work in their own words.

7. The report should have a bibliography and references, if applicable.

Report Writing - Format and Contents

· The arrangement of Internship / On-the-job training report should be as follows:

· Title page

· Bonafide certificate page in the prescribed format

· Declaration page

· Certificate issued by the Industry/Organization/Company·

Work diary

· Acknowledgement

· Table of Contents

· Table of Abbreviations

· Introduction

· Technical report

· Conclusion

· Bibliography (if applicable

1. Front pages: The Title page should be in prescribed format. It should be followed by the Bonafide certificate page and the declaration page. The certificate issued by the Industry /

Organisation / Company and the work diary should be placed after these pages.

2. Acknowledgements: In this section, student can acknowledge the help, assistance and advice given during the internship and in the preparation of the report.

3. Table of Content: The report must have a table of content which should show the principle divisions of the work and the page numbers on which they are found.

4. Table of Abbreviations: This section should list each abbreviation within the report and its meaning.

5. Introduction: The purpose of this section is to provide a brief introduction of the work. It should not exceed five pages and should comprise the following topics:

a) Organization / Company Background: A brief and clear presentation of the company and the functions of the department(s) in which the student completed her internship.

b) Training Objective: Description of the student's internship objective and work accomplishments.

c) Student's Work Assignment: A general presentation of the student's function within the company and work assignments.

6. Technical report / Areas Covered / Training Experience: This section constitutes the core (subject) of the report. It describes the work that a student has accomplished during the training, the techniques he/she has learnt, the skills acquired, the contributions made, the responsibilities assumed, the equipment he/she has used (if any), the safety procedures followed and all other relevant information. It should contain all the crucial technical details including illustrations, equations, programs, software versions, graphs, tables, charts, diagrams, etc. The technical part may be presented in the form of chapters, sections or any other arrangement suitable to the nature of the technical report. One or two pages of Geo-tagged photographs (taken along with the student) should be included

7. Conclusion: A short description of training experience in own words, his/her opinion on the importance and merits of the internship/On Job training and how far it is supportive to his/her Programme can be included in this section. It should also include a student's technical preparation for launching a career / start-up.

8. Bibliography: A bibliography is a list of books and other references that a student used in preparing the report, which should be provided in an appropriate style.

Note:

Two copies of the report not less than 20 pages should be submitted by the students before the commencement of the first term test of the V Semester.

Formatting

Times New Roman - Font size 12 - Double-Spacing

Paper size A4.

Page Numbering:

Page number should begin with <1= from the introduction page and should continue throughout the report excluding the reference pages.

The page numbers should be on the bottom middle or bottom right of each page throughout the text.