S M V E C
SCHOOL OF ARTS AND SCIENCE
( Approved by Government of Puducherry and Affiliated to Pondicherry University)
Madagadipet, Puducherry - 605 107

# MASTER OF SCIENCE
# IN
# CHEMISTRY

# ACADEMIC REGULATIONS
# (R 2023)
# CURRICULUM AND SYLLABI

## COLLEGE VISION AND MISSION

### Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society.

### Mission

**M1: Quality Education:**

To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

**M2**: **Research and Innovation:**

To foster value based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

**M3: Employability and Entrepreneurship:**

To inculcate the employability and entrepreneurial skills through value and skill based training.

**M4: Ethical Values:**

To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

## Department of Chemistry

## Vision and Mission

### Vision

To develop the department as world class centre of excellence in all aspects of higher education and research with an expertise in chemical sciences.

### Mission

**M1: Quality Education:**

To inculcate quality inter-disciplinary training to improve the welfare of humanity.

**M2: Practical knowledge:**

To provide laboratory training in the field of chemistry in both public and private sectors.

**M3: Research:**

To educate our students for research to meet the global environmental issues

**M4: Knowledge:**

To produce graduates of International distinction, committed to integrity, professionalism and lifelong learning by widening their knowledge horizons in range and depth.

## STRUCTURE FOR POSTGRADUATE PROGRAMME

| Sl. No | Course Category | Breakdown of Credits |
|---|---|---|
| 1 | Discipline Specific Core Courses (DSC) | 64 |
| 2 | Discipline Specific Elective Courses (DSE) | 16 |
| 3 | Skill Enhancement Courses (SEC) | 08 |
| 4 | Internship | 02 |
| **Total** | | **90** |

## SCHEME OF CREDIT DISTRIBUTION – SUMMARY

| Sl. No | Course Category | Credits per Semester | | | | Total Credits |
|---|---|---|---|---|---|---|
| | | I | II | III | IV | |
| 1 | Discipline Specific Core Courses (DSC) | 16 | 16 | 16 | 16 | 64 |
| 2 | Discipline Specific Elective Courses (DSE) | 4 | 4 | 4 | 4 | 16 |
| 3 | Skill Enhancement Courses (SEC) | 2 | 2 | 2 | 2 | 8 |
| 4 | Internship | - | - | 2 | - | 2 |
| **Total** | | **22** | **22** | **24** | **22** | **90** |

| SEMESTER – I | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Title** | **Category** | **Periods** | | | **Credits** | **Max. Marks** | | |
| | | | | **L** | **T** | **P** | | **CAM** | **ESM** | **Total** |
| **Theory** | | | | | | | | | | |
| 1 | A23PCHT101 | Inorganic Chemistry – I | **DSC** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 2 | A23PCHT102 | Organic Chemistry – I | **DSC** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 3 | A23PCHT103 | Physical Chemistry – I | **DSC** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 4 | A23PCHE10X | DSE - I* | **DSE** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| **Practical** | | | | | | | | | | |
| 5 | A23PCHL101 | Organic Chemistry Lab -I | **DSC** | 0 | 0 | 4 | 2 | 50 | 50 | 100 |
| 6 | A23PCHL102 | Inorganic Chemistry Lab – I | **DSC** | 0 | 0 | 4 | 2 | 50 | 50 | 100 |
| **Skill Enhancement Course** | | | | | | | | | | |
| 7 | A23PCMS102 | Professional Skills | **SEC** | 2 | 0 | 0 | 2 | 100 | - | 100 |
| | | | **First Semester Total** | | | | 22 | 300 | 400 | 700 |

| SEMESTER – II | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Title** | **Category** | **Periods** | | | **Credits** | **Max. Marks** | | |
| | | | | **L** | **T** | **P** | | **CAM** | **ESM** | **Total** |
| **Theory** | | | | | | | | | | |
| 1 | A23PCHT204 | Inorganic Chemistry – II | **DSC** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 2 | A23PCHT205 | Organic Chemistry – II | **DSC** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 3 | A23PCHT206 | Physical Chemistry – II | **DSC** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 4 | A23PCHE20X | DSE - II* | **DSE** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| **Practical** | | | | | | | | | | |
| 5 | A23PCHL203 | Physical Chemistry Lab –I | **DSC** | 0 | 0 | 4 | 2 | 50 | 50 | 100 |
| 6 | A23PCHL204 | Inorganic Chemistry Lab – II | **DSC** | 0 | 0 | 4 | 2 | 50 | 50 | 100 |
| **Skill Enhancement Courses** | | | | | | | | | | |
| 7 | A23PMAS201 | Quantitative Reasoning and Research Aptitude | **SEC** | 2 | 0 | 0 | 2 | 100 | - | 100 |
| **Second Semester Total** | | | | | | | 22 | 300 | 400 | 700 |

***Discipline Specific Electives are to be selected from the list given in Annexure I***

| SEMESTER – III | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Title** | **Category** | **Periods** | | | **Credits** | **Max. Marks** | | |
| | | | | **L** | **T** | **P** | | **CAM** | **ESM** | **Total** |
| **Theory** | | | | | | | | | | |
| 1 | A23PCHT307 | Inorganic Chemistry – III | **DSC** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 2 | A23PCHT308 | Organic Chemistry – III | **DSC** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 3 | A23PCHT309 | Physical Chemistry – III | **DSC** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 5 | A23PCHE30X | DSE - III* | **DSE** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| **Practical** | | | | | | | | | | |
| 6 | A23PCHL305 | Organic Chemistry Lab - II | **DSC** | 0 | 0 | 4 | 2 | 50 | 50 | 100 |
| 7 | A23PCHL306 | Physical Chemistry Lab - II | **DSC** | 0 | 0 | 4 | 2 | 50 | 50 | 100 |
| **Skill Enhancement Courses** | | | | | | | | | | |
| 8 | A23PCHS301 | Advance Research Methodology in Chemistry | **SEC** | 2 | 0 | 0 | 2 | 100 | 0 | 100 |
| **Internship** | | | | | | | | | | |
| 9 | A23PCHN301 | Internship | DSC | 0 | 0 | 4 | 2 | 40 | 60 | 100 |
| **Third Semester Total** | | | | | | | 24 | 340 | 460 | 800 |

***Discipline Specific Electives are to be selected from the list given in Annexure I***

| SEMESTER – IV | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Title** | **Category** | **Periods** | | | **Credits** | **Max. Marks** | | |
| | | | | **L** | **T** | **P** | | **CAM** | **ESM** | **Total** |
| **PROJECT** | | | | | | | | | | |
| 1 | A23PCHT410 | Organic Chemistry – IV | **DSC** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 2 | A23PCHT411 | Physical Chemistry – IV | **DSC** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 3 | A23PCHE40X | DSE - IV* | **DSE** | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| **Practical** | | | | | | | | | | |
| 4 | A23PCHL407 | Industrial Chemistry Lab - II | **DSC** | 0 | 0 | 4 | 2 | 50 | 50 | 100 |
| **PROJECT** | | | | | | | | | | |
| 5 | A23PCHP401 | Project Work | **DSC** | 0 | 0 | 10 | 6 | 40 | 60 | 100 |
| **SKILL ENHANCEMENT COURSES** | | | | | | | | | | |
| 6 | A23PCHS402 | Health Science | **SEC** | 2 | 0 | 0 | 2 | 100 | - | 100 |
| | | | **Fourth Semester Total** | | | | 22 | 265 | 335 | 600 |

***Discipline Specific Electives are to be selected from the list given in Annexure I***

# *Annexure I*

## DISCIPLINE SPECIFIC ELECTIVE COURSES*

| **Discipline Specific Elective – I (Offered in Semester I)** | | |
|---|---|---|
| **Sl. No.** | **Course Code** | **Course Title** |
| 1 | A23PCHE101 | Industrial Products |
| 2 | A23PCHE102 | Material Science |
| 3 | A23PCHE103 | Chemistry Of Heterocyclic And Natural Products |

| **Discipline Specific Elective – II (Offered in Semester II)** | | |
|---|---|---|
| **Sl. No.** | **Course Code** | **Course Title** |
| 1 | A23PCHE204 | Cheminformatics |
| 2 | A23PCHE205 | Asymmetric Synthesis |
| 3 | A23PCHE206 | Green Chemistry |

| **Discipline Specific Elective – III (Offered in Semester III)** | | |
|---|---|---|
| **Sl. No.** | **Course Code** | **Course Title** |
| 1 | A23PCHE307 | Bioorganic Chemistry |
| 2 | A23PCHE308 | Basics of forensic Science |
| 3 | A23PCHE309 | Polymer And Plastics |

| **Discipline Specific Elective – IV (Offered in Semester IV)** | | |
|---|---|---|
| **Sl. No.** | **Course Code** | **Course Title** |
| 1 | A23PCHE410 | Pharmaceutical Chemistry |
| 2 | A23PCHE411 | Inorganic Chemistry-IV |
| 3 | A23PCHE412 | Stereochemistry |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **First** | Course Category Code: DSC | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHT101** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **INORGANIC CHEMISTRY - I** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To study the periodic table and atomic structure. | | | | | | | |
| | • To know the chemistry of covalent bond. | | | | | | | |
| | • To study the cement, glass and ceramics. | | | | | | | |
| | • To analyze the transition and inner transition elements. | | | | | | | |
| | • To acquire knowledge about the different nuclear reactions and applications | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping (Highest Level) |
|---|---|---|
| | **CO1** Comprehend the electronic structure of atoms and periodic properties of elements | **K3** |
| | **CO2** Apply the concepts of VB, MO and VSEPR theory to determine the structure of molecules | **K3** |
| | **CO3** Illustrate acid-base concepts, its measures and to evaluate various effects on acid base strength | **K3** |
| | **CO4** Students should able to learn about the chemistry of inner transition elements and their applications. | **K3** |
| | **CO5** Understand nuclear Chemistry | **K3** |

| **UNIT-I** | **ATOMIC STRUCTURE AND PERIODIC TABLE** | **Periods: 12** |
|---|---|---|
| Modern views on atomic structure: wave mechanical description of electron and orbitals, radial density functions and orbital energies, angular functions and orbital shapes. Quantum numbers - Theories of quantum numbers– Aufbau principle – Zeeman Effect - Stability of half-filled and completely filled orbitals– Electronic configuration - Electron Angular momentum in atoms Effective nuclear charge- Slater rule and their uses: computation of and radii of atoms anions. Modern periodic table: periodic properties, trends and the underlying reasons. | | **CO1** |
| **UNIT-II** | **COVALENT BOND** | **Periods: 12** |
| Molecular topologies: shared and lone pairs and Lewis structures, isoelectronic and isolable relationships, hybridization and geometry, VSEPR model, and Bent's rule. Molecular Orbital Theory: Symmetry of molecular orbitals formed from atomic orbital overlap, Extended Huckel theory of Hartree-Fock approximation (SCF), LCAO- MO model, TASO, LUMO, and HOMO concepts in bonding. MO energy level diagrams of homo diatomic and hetero dinuclear molecules (CO, NO, and HCI). Bonding in metals: packing of atoms in metals, band theory of metals and metallic properties, insulators, and semiconductors | | **CO2** |
| **UNIT-III** | **ACID- BASE THEORY AND SOLVENT SYSTEMS** | **Periods: 12** |
| Acid-Base theories: Bronsted-Lowry, Lux-Flood, Usanovich, Lewis and solvent system definitions,measures of acid-base strength, Factors affecting the strength of acids and bases Common ion effect and Henderson's equation-Hard and Soft acids and bases – symbiosis – theoretical basis of hardness and softness. Classification, properties and uses of solvents – protic, aprotic, superacids, molten salts as solvents,ionic liquids (gel effects) properties of ionizing solvents. Typical reactions in non–aqueous solvents- liquid HF, liquid $SO_2$, liquid $NH_3$, and Sulphuric acid. | | **CO3** |
| **UNIT-IV** | **TRANSITION & INNER TRANSITION ELEMENTS** | **Periods: 12** |

| | |
|---|---|
| Transition elements - general characteristics - Inner transition elements - position in the periodic table - electronic configuration, oxidation states, solubility, colour and spectra, magnetic properties - separation of lanthanides - lanthanide contraction: causes and consequences - gadolinium break, shift reagents - extraction of thorium and uranium- comparison of actinides and lanthanides. | **CO4** |

| **UNIT-V** | **NUCLEAR CHEMISTRY** | **Periods: 12** |
|---|---|---|

| | |
|---|---|
| Radioactive decay and equilibrium- Different types of nuclear reaction – spallation –fission and fusion. Theories of fission. Fissile and Fertile isotopes. -Nuclear fusion – stellar Energy-Nuclear forces:Liquid drop model, shell Model-Calculation of Q-values – Cross section. Detectors: Scintillation counter, Gas Ionisation chamber. Proportional Counter, Cerenkov Counter- Accelerators: Cyclotron, Synchrocyclotron, Betatron. Radio isotopes and their Applications: Activation analysis, Isotopic dilution technique-radiometric titration. Nuclear reactors: Types (Thermo nuclear and breeder reactors) feed materials production. Reprocessing of nuclear materials waste disposal. | **CO5** |

| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |
|---|---|---|---|

**Text Books**


1. Huheey, J. E.; Keiter, E. A. Keiter, R. L. “Inorganic Chemistry”, Harper and Row:New York, 4th Edition,1983.
2. Cotton, F. A.; Wilkinson, G.; Murillo, C. A.; Bochmann, M. “Advanced Inorganic Chemistry”, Wiley Interscience: New York, 6th Edition, 1988.
3. Purcell, K. F.; Kotz, J. C. “Inorganic Chemistry” Saunders: Philadelphia, 2nd Edition, 1976


**Reference Books**


1. Moeller, T. “Inorganic Chemistry, A Modern Introduction”, John Wiley: New York, 1982.
2. Shriver, D. F.; Atkins, P. W.; Langford, C. H. “Inorganic Chemistry”, 3rd ed.; Oxford University Press: London, 2001.
3. Stout, G. H.; Jenson, L. H. X-Ray Structure Determination, 2nd ed.; John Wiley & Sons: NewYork,1989.
4. West, A. R. Solid State Chemistry and its Applications, John Wiley & Sons: New York,1989.
5. Rhodes, G. Crystallography Made Crystal Clear; Academic Press, Inc.: New York,1993.


**Web References**

1. https://nptel.ac.in/
2. https://ocw.mit.edu/courses/chemistry/
3. https://swayam.gov.in

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **First** | Course Category Code: **DSC** | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHT102** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **ORGANIC CHEMISTRY - I** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |

| | | | |
|---|---|---|---|
| Prerequisite | Basic Knowledge studied in the UG Level | | |
| Course Objectives | • To learn basic organic mechanism and study the rate law | | |
| | • To analyze various types of rearrangement reactions | | |
| | • To understand about oxidation and reduction reaction in the organic compounds | | |
| | • To study the stereochemistry with configuration | | |
| | • To evaluate the design and synthesis of new organic compounds. | | |
| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping(Highest Level) |
| | **CO1** | Recall the basic principles of organic reaction mechanism and rate law | **K3** |
| | **CO2** | Understand the various types of rearrangement reaction | **K3** |
| | **CO3** | Categorize the reaction based on oxidation and reduction. | **K3** |
| | **CO4** | predict the reaction mechanism of organic reactions and stereochemistry of organic compounds | **K3** |
| | **CO5** | Design and synthesize new organic compounds by correlating the stereochemistry of organic compounds | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **MECHANISMS AND METHODS** | **Periods: 12** |
| Types of mechanism; Reagents and reactions. Thermodynamic and kinetic requirements of reactions; Baldwin rules for ring closure; Hammond postulate; microscopic reversibility and Marcus theory Methods of determining mechanism: Non-kinetic methods: identification of products and intermediates; isotopic labelling; stereo chemical evidences; isotopic effects; cross-over experiments, trapping of intermediates. Kinetic methods- determination of rate law and rate constants; relation of rate with the mechanism of reaction. | | **CO1** |
| **UNIT-II** | **REARRANGEMENT REACTIONS** | **Periods: 12** |
| Types of rearrangements: Nucleophilic; free radical and electrophilic reactions. Mechanisms: Nature of migration; migratory aptitude and memory effects, ring enlargement and ring contraction rearrangements. Reactions: Wagner-Meerwin and related reactions, Benzil- benzilic acid, Favorskii, Hofmann and related rearrangements, Beckmann, Neber, Baeyer-Williger, Stevens. Claisen rearrangements, boron-carbon migration, Non- 1,2-rearrangements, Fischer- indole synthesis, Arndt- Eistert synthesis. | | **CO2** |
| **UNIT-III** | **OXIDATION AND REDUCTION REACTIONS** | **Periods: 12** |
| Mechanisms: direct electron transfer, hydride transfer, displacement_ addition- elimination and formation of ester intermediates. Oxidation Reactions: Aromatization of six membered rings; dihydro elimination; oxidation of alcohols and dehydrogenation of amines; Reactions involving cleavage of C- C bonds; ozonolysis; cleavage of double bonds; oxidative decarboxylation. Reduction Reactions involving replacement of oxygen by hydrogen: - Wolff Kishner and Clemmenson reductions; Removal of Oxygen from substrate; Reduction with cleavage; Reductive coupling. | | **CO3** |
| **UNIT-IV** | **STEREOCHEMISTRY-I** | **Periods: 12** |

| | |
|---|---|
| Optical isomerism due to asymmetric carbon atoms Racemic modifications; racemization; thermal, anion, cation, reversible formation Epimerisation; mutarotation; I and II order asymmetric transformations Resolution of racemic modifications; asymmetric transformations; asymmetric synthesis destruction; Cram's and Prelog's rules; absolute asymmetric synthesis. Criteria for optical purity; D, L, R, S- notations; Cahn- Ingold- Prelog rules, absolute and relative configuration; configurations of allenes ,spiranes, and biphenyls. | **CO4** |

| **UNIT-V** | **STEREOCHEMISTRY-II** | **Periods: 12** |
|---|---|---|

| | |
|---|---|
| Conformation and reactivity of acyclic systems; intramolecular rearrangement; neighbouring group participation; Curtin-Hammet principle. Stability of six and seven-membered rings; mono and disubstituted cyclohexanes; conformation and reactivity in cyclohexane systems. Fused and bridged rings; bicyclic and polycyclic systems; decalins and Brett'srule. optical rotation and optical rotatory dispersion; conformational asymmetry, ORD curves; octant rule; configuration and conformation; Cotton effect; axial haloketone rule; Determination of configuration. Stereo selective synthesis: Synthesis of yohimbine, reserpine | **CO5** |

| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |
|---|---|---|---|

**Text Books**

1. J. March and M. Smith, Advanced Organic Chemistry, 5th edn, John-Wiley and Sons.2001.
2. E.S. Gould, Mechanism and Structure in Organic Chemistry Holt, Rinehart and Winston Inc.,1959.
3. E.L. Eliel, Stereochemistry of Carbon Compounds, Tata-McGraw Hill, (2000)

**Reference Books**

1. P.S. Kalsi, Stereochemistry, 3rd edition, New Age International Publishers,1995.
2. I.L. Finar, Organic chemistry, Vol-1, 6th edition, Pearson Education Asia.2004
3. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry Part-A and B, 4th edition, Kluwer Academic/Plenum Publishers. 2000.

**Web References**

1. https://bit.ly/3zT4PUq
2. https://www.organic-chemistry.org/
3. https://www.studyorgo.com/summary.php 4

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT | CAT | Model | Assignment* | Attendance | | |

| | 1 | 2 | Exam | | | | |
|---|---|---|---|---|---|---|---|
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | | Programme: M.Sc. Chemistry | | | | | |
| Semester | **First** | | Course Category Code: **DSC** | | | *End Semester Exam Type: **TE** | | |
| Course Code | **A23PCHT103** | | Periods/Week | | | Credit | Maximum Marks | |
| | | | L | T | P | C | CAM | ESE | TM |
| Course Name | **PHYSICAL CHEMISTRY - I** | | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To study the fundamental principles of Quantum Chemistry, Schrodinger wave equation and its applications | | | | | | | |
| | • To expose the ideas on theories of reaction rate | | | | | | | |
| | • To give an in-depth knowledge on thermodynamics | | | | | | | |
| | • To understand the concepts of statistical thermodynamics | | | | | | | |
| | • To give insight into the applications of the M-B, B-E and F-D statistics. | | | | | | | |
| Course Outcome | **On completion of the course, the students will be able to** | | | | | BT Mapping(Highest Level) | | |
| | **CO1** | Identify the limitations of classical mechanics | | | | **K3** | | |
| | **CO2** | Apply the quantum chemistry to solve the Schrödinger wave equation for one, two and three dimensional box | | | | **K3** | | |
| | **CO3** | Gain knowledge on theories of reaction rates and applications of reaction kinetic chemistry | | | | **K3** | | |
| | **CO4** | Illustrate the relationship between microscopic properties of individual atoms and molecules with macroscopic thermodynamic observables and derive the different types of distribution laws. | | | | **K3** | | |
| | **CO5** | Derive thermodynamic functions in terms of partition functions | | | | **K3** | | |

| **UNIT-I** | **QUANTUM CHEMISTRY** | **Periods: 12** |
|---|---|---|
| Inadequacy of classical mechanics, Black body radiation, Planck's quantum concepts, Photoelectric effect. Bohr's theory of hydrogen atom: Hydrogen spectra, de Broglie principle, Uncertainty principle, Inadequacy of Bohr theory. Wave equation, Derivation of time dependent and independent Schrodinger equation- Postulates of quantum mechanics, well behaved function- orthogonality and normalization. Operator algebra: operator, linear and hermitian, Verification of operators Hamiltonian - Eigen functions and Eigen values, angular momentum operator, communication relations, related theorems. Applications of wave mechanics to simple systems – particle in a box, one, two and three – dimensional, distortion of the box, quantum numbers, zero – point energy, finite potential barrier. | | **CO1** |
| **UNIT-II** | **CHEMICAL KINETICS – I** | **Periods: 12** |
| Theories of reaction rates and reaction mechanism - Arrhenius equation -Potential energy surfaces and reaction coordinates - Collision theory – ARRT(thermodynamic treatment only)–Applications of ARRT to unimolecular, bimolecular and termolecular reactions - Kinetic isotope effect, iso kinetic relation and temperature - Theories of unimolecular reactions – Lindemann and RRK - Principle of microscopic reversibility-Steady state approximation Chain reactions. Thermal and photochemical reactions between hydrogen and halogens – Explosions and hydrogen – oxygen reactions. | | **CO2** |
| **UNIT-III** | **CHEMICAL KINETICS – II** | **Periods: 12** |

| | |
|---|---|
| Application of ARRT to solution kinetics - Factors affecting reaction rate in solution-. Internal pressure - Solvent dielectric constant - Ionic strength -Hydrostatic pressure - Ion-dipole and dipole-dipole reactions – van't Hoff equation and volume of activation - Catalysis Characterics of a catalyst –Factors affecting Catalytic reactions - Types of Catalysis- homogeneous catalysis – Acid base catalysis – Van't Hoff and Arrhenius intermediates- Mechanism - protolytic and prototropic catalysis laws - Acidity functions -Hammett - Zucker hypothesis - Catalysis in biological systems. Michaelis -menten equation – Lineweaver - Burk and Eadie-Hofstee plots - influency of substrate concentration, pH, and temperature on rate - Influence of substituent's on reaction rates – Hammett and Taft equations - Linear free energy relations. | **CO3** |
| **UNIT-IV** **FUNDAMENTALS OF STATISTICAL THERMODYNAMICS** **Periods: 12** | |
| Statistical method - microstates- macro states - permutations and combinations – combinatory rule - probability theorems - ensembles - phase space - thermodynamic probability - statistical equilibrium - Maxwell Boltzmann statistics - derivation of M.B. statistics - relationship between entropy and probability - heat capacity of solids - Einstein and Debye models - statistical meaning of third law of thermodynamics. | **CO4** |
| **UNIT-V** **APPLICATIONS OF STATISTICAL THERMODYNAMICS** **Periods: 12** | |
| Partition functions - molar- translational- rotational and vibrational partition functions of diatomic and polyatomic molecules - separation of partition function according to forms of energy-partition function and vibrational energy - total partition function - electronic partition function-derivation of thermodynamic quantities E, S, A, H, G, K and Cp, Cv using partition function-Sackur-Tetrode equation - Bose - Einstein statistics - Fermi - Dirac statistics -electronic heat capacity of gases - equipartition of energy - classical and quantum statistical theory of heat capacities - heat capacities for diatomic molecule - rotational heat capacity of hydrogen molecule - nuclear spin statistics - nuclear spin entropy- quantum statistics | **CO5** |

| | | | |
|---|---|---|---|
| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |

**Text Books**

1. R.K.Prasad - Quantum Chemistry - New Age International (P) Ltd. Publishers, New Delhi,3rd Edition 2006.
2. Puri, B.R. and Sharma, L.R. and Madan S.Pathania, "Principles of Physical Chemistry", Vishal Publishing 48th Edition, 2021
3. B.G.Kyle - Chemical and Process Thermodynamics - Prentice Hall of India, 3rd Edition, 2004.

**Reference Books**

1. Ira N. Levine - Quantum Chemistry - Prentice Hall of India, New Delhi, 5th Edition, 2006
2. KeithJ.Laidler - Chemical Kinetics - Pearson Edition Company Pvt. Ltd.,Third Edition, 2005.
3. M.C.Gupta - Statistical Thermodynamics - New Age International, 2nd Edition, 2003.
4. R.C.Srivatsava, Subit K. Saha, Abhay K. Jain - Thermodynamics: A Core Course -PHC Pvt. Ltd., 2nd Edition, 2005.

**Web References**

1. https://chem.libretexts.org/Courses/MountRoyalUniversity/Chem1201/Unit1%3AQuantumChemistry
2. http://www.yorku.ca/stynes/kindvs309.pdf
3. https://sites.krieger.jhu.edu/jared-kaplan/files/2018/11/StatisticalMechanicsNotes.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| **1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **3** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| **4** | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| **5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | End Semester | Total |
|---|---|---|---|

| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | Examination (ESE) Marks | Marks |
|---|---|---|---|---|---|---|---|
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | | | Programme: M.Sc. Chemistry | | | | |
| Semester | **First** | | | Course Category Code: **DSE** | | *End Semester Exam Type: **TE** | | |
| Course Code | **A23PCHE101** | | | Periods/Week | | | Credit | Maximum Marks |
| | | | | L | T | P | C | CAM / ESE / TM |
| Course Name | **INDUSTRIAL PRODUCTS** | | | **4** | **-** | **-** | **4** | **25 / 75 / 100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To acquire the knowledge on cement and glass manufacturing<br>• To study the paints manufacturing and various constituents<br>• To know chemistry of fiber, plastic and rubber<br>• To study the industrial gasses and petroleum products<br>• To analyze the various cosmetics products. | | | | | | | |
| Course Outcome | **On completion of the course, the students will be able to** | | | | | | | BT Mapping(Highest Level) |
| | **CO1** | Understand the manufacture processes of cement, glass their physicochemical properties | | | | | | **K3** |
| | **CO2** | Able to classify dyes, pigments and paints. | | | | | | **K3** |
| | **CO3** | Understand the importance of plastic and fibers. | | | | | | **K3** |
| | **CO4** | Explain the petroleum and fuel gases and applications of fertilizers. | | | | | | **K3** |
| | **CO5** | Illustrate the preparation and uses of shampoo, dye, soap and detergents. | | | | | | **K3** |
| **UNIT-I** | **CEMENT AND GLASS** | | | | | | **Periods: 12** | |
| Cement - analysis of major constituents, Composition, different methods of manufacturing and uses - Portland cement - Composition, different methods of manufacturing (Wet and Dry process), uses – Setting and hardening of cement, Glass- Composition, Types of glasses, method of manufacturing - Melting, Blowing, Pressing, Annealing and finishing- chemical and physical properties of glass. | | | | | | | | **CO1** |
| **UNIT-II** | **PIGMENTS, DYES AND PAINTS** | | | | | | **Periods: 12** | |
| Paints - Primary constituents of paints, Composition, Types, Manufacture and testing of Paints. Dispersion medium (solvent), binder Pigments, formulation of paints. Requirements of a good paint. Pigments - Classification, Manufacture and uses. Dyes - Classification, preparation, dyeing processes. | | | | | | | | **CO2** |
| **UNIT-III** | **FIBERS, PLASTICS AND RUBBER** | | | | | | **Periods: 12** | |
| Fibres – definition - difference between Natural and synthetic fibres-properties of synthetic fibres - Artificial silk, rayon, nylon and Terylene Plastics - composition, Classification, manufacture, properties and uses recycling of plastics Rubber: types of rubber-synthetic rubber- natural rubber - Vulcanizations of Rubber- properties and uses of rubber. | | | | | | | | **CO3** |

| UNIT-IV | FERTILIZERS AND FUELS | Periods: 12 | |
|---|---|---|---|
| Fertilizers -Types of Fertilizers: Organic and Inorganic fertilizers, Preparation and uses, Fuel Gases: coal gas, water gas, producer gas, and oil gas. Petroleum: synthetic petrol manufacturing, refining, cracking, reforming, knocking and octane number, LPG. | | | CO4 |
| **UNIT-V** | **COSMETICS** | **Periods: 12** | |
| Shampoo- composition and its preparation, lipstick -preparation, Face cream and face powder composition and their preparation. Hair dyes - chemical and herbal dyes. Perfumes and Deodorants. Soaps: manufacture of soaps by hot and cold process, classification of soap, cleansing of soap and classification of detergents (anionic and cationic). | | | CO5 |
| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |

**Text Books**

B.K. Sharma, —Industrial Chemistryǁ, Goel publishing house, 6th Edition, 2011.
2. Joseph Henry Stephenson, —Industrial Chemistry—, Leopold Classic Library, 1st Edition, 2015.
3. M Kelway Bambe, —A Text Book on the Chemistry and Agriculture of Teaǁ, Franklin Classics Trade Press, 1st Edition, 2018.

**Reference Books**

B.N.Chakrabarty, "Industrial Chemistry", Oxford & IBH Publishing Co, New Delhi, 4th Edition, 1981.
2. P.P.Singh, T.M.Joseph, R.G.Dhavale, "College Industrial Chemistry", Himalaya Publishing House, Bombay, 4th Edition., 1983.
3. O.P. Veramani, A.K. Narula, "Industrial Chemistry", Galgotia publication Pvt. Ld, 1st Edition, 2004.

**Web References**

1. https://www.toppr.com/guides/business-environment/scales-of-business/small-scale-industries/
2. https://www.britannica.com/science/pollution-environment
3. http://www.falzongroup.com/our-products-and-services/fuel-for-industry

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | | Programme: M.Sc. Chemistry | | | | |
| Semester | **First** | | Course Category Code: **DSE** | | *End Semester Exam Type: **TE** | | |
| Course Code | **A23PCHE102** | | Periods/Week | | | Credit | Maximum Marks |
| | | | L | T | P | C | CAM / ESE / TM |
| Course Name | **MATERIAL SCIENCE** | | **4** | **-** | **-** | **4** | **25 / 75 / 100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | |
| Course Objectives | • To understand the crystal structure, growth methods and X-ray scattering<br>• To explain the optical, dielectric and diffusion properties of crystals<br>• To recognize the basis of semiconductors, superconductivity materials and magnets<br>• To study the synthesis, classification and applications of nanomaterials<br>• To learn about the importance of super conductors | | | | | | |
| Course Outcome | **On completion of the course, the students will be able to** | | | | | | BT Mapping(Highest Level) |
| | **CO1** | Understand X-ray structure determination and identification of lattice structure | | | | | **K3** |
| | **CO2** | Analyze the magnetic properties of the materials | | | | | **K3** |
| | **CO3** | Apply the x-ray diffraction in the study | | | | | **K3** |
| | **CO4** | Utilize ceramics and nanomaterials in the scientific applications | | | | | **K3** |
| | **CO5** | Harvest solar energy in the energy production. | | | | | **K3** |

| **UNIT-I** | **STRUCTURE OF SOLIDS** | **Periods: 12** | |
|---|---|---|---|
| Introduction to solids – Crystalline and Amorphous unit cell – Bravais lattice and x-ray structure determination (NaCl and KCl only), Powder and single crystal – methods and its application with NLO properties – Identification of the cubic lattice and indexing of the x-ray diffraction lines Radius ratio rules – co-ordination number packing arrangement – different structure types in Solid – rock salt, Zinc blende wurzite, fluorite and antifluorite, spinel and inverse – spinel and perovskite structures. | | | **CO1** |
| **UNIT-II** | **MAGNETIC PROPERTIES** | **Periods: 12** | |
| Types of Magnetism – Dia – Para – Ferro and anti-ferromagnetism. Magnetic properties of free ions – First order second order Zeeman Effect – states KT – States, KT Determination of Magnetic moments and their application to elucidation of structures of inorganic compounds temperature – temperature independent paramagentism. Magnetic | | | |

| | |
|---|---|
| properties of lanthanides and actinides – orbital contribution to magnetic moment, range of μeff for various complexes Guoy's method spin crossover in co-ordination compounds | **CO2** |

| **UNIT-III** | **X-RAY DIFFRACTION** | **Periods: 12** |
|---|---|---|

| | |
|---|---|
| X-ray diffraction by single crystal, space groups – systematic absences in x-ray data and identification of lattice types, glid planes and screw axis- x-ray intensities, structure factor (R-value) and its relation to intensity and electron density – phase problem. Electron diffraction by gases – scattering intensity vs scattering angle, wierl equation, measurement technique. Neutron diffraction by crystals – magnetic scattering – measurement techniques. | **CO3** |

| **UNIT-IV** | **CERAMICS** | **Periods: 12** |
|---|---|---|

| | |
|---|---|
| Ceramics – types and application – composites – classification – processing of fiber Reinforced plastics – metallic glasses types, glass – glass forming ability of alloys – melt spinning process – applications – shape memory effect – Nano material preparation (bottom up and top down approaches) proportion and its application – carbon – nano tubes. | **CO4** |

| **UNIT-V** | **SUPER CONDUCTORS** | **Periods: 12** |
|---|---|---|

| | |
|---|---|
| Super conductors – materials – Basic concept – types characteristics - application solar energy materials – Photo thermal conversion , Solar electric coating enhanced solar thermal energy collection – photovoltic conversion – solar cells, silicon, Cadmium sulphide and Gallium arsenic – organic solar cells. | **CO5** |

| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |
|---|---|---|---|

**Text Books**

. 1. S. Mohan and V. Arjunan, Principles of Materials Science, MJP Publishers, 2016.
2. Arumugam, Materials Science, Anuradha Publications, 2007.
3. Giacavazzoet. al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010

**Reference Books**

1. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012.
2. James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science for Engineers. 6th ed., PEARSON Press, 2007.
3. P.K. Palanisamy, Materials Science, Scitech Publications, India, 2002.
4. T. Balachandran, Materials Science, Charulatha Publications, India, 2003.

**Web References**

1. http://xrayweb.chem.ou.edu/notes/symmetry.html.
2. http://www.uptti.ac.in/classroom-content/data/unit%20cell.pdf.
3. https://bit.ly/3QyVg2R

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| **1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **3** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| **4** | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| **5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **First** | Course Category Code: **DSE** | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHE103** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **CHEMISTRY OF HETEROCYCLICS AND NATURAL PRODUCTS** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |

| | | |
|---|---|---|
| Prerequisite | Basic Knowledge studied in the UG Level | |
| Course Objectives | • To Classify heterocyclic - nomenclature, structure, biosynthesis, occurrence, analysis and pharmaceuticalperspectives of natural products | |
| | • To elucidate the structure of alkaloids | |
| | • To study the biological importance of terpenes | |
| | • To learn about steroids with biological importance | |
| | • To know the structure and synthesise of anthocyanins | |
| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
| | **CO1** Understand the basic concepts of biomolecules and natural products. | **K3** |
| | **CO2** Integrate and assess the different methods of preparation of structurally different natural products. | **K3** |
| | **CO3** Illustrate the applications of biomolecules and their functions in the metabolism of livingorganisms. | **K3** |
| | **CO4** Analyse and rationalise the structure determination of steroids | **K3** |
| | **CO5** Analyze nature and structure of anthocyanins | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **HETEROCYCLIC CHEMISTRY** | **Periods: 12** |
| Nomenclature – reactivity – aromaticity – spectral properties.Elementary study of the following systems only – indole, isoindole – oxazole, imidazole, thiazole, pyridines, pyrimidine, pyridazine, pyrazine, chromans, chromons, coumarins, carbazoles, uracil, uric acid, xanthiones and flavonoids. | | **CO1** |
| **UNIT-II** | **ALKALOIDS** | **Periods: 12** |
| General methods of structural elucidation of alkaloids – a general survey. The structural elucidation of Belladine, Papaverine, Cocaine, Atropine, Heptaphylline, Peepuloidin, Morphine. | | **CO2** |
| **UNIT-III** | **TERPENES** | **Periods: 12** |
| General methods of determination of structure. Structural elucidation of Camphor, Cadinene, Vitamin A, Abietic acid, Gibberelic acid, Zinziberine and Squalene | | **CO3** |
| **UNIT-IV** | **STEROIDS** | **Periods: 12** |
| Conformations of stereoids - molecular rearrangements (acid and base catalysed, photochemical). Synthesis of steroids – ring forming reaction and control of ring junction stereochemistry. Synthesis of cholestrol, androgens, oestrone, progesterone and cortisone. (questions on complete synthesis is not included for examination) | | **CO4** |

| UNIT-V | ANTHOCYANINS | Periods: 12 | |
|---|---|---|---|
| General nature of anthocyanins – structure of the anthocyanidins. General methods of synthesizing anthocyanidins. Structural elucidation of cyanidin chloride, pelargolidin chloride, Hirsutidin chloride. Flavones – flavonols – isoflavones. Biosynthesis of flavonoids – depsides – tannins. | | | CO5 |
| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |

**Text Books**

1. O.P. Agarwal, Chemistry of Organic Natural Products, Vol.1, Goel Publishing House,Meerut, 1997.
2. L. Finar, Organic Chemistry Vol-2, 5th edn, Pearson Education Asia, 1975.
3. M. P. Singh and H. Panda, Medicinal Herbs with their formulations, Daya Publishing House, Delhi,2005. 6. V. K. Ahluwalia, Steroids and Hormones, Ane books pub., New Delhi, 2009.

**Reference Books**

1. I. L. Finar, Organic Chemistry Vol-1, 6thedition, Pearson Education Asia, 2004.
2. Pelletier, Chemistry of Alkaloids, Van Nostrand Reinhold Co, 2000.
3. Shoppe, Chemistry of the steroids, Butterworthes, 1994.
4. I. A. Khan, and A. Khanum. Role of Biotechnology in medicinal & aromatic plants, Vol 1 and Vol10, Ukkaz Publications, Hyderabad, 2004.

**Web References**

1. https://bit.ly/39LXStz
2. https://www.organic-chemistry.org/
3. https://www.studyorgo.com/summary.php

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Commerce and Management** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **First** | Course Category Code: SEC | | | *End Semester Exam Type: | | | |
| Course Code | **A23PCMS102** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **PROFESSIONAL SKILLS** | **2** | **-** | **-** | **2** | **100** | **-** | **100** |
| Prerequisite | Intra- personal skills and basic for communication skills | | | | | | | |

| | |
|---|---|
| Course Objectives | • To enable the students to understand the importance of Interpersonal and Team skills.<br>• To Acquire Different Interpersonal and Team skills to be an employable person.<br>• To know how to communicate in an emotionally intelligent way.<br>• To identify needed information and/or eliminate extraneous information towards solving<br>• To achieve the desired result of a good employability through Team work. |

| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping (Highest Level) |
|---|---|---|---|
| | **CO1** | Remember the various Interpersonal skill requirements in organizational entry level | **K3** |
| | **CO2** | Understand the need for different communication skill requirement at different occasions | **K3** |
| | **CO3** | Understand what Emotional Intelligence is and why it is important | **K3** |
| | **CO4** | Demonstrate a good Problem solving skill in work environment | **K3** |
| | **CO5** | Demonstrate their ability in team work to achieve desired result | **K3** |

| | | | |
|---|---|---|---|
| **UNIT-I** | **INTRODUCTION TO INTERPERSONALSKILL** | **Periods: 6** | |
| Introduction to Interpersonal skills – definition – Importance of interpersonal skills - Developing Your Interpersonal Skills – Types of Interpersonal relationships – uses of Interpersonal relationships skills – Factors affecting Interpersonal Relationships – How to accommodate different styles – consequences of Interpersonal relationships | | | **CO1** |
| **UNIT-II** | **COMMUNICATION SKILLS** | **Periods: 6** | |
| Introduction – Meaning – Process of communication – Tools for communication – Verbal communication –Non – Verbal communication– Dealing with Conflict– Communication Barriers. | | | **CO2** |
| **UNIT-III** | **EMOTIONAL INTELLIGENCE** | **Periods: 6** | |
| Emotional intelligence, emotional quotient, ability to understand, use manage own emotions, positive ways to relieve stress, empathy and resolving conflict. | | | **CO3** |
| **UNIT-IV** | **PROBLEM SOLVING** | **Periods: 6** | |
| Introduction – Need for problem Solving – Skills for Problem Solving –Process of Problem solving – Stages of problem solving –Methods of Problem solving. | | | **CO4** |
| **UNIT-V** | **TEAM SPIRIT AND GROWTH** | **Periods: 6** | |
| Team spirit, growth mindset, high performing teams, trust and mind alignment, focus, target achievement and time compliance. | | | **CO5** |

| | | | |
|---|---|---|---|
| **Lecture Periods: 30** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:30** |

**Text Books**

1. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press,Oxford:2011.
2. Richards,C.Jack.&DavidBholke. SpeakNowLevel3.OxfordUniversityPress,Oxford:2010

**Reference Books**

1. Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson:New Delhi,2010.
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford,2014.
3. Vargo,Mari. SpeakNowLevel4.OxfordUniversityPress: Oxford, 2013.

**Web References**

1. https://mrcet.com/downloads/MBA/Professional%20Communication%20Skills.pdf
2. https://www.drishtiias.com/pdf/emotional-intelligence.pdf

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | CAT 3 | Assignment* | Attendance | | |
| Marks | 70 | | | 20 | 10 | - | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Semester | **First** | Course Category Code: **DSC** | | | *End Semester Exam Type: **PE** | | | |
| Course Code | **A23PCHL101** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **ORGANIC CHEMISTRY LABORATORY - I** | **-** | **-** | **4** | **2** | **50** | **50** | **100** |

| | | |
|---|---|---|
| Prerequisite | Basic Knowledge studied in the UG Level | |
| Course Objectives | • To know the basic knowledge of the separation of organic mixture | |
| | • To Develop the skill on the identification of functional group | |
| | • To improve practical knowledge on the preparation of organic compounds | |
| | • To implement the Oxidation and reduction in the chemical reactions | |
| | • To learn the method to introduce acyl group in the organic compounds | |
| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
| | **CO1** Develop the knowledge on the separation of organic mixture | **K3** |
| | **CO2** Identify the functional groups in the organic compounds | **K3** |
| | **CO3** prepare organic compounds | **K3** |
| | **CO4** Understand Oxidation and reduction in the chemical reactions | **K3** |
| | **CO5** Add acyl group in the organic compounds | **K3** |

## List of Experiments

1. Identification of components in a two component mixture and preparation of their derivatives.

2. Preparations

(i) p-Nitrobenzoic acid from p-Nitrotoluene (Oxidation)

(ii) Anthroquinone from Anthracene (Oxidation)

(iii) 1,2,3,4 – Tetrahydrocarbazole from Cyclohexanone (Reduction)

(iv) Methyl orange from Sulphanilic acid

(v) Acetyl Salicylic acid (Aspirin) from Salicylic acid (Acetylation)

**(vi)** m-nitro aniline from m-dinitrobenzene(Reduction)

| **Lecture Periods: -** | **Tutorial Periods:-** | **Practical Periods:-30** | **Total Periods:30** |
|---|---|---|---|

**Reference Books**

1. S. Furniss Brain - Vogel's Textbook of Practical Organic Chemistry – Pearson Publication, 5th Edition, Reprint 2004.
2. N.S. Gnanapragasam &G.Ramamurthy - Organic Lab Manual (Semi-Micro Qualitative Analysis and Separation) - S.

Viswanathan (Printers & Publishers), Pvt., Ltd, Reprint 2002.

**Web References**

1. https://mis.alagappauniversity.ac.in/siteAdmin/dde-admin/uploads/2/PG_M.Sc._Chemistry_344%2024_Practical%20Organic%20Chemistry_MSc%20Chemistry.pdf
2. https://www.vedantu.com/chemistry/salicylic-acid

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|
| | Observation | Model Exam | Viva Voce | Attendance | | |
| Marks | 15 | 15 | 10 | 10 | 50 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Semester | **First** | Course Category Code: **DSC** | | | *End Semester Exam Type: **PE** | | | |
| Course Code | **A23PCHL102** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **INORGANIC CHEMISTRY LABORATORY - I** | **-** | **-** | **4** | **2** | **50** | **50** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To know the basic principles of semi micro qualitative analysis<br>• To learn to indentify the common ions present in the mixture<br>• To develop the practical knowledge on the preparation of inorganic complex<br>• To know the method of estimation of metal ion<br>• To improve the knowledge on the colorimetric method | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping(Highest Level) |
|---|---|---|---|
| | **CO1** | Demonstrate group separation and analysis of inorganic mixtures | **K3** |
| | **CO2** | Identify rare and common ions present in the inorganic mixtures | **K3** |
| | **CO3** | Prepare selected inorganic complexes | **K3** |
| | **CO4** | Estimate the metal ions present in the sample by colorimetric method | **K3** |
| | **CO5** | Identify the metal ion present in the solution | **K3** |

## List of Experiments

1. Semi micro qualitative analysis of mixture containing two common and two rare cations. (The following are the rare cations to be included. W, Te, Se, Ce, Th, Zr, Be, V, Mo, L.,)
2. Colorimetric Analysis using photoelectric method: Estimation of Iron, Nickel, Copper and Manganese.
3. Preparations:
   - i. Potassium tris(oxalato)aluminate(III) trihydrate
   - ii. Tris(thiourea)copper(I) chloride
   - iii. Sodium hexanitrocobaltate (III)
   - iv. Tetrammine copper(II) sulphate
   - **v.** Sodium cuprousthiosulphate

| **Lecture Periods: -** | **Tutorial Periods:-** | **Practical Periods:-30** | **Total Periods:30** |
|---|---|---|---|

**Reference Books**

1. V.V.Ramanujam, Inorganic Semi Micro Qualitative Analysis, The National Publication, 3rd Edition, Reprint 2004.
2. G. Svehila, Vogel's Qualitative Inorganic Analysis, Pearson Publication, 5th Edition**,** Reprint 2004.

**Web References**

1. https://iscnagpur.ac.in/study_material/dept_chemistry/4.1_MIS_and_NJS_Manual_for_Inorganic_semi-micro_qualitative_analysis.pdf

2. https://archive.int.washington.edu/users/bertsch/articles/176.pdf
3. https://www.scribd.com/document/250411802/SKT1013-Experiment-4

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|
| | Observation | Model Exam | Viva Voce | Attendance | | |
| Marks | 15 | 15 | 10 | 10 | 50 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Second** | Course Category Code: **DSC** *End Semester Exam Type: **TE** | | | | | | |
| Course Code | **A23PCHT204** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **INORGANIC CHEMISTRY II** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • Advanced theories of bonding in complexes along with their stereochemistry<br>• Mechanisms of inorganic redox reactions involving coordination compounds<br>• Electronic spectroscopy and magnetic properties of coordination compounds. | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
|---|---|---|
| | **CO1** Know the different kinds of compounds of the main group elements | **K3** |
| | **CO2** Understand the structure and bonding in inorganic chains, rings, and cages. | **K3** |
| | **CO3** Identify ligands of main group elements and complexing agents for main group metals. | **K3** |
| | **CO4** Analyse the synthetic techniques in inorganic chemistry. | **K3** |
| | **CO5** Know about organo metallic compounds- | **K3** |

| **UNIT-I** | **NATURE OF BONDING IN MAIN GROUP ELEMENTS** | **Periods: 12** |
|---|---|---|

Structures of Main group compounds, Geometric Distortions, Jahn Teller Distortions, MOT to explain shapes of $AH_n$ compounds and $A_2H_n$ compounds. Hyperconjugation, Multiple Bonding, Multicentre bonding, Electron deficient, electron precise, and electron rich compounds of main group elements. Catenation, polyacetylene, Pierls Distortion, Zintl clusters, Wade's Rule, structure of polyhedral boranes, 2-D aromaticity, 3-D aromaticity. **CO1**

| **UNIT-II** | **INORGANIC CHAINS, RINGS, AND CAGES** | **Periods: 12** |
|---|---|---|

Chemistry of simple boranes, silanes, phosphanesand sulphanes–Boranes: synthesis of neutral boron hydrides, polyhedral borane anions and dianions.Carboranes: synthesis and polyhedral geometries, metalloboranes, and metallocarboranes - Boron – nitrogen compounds: azaboranes, borazines. Silicates: classification - orthosilicates, noncyclic silicate anions, cyclic silicate anions, infinite chain anions, infinite sheet anions, Structure of cyclic siloxanes and cyclopolysilanes. **CO2**

| **UNIT-III** | **COORDINATION CHEMISTRY - I** | **Periods: 12** |
|---|---|---|

Stereochemical aspects, Stereoisomerism in inorganic complexes: Isomerism arising out of ligand distribution and ligand conformation; chirality and nomenclature of chiral complexes; optical rotatory dispersion and circular dichroism. Macrocyclic ligands; types; porphyrins; corrins, Schiff bases; crown ethers and cryptates. **CO3**

| **UNIT-IV** | **HALOGEN AND NOBLE GAS CHEMISTRY** | **Periods: 12** |
|---|---|---|

Halogen oxides and oxocompounds: dichlorinemonooxide, chlorine dioxide, dibrominemonooxide, and iodine pentaoxide-preparation and properties; halogen oxyfluoridesand ionic oxyhalogenspecies. Xenon oxides and fluorides: xenon trioxide, xenon difluoride, xenon tetrafluoride. Halogen compounds of nitrogen: nitrogen trifluoride, tetrafluorohydrazine, dinitrogen difluoride, haloamines, oxohalides, andnitrogen trifluorideoxide. Sulfurfluorides: Synthesis and reactivity of disulfur difluoride, sulfurtetrafluoride. **CO4**

| | | |
|---|---|---|
| **UNIT-V** | **ORGANO METALLIC COMPOUNDS** | **Periods: 12** |
| Organometallic compounds: synthesis, bonding and structure, and reactivity. The role of organometallic chemistry in catalysis, Co-ordinative unsaturation, oxidative addition, addition reactions of specific molecules- Hydrogen addition- HX addition- Addition of X2, Addition reactions of Si-H Bonds, addition of C-C , C-Si and Si-Si bonds- Elimination reactions – α and β elimination. | | **CO5** |

| | | | |
|---|---|---|---|
| **Lecture Periods: 45** | **Tutorial Periods:-15** | **Practical Periods:-** | **Total Periods:60** |

**Text Books**

1. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Advanced Inorganic Chemistry; 6th ed.; Wiley Interscience: New York,1988.
2. J. E. Huheey, E. A. Keiter, and R. L. Keiter, Inorganic Chemistry; 4th ed.; Harper and Row: New York,1983.
3. K. F. Purcell, and J. C. Kotz, Inorganic Chemistry; Saunders: Philadelphia,1976.

**Reference Books**

1. D. F. Shriver, P. W. Atkins, and C. H. Langford, Inorganic Chemistry; 3rd ed.; Oxford University Press: London,2001.
2. T. Moeller, Inorganic Chemistry, A Modern Introduction; John Wiley: New York,1982.
3. W. L. Jolly, Modern Inorganic Chemistry, 2nd Edn, McGraw-Hill International Edition,1991.
4. G. S. Girolami, T. B. Rauchfuss, and R. J. Angelici, Synthesis and Technique in Inorganic Chemistry, 3rded., University Science Books, Sausalito,1999.
5. W. L. Jolly, The Synthesis and Characterization of Inorganic Compounds, Prentice Hall, New Jercy,1970

**Web References**

1. https://bit.ly/3OtepkR
2. https://bit.ly/3QyVg2R
3. https://bit.ly/3zSu8pu

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 |
| 2 | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 |
| 4 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Second** | Course Category Code: **DSC** *End Semester Exam Type: **TE** | | | | | | |
| Course Code | **A23PCHT205** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **ORGANIC CHEMISTRY II** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • Mechanisms and evidences for aromatic electrophilic and nuleophilic substitutions, addition reactions, elimination reactions and rearrangements<br>• Effect of substrate structure, leaving group and attacking species in the above reactions.<br>• Understand the concept of aromaticity<br>• Synthesis and applications of selected reagents used for various organic transformations. | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
|---|---|---|
| **CO1** | Recall the basic principles of Electrophilic Substitution. | **K3** |
| **CO2** | Recall the basic principles of Nucleophilic Substitution | **K3** |
| **CO3** | Understand the mechanism of free radical reaction | **K3** |
| **CO4** | Describe the concept of aromaticity. | **K3** |
| **CO5** | Utilize the selected reagents used for various organic transformations. | **K3** |

| **UNIT-I** | **AROMATIC AND ALIPHATIC ELECTROPHILIC SUBSTITUTION** | **Periods: 12** |
|---|---|---|
| Aromatic electrophilic substitution: Mechanism, orientation and reactivity-Quantitative treatment of reactivity in the substrates and reactivity of the electrophiles - Selectivity relationship Hammett and Taft equations. Reactions involving- Nitrogen electrophiles: nitrationand diazonium coupling. Sulphur electrophiles: sulphonation - Halogen electrophiles: chlorination and bromination -Carbon electrophiles: Friedel-Crafts alkylation and acylation reactions. Mechanisms: $S_E2$ and $S_E1$, Substitution by double bond shifts - other mechanism: addition- elimination and cyclic mechanism with various electrophiles – Hydrogen, Nitrogen, Sulphur and Carbon. | | **CO1** |
| **UNIT-II** | **ELIMINATION AND FREE RADICAL REACTIONS** | **Periods: 12** |
| Mechanisms: E2, E1, E1cB and E2C syn eliminate ions. Orientation of the double bond: Hoffmann and Saytzeff rules and applications. Reactivity: Effect of substrate, attacking bases, leaving group and medium. Mechanisms and orientation in pyrolytic eliminations. Long - lived and short-lived radicals - Production of radicals - thermal and photochemical reactions, methods of detection, stability. Reactions - polymerization, addition, halogenations, aromatic substitutions and rearrangements. | | **CO2** |
| **UNIT-III** | **ADDITION TO CARBON-CARBON MULTIPLE BONDS** | **Periods: 12** |
| Addition reactions – Mechanisms - electrophiles, nucleophiles, free radicals, carbenes and cyclic mechanisms. Orientation and reactivity, hydrogenation of double and triple bonds, Michael reaction, addition of oxygen and nitrogen. Addition to carbon-hetero atom multiple bonds - Mannich reaction, acids, esters, nitrites, addition of Grignard reagents, Wittig and Prins reactions. Stereochemical aspects of addition reactions - Addition to carbon-hetero atom multiple bonds: Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. | | **CO3** |
| **UNIT-IV** | **AROMATICITY** | **Periods: 12** |
| Aromaticity of benzenoid – non-benzenoid and heterocyclic compounds-Huckel's rule- aromatic, non- aromatic and anti- aromatic systems .- System of two (cyclopropenyl cation, cyclobutadienyl cation etc,), four(cyclopropenyl anion, cyclobutadiene, cyclopentadienyl cation etc,), six (benzene, pyridine, pyrrole, thiophene, furan etc,) eight (cyclooctatetraene etc,) and ten electrons (annulene [10] etc,). System with more than 10 pi electrons (4n+2 & 4n system)- Annulene up to C-18. Aromaticity Azulene- homoaromatic compounds. | | **CO4** |

| | | |
|---|---|---|
| **UNIT-V** | **ORGANIC TRANSFORMATION AND REAGENTS** | **Periods: 12** |
| Preparation and synthetic applications of Lithium aluminum hydride, sodium Borohydride, Tri-n-butyl tin hydride,9-BBN,NBS,Trimethylsillyl iodide, n-Butyl Lithium, Grignard reagent, Gilmann reagent, LDA, DCC, PCC, DDQ, 1,3-Dithiane, SeO2,OsO4, KMnO4. Phase transfer catalyst, Crown ethers and Merrifield resins. Chemoselective reaction-regioselective reaction - strereoselective reactions. | | **CO5** |

| | | | |
|---|---|---|---|
| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |

**Text Books**


1. R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee Organic Chemistry, 7th edition, Pearson Education, 2010.
2. E. S. Gould, Mechanism and Structure in Organic Chemistry, Holt, Rinehart and Winston Inc., 1959.
3. P. S. Kalsi, Organic Reactions and their mechanism, 5th edition, New Age International Publishers, 2021.
4. V.K.Ahluwalia, R.K Parashar, Organic reaction mechanisms, Ane Books India Publications, 3rd edition, 2009.


**Reference Books**


1. P. Y. Bruice, Organic Chemistry, 7th edition, Prentice Hall, 2013.
2. S. M. Mukherji and S. P. Singh, Reaction Mechanism in Organic Chemistry, 3rd edition, Macmillan India Ltd.1984.
3. Jonathan Clayden, Nick Greeves and Stuart Warren, Organic Chemistry, Oxford University Press, 2nd edition, 2016.4.
4. Francis A.Carey and Richard J.Sunberg, Advanced Organic Chemistry, Springer Science & Business Media, 3rd Edition,2013.
5. J. March and M. Smith, Advanced Organic Chemistry, 5th edition, John-Wiley and Sons.2001.


**Web References**

1. https://bit.ly/3HMlFWX
2. https://www.organic-chemistry.org/
3. https://www.studyorgo.com/summary.php

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Second** | Course Category Code: **DSC** | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHT206** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **PHYSICAL CHEMISTRY II** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |

| | |
|---|---|
| Prerequisite | Basic Knowledge studied in the UG Level |
| Course Objectives | • To understand the behaviour of electrolyte solutions<br>• To know about the partial molar thermodynamics properties and fugacity<br>• To categorize the molecules based on the symmetry and group.<br>• To solve Schrodinger equation for multi electron systems and know about approximation methods<br>• To study about molecular spectroscopy |

| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping(Highest Level) |
|---|---|---|---|
| | **CO1** | Understand the behaviour of electrolyte solutions | **K3** |
| | **CO2** | Know about the partial molar thermodynamics properties and fugacity | **K3** |
| | **CO3** | Categorize the molecules based on the symmetry and group. | **K3** |
| | **CO4** | Solve Schrodinger equation for multi electron systems and know about | **K3** |
| | **CO5** | Study about molecular spectroscopy | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **ELECTROCHEMISTRY - I** | **Periods: 12** |
| Conductance, equivalent molar conductance - Conductometric titarions-Oswald Dilution law -Mean ionic activity and mean ionic acitivity coefficient - activity coefficient of strong electrolytes –Ionic strength -Debye Huckel limiting law – qualitative and quantitive verification – limitation – Deybe Huckel limiting law appreciable concentrations of electrolytes – Debye – Huckel – Bronsted equation. | | **CO1** |
| **UNIT-II** | **THERMODYNAMICS** | **Periods: 12** |
| Partial molar properties – partial molar free energy (Chemical Potential), Gibbs-Duhem Equation- Variation of chemical potential with temperature and pressure. Partial molar volume and Partial molar heat content – Their significance and determination of these quantities. Definition of fugacity - Determination of fugacity by graphical method –variation of fugacity with temperature and pressure- The concept of activity and activity coefficient – determination of activity and activity coefficient by emf method – determination of activity and activity coefficient for non- electrolytes. | | **CO2** |
| **UNIT-III** | **GROUP THEORY - I** | **Periods: 12** |
| Symmetry elements and symmetry operations- groups-Abelian and non- abelian groups- cyclic groups- order of group-sub group-similarity transformation and conjugate elements- class-point groups (C1,C2,C3,C4,C2V,C3V,C∞V,C2h,D2h,D3h,D4h,D6h,Td, Oh). Reducible and Irreducible representations – Direct product representation. | | **CO3** |
| **UNIT-IV** | **QUANTUM MECHANICS** | **Periods: 12** |
| Solution of Schrodinger equation for multi electron systems (Approximation methods)- perturbation theory-Nondegenerate perturbation theory- first order correction to the energy and wave function. Application of first order perturbation theory to Helium atom. Variation method-Application of variation method to Helium atom.<br>Huckel Molecular orbital theory of conjugated systems-ethylene, butadiene, cyclobutadiene and benzene. Calculation of electron density, bond order and delocalization energy. | | **CO4** |
| **UNIT-V** | **MOLECULAR SPECTROSCOPY - I** | **Periods: 12** |
| Electromagnetic radiation- types of molecular spectra. Rotational spectroscopy- selection rule-rotational spectra of diatomic molecules (Rigid rotator)- Types of poly atomic molecules. Vibrational spectroscopy- selection rule-vibrational spectra of diatomic molecules (SHO)-Anharmonic oscillator. Rotation- Vibration of diatomic molecules-fundamental vibration of linear and non- linear molecules- overtones-fermi resonance. Raman spectroscopy- | | **CO5** |

selection rule-Rayleigh and Raman Scattering-Rotational Raman spectrum of a diatomic Molecule-Rotational – Vibrational Raman spectrum. Mutual Exclusion principle. Electronic spectroscopy- Absorption and intensity shifts-selection rule.Frank- Condon principle for the electronic transition for a diatomic molecule.

| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |
|---|---|---|---|

**Text Books**


1. B.R.Puri , L.R Sharma Madan S Pathania, Principles of Physical Chemistry, 2022, Vishal Publishing co, 48th edition.
2. Gupta M. C., 1993, Statistical Thermodynamics, Wiley Eastern limited, New Delhi.
3. Lee, Sears, Tercotte, 1973, Statistical Thermodynamics, Addision Wesley Publishing Co., London – 1st Edition.
4. R.K.Prasad, Quantum Chemistry, New age international publishers, 4th revised edition , 2020.
5. P.K.Bhattacharya, Group Theory and its applications, Himalaya Publeshers. 3rd edition. 2014.


**Reference Books**


1. Antropov L., 1999, Theoretical electrochemistry, MIR Publications, New Delhi.
2. Glasstone S., 2002, An Introduction to Electrochemistry, Von Nostrand Co. Inc., Toronto.
3. Kuriakose J. C., Rajaram, J. 1999, Thermodynamics, III edition, Shobanlal Nagin Chand, New Delhi, India.
4. H.W. Hanna, 1993, Quantum Mechanics in Chemistry-Benjamin –CummizaLondon Publishing Company, New Delhi, India.
5. Chandra A. K., 1988, Introductory Quantum Chemistry, 3rd edition, Tata McGraw-Hill Publishing Co, New Delhi, India


**Web References**

1. https://nptel.ac.in/courses/104/103/104103112/
2. https://bit.ly/3tL3GdN
3. https://www.whfreeman.com/pchem8

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| **1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **3** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| **4** | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| **5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Second** | Course Category Code: **DSE** *End Semester Exam Type: **TE** | | | | | | |
| Course Code | **A23PCHE204** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **CHEMINFORMATICS** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To apply a range of computational tools to address toxicological questions<br>• To give students skills in the retrieval, processing, dissemination, and use of information systems for chemical/biological information and structures<br>• To prepare for a career in in-silico toxicity prediction in the pharma, industryetc. | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
|---|---|---|
| **CO1** | Learn about the information of cheminformatics and its applications | **K3** |
| **CO2** | Know about the Representation of Molecules and Chemical Reactions. | **K3** |
| **CO3** | Identify about the Searching Chemical Structure. | **K3** |
| **CO4** | Understand about the Computer Assisted Virtual screening design. | **K3** |
| **CO5** | Learn about the Application of Cheminformatics in Drug Design | **K3** |

| **UNIT-I** | **INTRODUCTION TO CHEMINFORMATICS** | **Periods: 12** |
|---|---|---|
| Introduction to cheminformatics, History and Evolution of cheminformatics, Use of cheminformatics, Prospects of cheminformatics, Molecular Modeling. | | **CO1** |
| **UNIT-II** | **REPRESENTATION OF MOLECULES AND CHEMICAL REACTIONS** | **Periods: 12** |
| Nomenclature; Different types of Notations; SMILES coding; Matrix Representations; Structure of Molfiles and Sdfiles; Libraries and toolkits; Different electronic effects; Reaction classification | | **CO2** |
| **UNIT-III** | **SEARCHING CHEMICAL STRUCTURE** | **Periods: 12** |
| Full structure search; sub structure search; basic ideas; similarity search; Three dimensional search methods; Basics of Computation of Physical and Chemical Data and structure descriptors; Data visualization. | | **CO3** |
| **UNIT-IV** | **COMPUTER ASSISTED VIRTUAL SCREENING DESIGN** | **Periods: 12** |
| Structure Based Virtual Screening- Protein Ligand Docking, Scoring Functions for Protein Ligand docking, Practical aspects of structure based Virtual Screening; Prediction of ADMET Properties, 2 D and 3D data searching, Chemical databases, Role of computers in Chemical Research. | | **CO4** |
| **UNIT-V** | **APPLICATION OF CHEMINFORMATICS IN DRUG DESIGN** | **Periods: 12** |
| Quantitative Structure-Property Relations; Descriptor Analysis; Computer Assisted Structure elucidations; Target Identification and Validation; Lead Finding and Optimization; Analysis of HTS data; Design of Combinatorial Libraries; Ligand Based and Structure Based Drug design. | | **CO5** |

| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |
|---|---|---|---|

**Text Books**

1. Andrew R. Leach, Valerie J. Gillet, Cluwer, Introduction to Cheminformatics, Academic Publisher, Netherlands, 2003.
2. Johann Gasteiger& Thomas Engel, A Textbook of Chemoinformatics, Wiley Publisher, 2003.
3. Johann Gasteiger& Thomas Engel, Basic Concepts and Methods, Wiley Publisher, 2018.

**Reference Books**

1. Lisa B. English (Editor), Combinatorial Library Methods and Protocols, Humana Press Inc, Volume:201, 2002.
2. Frank Jensen, Introduction to Computational Chemistry, Wiley Publisher, Second Edition, 2006.
3. FideleNtie – Kang, Chemoinformatics of Natural Products, De Gruyter Publisher, 2022.
4. Jagjeet Singh, Cheminformatics, Random House Publisher, 2020.
5. JurgenBaiorath, Chemoinformatics for Drug Discovery, Wiley Publisher, 2013.

**Web References**

1. https://chem.libretexts.org
2. https://en.wikibooks.org/wiki/Chemical_Information_Sources
3. https://guides.loc.gov/chemistry-resources

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 2 | 3 | 2 | 1 | 3 | 2 | 2 |
| 3 | 2 | 2 | 2 | 3 | 2 | 1 | 3 | 3 |
| 4 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 |
| 5 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Second** | Course Category Code: **DSE** | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHE205** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **ASYMMETRIC SYNTHESIS** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To create awareness about the importance of chirality for organic synthesis and for biological activity<br>• Apply the important principles of stereochemistry and understand them. | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
|---|---|---|
| | **CO1** Understand the basic concept of asymmetric Synthesis | **K3** |
| | **CO2** Able to synthesize on chiral substrate | **K3** |
| | **CO3** Use chiral substrate to synthesize asymmetric compounds | **K3** |
| | **CO4** Utilysze chiral auxiliary to synthesize asymmetric compounds | **K3** |
| | **CO5** handle chiral catalyst to synthesize asymmetric compounds | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **INTRODUCTION TO ASYMMETRIC SYNTHESIS** | **Periods: 12** |
| Basic principles of Asymmetric synthesis – Definition - Stereospecific, Stereo selective enantioselective and diastereoselective. Importance of asymmetric synthesis, conditions for an efficient asymmetric synthesis, energetic considerations, strategies for asymmetric synthesis- advantages and limitations of each strategy, analytical methods for determining enantiomeric excess. Resolving agents and resolution of racemic compounds having common functional groups for e.g. alcohol, amine, acid. Resolution of chiral ligands - BINOL, trans 1,2-diaminocyclohexane. Interaction between chiral substrate and chiral reagent. Kinetic resolution of racemic mixtures. | | **CO1** |
| **UNIT-II** | **ASYMMETRIC SYNTHESIS ON CHIRAL SUBSTRATE** | **Periods: 12** |
| Nucleophilic addition to α–chiral carbonyl compounds; Prediction of stereochemistry Cram's rule and related modifications. Double stereo differentiation; matched pair and mismatched pair; examples from aldol condensation and hydroboration reactions. Electrophilic addition to α – chiral olefins - epoxidation, cyclopropanation, hydroboration – oxidation, alkylation of enolates of β-chiral carbonyl compounds. | | **CO2** |
| **UNIT-III** | **ASYMMETRIC SYNTHESIS USING CHIRAL REAGENTS** | **Periods: 12** |
| Chiral organo boranes -Application of chiral organ boranes, reduction ($Ipc_2BCl$) and allylation and crotylation reactions, T.S models; Chiral modification of lithium aluminum hydride, BINAL-H - application in reduction of prochiral ketones; oxazaborolidines. T.S model;<br>Asymetric Michael addition to α, β – unsaturated carbonyl compounds T.S model; chiral lithium amides – enantioselective deprotonation. | | **CO3** |
| **UNIT-IV** | **ASYMMETRIC SYNTHESIS USING CHIRAL AUXILIARY** | **Periods: 12** |
| Chiral auxiliaries derived from proline, champhor, menthol and other chiral pool sources. SAMP / RAMP hydrazines, and other pyrrolidines, oxithiane, oxazolidine-2- one, thiazolidine-2-one, phenylethylamine, 2- phenylcyclohexanol, 8-phenyl menthol. | | **CO4** |
| **UNIT-V** | **ASYMMETRIC SYNTHESIS USING CHIRAL CATALYSTS** | **Periods: 12** |
| Asymmetric alkylation and allylation of carbonyl compounds, chirality amplification, non-linear effects: Selected reactions: DAIB, Keck's allylation, TADDOLs and other privileged ligands. Asymmetric hydrogenation: early advances DIPAMP, DIOP and Noyori's BINAP - selected reactions &examples. Proline mediated aldol reactions and further expansion in the field of organo catalysis. Sharpless epoxidation, dihydroxylation, aminohydroxylation of alkenes; Utility metal-semicorrinato complexes and Jacobson catalysts – Evans catalyst - Aziridination. | | **CO5** |

| Lecture Periods: 60 | Tutorial Periods:- | Practical Periods:- | Total Periods:60 |
|---|---|---|---|

**Text Books**


1. Asymmetric Synthesis: Morrison, J. D. Vol 1- 5, Academic press,1983.
2. Stereochemistry of Carbon compounds: E. L. Eliel, Wiley, 1992.
3. Comprehensive Asymmetric Catalysis (Jacobsen, E. N,Pfaltz, A. Yamamoto, H. Eds.) Springer 2000.


**Reference Books**


1. Asymmetric Catalysis in Organic synthesis: Noyori, R. Wiley-NY 1994.
2. Catalytic Asymmetric Synthesis: Ojima, I.VCH-NY, Pergamon, 1998.
3. Methods for the Asymmetric Synthesis of Complex Organic Molecules, Daniel J. O'Leary, Lecture Notes 2001.
4. Principles of Asymmetric Synthesis (Tetrahedron series in Organic Chemistry), R.
5. E. Gawley, J Aube, Pergman, 1996 Aymmetric Synthesis, H. B. Kagan, Thieme Medical Publishers, I$^{st}$Edn., 2003. Asymmetric Synthesis, G. Proctor, Oxford University Press, USA, 1997.


**Web References**

1. https://chem.libretexts.org
2. https://en.wikibooks.org/wiki/Assymetric _Synthesis Sources
3. https://guides.loc.gov/chemistry-resources

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| 4 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 |
| 5 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Semester | **Second** | Course Category Code: **DSE** | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHE206** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **GREEN CHEMISTRY** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |

| | | |
|---|---|---|
| Prerequisite | Basic Knowledge studied in the UG Level | |
| Course Objectives | • To Understand about Green Chemistry | |
| | • To learn about Ultrasound and Microwave usage in the Green Chemistry | |
| | • To know about Green Catalyst | |
| | • To learn about phase transfer mechanism in the Green Chemistry | |
| | • To use green chemistry concept in the various organic reactions | |
| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
| | **CO1** Learn about Green Chemistry | **K3** |
| | **CO2** Understand usage of Ultrasound and Microwave in the Green Chemistry | **K3** |
| | **CO3** Learn about usage various catalyst in the green chemistry | **K3** |
| | **CO4** Learn about phase transfer mechanism in the Green Chemistry | **K3** |
| | **CO5** Apply green chemistry concept in the various organic reactions | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **BASIC PRINCIPLES OF GREEN CHEMISTRY** | **Periods: 12** |
| Introduction, Principles of Green chemistry, prevention of waste, maximum Incorporation of the Reactants (starting materials and reagents) into the final product, prevention or minimization of hazardous products, designing safer chemicals, energy requirements for synthesis, selection of appropriate solvent, selection of starting materials, use of protecting group, use of catalyst and products designed should be biodegradable. | | **CO1** |
| **UNIT-II** | **ULTRASOUND AND MICROWAVE ASSISTED GREEN SYNTHESIS** | **Periods: 12** |
| Ultrasound: Introduction, instrumentation, the phenomenon of cavitation. Sonochemical esterification, substitution, addition, alkylation, oxidation, reduction and coupling reactions. Microwaves: introduction- concept- reaction vessel / medium- specific effects, atom efficiency (% atom utilization), advantages and limitations. Alkylation and N-alkylation of active methylene compounds and Diels –Alder reactions. Reactions in water and reactions in organic solvents. Solvent free reactions and deprotection of esters. | | **CO2** |
| **UNIT-III** | **GREEN REAGENT AND GREEN CATALYSTS** | **Periods: 12** |
| Green Reagent - Polymer supported reagents – polymeric thioanisolyl Resin, polymeric Carbodiimide, Polystyrene Anhydride, Polystyrene wittig Reagent, Sulfonazide polymer. Green Catalyst - Acid catalysts- base catalysts- oxidation catalysts - polymer supported catalysts- polystyrene-aluminum chloride – polymeric super acid catalysts- polymer supported photosensitizers | | **CO3** |
| **UNIT-IV** | **PHASE TRANSFER CATALYST IN GREEN SYNTHESIS** | **Periods: 12** |
| Introduction- mechanism of phase transfer catalyst reaction- types and advantages of phase transfer catalyst – applications of phase transfer catalyst in organic synthesis- nitriles from alkyl or acyl halides, alkyl fluorides from alkyl halides, generation of dichlorocarbenes, elimination reaction, alkylation reaction –Williamson Ether synthesis, Darzen reaction, Wittig reaction – Oxidation using hydrogen peroxide under PTC condition. | | **CO4** |
| **UNIT-V** | **ORGANIC SYNTHESIS IN GREEN CHEMISTRY** | **Periods: 12** |
| Aqueous phase reactions- oxidation of aldehydes and ketones- oxidation of amines into nitro compounds – oxidation of nitriles- Knoevenagel reaction. Michael reaction.Organic synthesis in solid state-Solid phase organic synthesis without using any solvent- aldol condensation-Reformatsky reaction, witting reaction - solid supported organic synthesis-pyrrole, furons - Synthesis of paracetamol. | | **CO5** |

| Lecture Periods: 60 | Tutorial Periods:- | Practical Periods:- | Total Periods:60 |
|---|---|---|---|

**Text Books**

1. Organic Synthesis: Special Techniques, V.K.Ahluwalia and R. Aggarwal, Narosa Publications, New Delhi, 4th Edition, 2003
2. R.Sanghi, M.M Srivastava, Green Chemistry Environment Friendly alternatives, Narosa Publications New Delhi 2003.
3. Green Chemistry – An Introduction text, Royal Society of Chemistry, UK 2002.

**Reference Books**

1. P.T.Anastas and JJ.C Warner, Green Chemistry theory and Prctices, Oxford University press, Oxford 1988.
2. E.V. Dehmlov, S.S Dehmlov, Phase Transfer Catalysis, 2nd edition Verlagchemie, Wienhein, 1983.

**Web References**

1. https://www.hansrajcollege.ac.in/hCPanel/uploads/elearning/elearning_document/Twelve_principle_of_GC.pdf
2. https://fccollege.ac.in/Admin/Files/StudyMaterials/MICROWAVE%20&%20US%20GREEN%20SYNTHESIS(REVIEW)-2022.pdf
3. https://fccollege.ac.in/Admin/Files/StudyMaterials/MICROWAVE%20&%20US%20GREEN%20SYNTHESIS(REVIEW)-2022.pdf.

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Second** | Course Category Code: **DSC** | | | *End Semester Exam Type: **PE** | | | |
| Course Code | **A23PCHL203** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **PHYSICAL CHEMISTRY LAB –I** | **-** | **-** | **4** | **2** | **50** | **50** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To learn about critical solution system and distribution coefficient | | | | | | | |
| | • To understand rate constant of the reaction and Comparison of acid strengths | | | | | | | |
| | • To Analyse the activation and frequency factor | | | | | | | |
| | • To learn about Molecular weight of the compound | | | | | | | |
| | • To analyze phase diagram of compound | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping (Highest Level) |
|---|---|---|---|
| | **CO1** | Learn about critical solution system and distribution coefficient | **K3** |
| | **CO2** | Understand rate constant of the reaction and Comparison of acid strengths | **K3** |
| | **CO3** | Analyse the activation and frequency factor | **K3** |
| | **CO4** | Learn about Molecular weight of the compound | **K3** |
| | **CO5** | Analyze phase diagram of compound | **K3** |

**List of Experiments**

1. Determination of CST and study of the effect of impurity on CST
2. Determination of distribution coefficient and determination of equilibrium Constant for the formation of $KI_3$(Demonstration only)
3. Determination of the rate constant for Persulphate oxidation both by titrimetry and Colorimetry.
4. Comparison of acid strengths by Kinetics.
5. Determination of the energy of activation and frequency factor.
6. Association factor of benzoic acid between benzene and water
7. Determination of molecular weight by Rast macro method
8. Phase diagram – simple eutectic system
9. Phase diagram – three component system
10. Adsorption of oxalic acid on charcoal.
11. Determination of molecular weight by Transition Temperature Method

| **Lecture Periods: -** | **Tutorial Periods:-** | **Practical Periods:-30** | **Total Periods:30** |
|---|---|---|---|

**Reference Books**

1. Venkateswaran, V., Veeraswamy, R. &Kulandaivelu, A. R. (1997). Basic Principles of Practical Chemistry, (2nd Ed.). Sultan Chand & Sons.
2. Daniels, Mathews, F., Howard, J. & John Warren, W. (1970). Experimental Physical Chemistry, (7th Ed.). Mc Graw Hill.
3. Findlay, A., (1959). Practical Physical Chemistry, (7th Ed.).

**Web References**

1. https://egyankosh.ac.in/bitstream/123456789/15870/1/Unit-12.pdf
2. https://www.chem.uci.edu/~lawm/11-2.pdf
3. https://www2.tulane.edu/~sanelson/eens212/ternaryphdiag.htm

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| 2 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|
| | Observation | Model Exam | Viva Voce | Attendance | | |
| Marks | 15 | 15 | 10 | 10 | 50 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Second** | Course Category Code: **DSC** | | | *End Semester Exam Type: **PE** | | | |
| Course Code | **A23PCHL204** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **INORGANIC CHEMISTRY LAB – II** | **-** | **-** | **4** | **2** | **50** | **50** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To Learn practical knowledge on the binary mixture analysis<br>• To understand and develop the practical experience on the complex preparation | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping (Highest Level) |
|---|---|---|---|
| | **CO1** | Gain knowledge on the binary analysis | **K3** |
| | **CO2** | Develop skill on the iron and copper analysis | **K3** |
| | **CO3** | Improve practical experience l on the calcium and magnesium analysis | **K3** |
| | **CO4** | Understand the complex formation in different methods | **K3** |
| | **CO5** | Learn the various complex making process | **K3** |

**List of Experiments**

**I) Estimations of Metal Ions in a Binary Mixture**

1. Quantitative analysis of a mixture of iron (volumetry) and copper (gravimetry)
2. Quantitative analysis of a mixture of copper (volumetry) and nickel (gravimetry)
3. Quantitative analysis of a mixture of calcium (volumetry) and magnesium (gravimetry)
4. Quantitative analysis of a mixture of calcium and magnesium (both by volumetry)
5. Quantitative analysis of a mixture of iron (volumetry) and zinc (gravimetry)
6. Quantitative analysis of a mixture of copper (volumetric) and zinc (gravimetry)

**II) Preparation of Selected Complexes**

1. Hexmannine cobalt (III) chloride.
2. Potassium bisoxalatodiaquo chromate (III)
3. Hexathiourea lead (II) nitrate
4. Lead tetra acetate
5. Bis (pyridiniumhexachloroplumbate)

| **Lecture Periods: -** | **Tutorial Periods:-** | **Practical Periods:-30** | **Total Periods:30** |
|---|---|---|---|

**Reference Books**

1. V.V.Ramanujam, Inorganic Semi Micro Qualitative Analysis, The National Publication, 3rd Edition, Reprint 2004.
2. G. Svehila, Vogel's Qualitative Inorganic Analysis, Pearson Publication, 5th Edition, Reprint 2004.

**Web References**

1. https://egyankosh.ac.in/bitstream/123456789/15906/1/Experiment-17.pdf
2. https://egyankosh.ac.in/bitstream/123456789/15906/1/Experiment-17.pdf
3. https://chemistry.iyte.edu.tr/wp-content/uploads/sites/48/2019/06/CHEM-332-Anorganik-Kimya-Lab.Kitap%C3%A7%C4%B1%C4%9F%C4%B1.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| **1** | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| **2** | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| **3** | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| **4** | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 2 |
| **5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|
| | Observation | Model Exam | Viva Voce | Attendance | | |
| Marks | 15 | 15 | 10 | 10 | 50 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Mathematics** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Second Semester** | Course Category Code: SEC | | | *End Semester Exam Type: | | | |
| Course Code | **A23PMAS201** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **QUANTITATIVE REASONING AND RESEARCH APTITUDE** | **2** | **-** | **-** | **2** | **100** | **-** | **100** |
| Prerequisite | Basic mathematical and reasoning knowledge | | | | | | | |
| Course Objectives | • To know the simple interest and compound interest.<br>• To know the Permutation and Combination.<br>• To gain the knowledge of Time and Work Problems.<br>• To gain the knowledge the of percentage, profit and loss.<br>• To know the concept of coding and decoding. | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping (Highest Level) |
|---|---|---|
| | **CO1** Learn about the simple interest and compound interest. | **K3** |
| | **CO2** Understand the Problems on Trains. | **K3** |
| | **CO3** Solve the Time and Distance Problems. | **K3** |
| | **CO4** Know about the ratio and proportion | **K3** |
| | **CO5** Understand the Alphanumeric series. | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | | **Periods: 6** |
| Simple interest and Compound interest. | | **CO1** |
| **UNIT-II** | | **Periods: 6** |
| Permutations and Combinations - Problems on Trains | | **CO2** |
| **UNIT-III** | | **Periods: 6** |
| Time and Work Problems - Time and Distance Problems. | | **CO3** |
| **UNIT-IV** | | **Periods: 6** |
| Percentage-Profit and Loss - Ratio and Proportion | | **CO4** |
| **UNIT-V** | . | **Periods: 6** |
| Input and Output – Coding and Decoding – Alphanumeric series – Ranking | | **CO5** |

| | | | |
|---|---|---|---|
| **Lecture Periods: 30** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:30** |

**Reference Books**

1. Quantitative Aptitude for competitive Examination-AbhijitGuha-TMH.
2. Mathematics for life-M. Immaclate-Nanjil offsetPrinters.
3. Objective Arithmetic's-R. S-Aggarwal-S. Chand &Co.

**Text Books**

1. Quantitative Aptitude for competitive Examination, R.S. Aggarwal. S. Chand and company Ltd,152, Anna salai, Chennai.(2001)
2. Quantitative Aptitude and Reasoning Praveen PHIP.Ltd.
3. Scope and treatment as in "Quantitative Aptitude" by R.S. Aggarwal. S. Chand and company Ltd.,Ram Nagar, New Delhi(2007).

**Web References**

1. https://www.careerbless.com/aptitude/qa/home.php
2. https://www.javatpoint.com/aptitude/quantitative
3. https://www.letsstudytogether.co/quantitative-aptitude-topic-wise-questions-and-answers-pdf-download/

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | CAT 3 | Assignment* | Attendance | | |
| Marks | 70 | | | 20 | 10 | - | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Third** | Course Category Code: **DSC** *End Semester Exam Type: **TE** | | | | | | |
| Course Code | **A23PCHT307** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **INORGANIC CHEMISTRY III** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To study the basic principles of crystal field theory and spectral and magnetic properties of complexes. | | | | | | | |
| | • To Understand the mechanism of coordination complexes | | | | | | | |
| | • To understand the spectral and magnetic properties of complexes and characterization | | | | | | | |
| | • To Recall the solid state chemistry. | | | | | | | |
| | • To understand the structure and functions of metallo biomolecules. | | | | | | | |
| Course Outcome | **On completion of the course, the students will be able to** | | | | | BT Mapping(Highest Level) | | |
| | **CO1** | Recall the basic principles of crystal field theory and spectral and magnetic properties of complexes | | | | **K3** | | |
| | **CO2** | Understand the mechanism of coordination complexes | | | | **K3** | | |
| | **CO3** | Understand the spectral and magnetic properties of complexes and characterization of inorganic compounds. | | | | **K3** | | |
| | **CO4** | Recall the solid state chemistry. | | | | **K3** | | |
| | **CO5** | understand the structure and functions of metallobiomolecules. | | | | **K3** | | |

| | | |
|---|---|---|
| **UNIT-I** | **COORDINATION CHEMISTRY – II** | **Periods: 12** |
| Crystal field theory - splitting of d orbitals in octahedral-factors affecting ∆o, splitting of d orbitals in tetrahedral, tetragonal distorted octahedral (Jahn-Teller effect) and square planar complexes – CFSE- nephelauxetic effect - MO theory of octahedral complexes (in weak field and strong field) - pi bonding and molecular orbital theory- octahedral complexes-experimental evidence for pi bonding. Term states for "d"- electron systems- energy diagrams and electronic spectrum of dx (d1 to d9) complexes - Orgel diagrams- Tanabe - Sugano diagrams- charge transfer spectra- magnetic properties of complexes- Gouy's method- orbital contribution-spin-orbit coupling and magnetic moments. | | **CO1** |
| **UNIT-II** | **COORDINATION CHEMISTRY – III** | **Periods: 12** |
| Inert and labile complexes - Stepwise, overall stability constants -Chelate effect- mechanisms of nucleophilic substitution reactions in octahedral complexes(SN1 and SN2 mechanism) - Aquation (acid hydrolysis) and anation - conjugate base mechanism of base hydrolysis (SN1CB mechanism) - Substitution reactions in square planar complexes - Trans effect- applications and theories of trans effect- electron transfer reactions(redox reactions) - inner and outer sphere mechanisms. | | **CO2** |
| **UNIT-III** | **INNER TRANSITION ELEMENTS & CHARACTERISATION OF INORGANIC COMPOUNDS** | **Periods: 12** |
| Spectral and magnetic properties of lanthanides and actinides-Applications of IR spectroscopy to inorganic compounds- interpretation of IR spectra of complexes containing CO, and SO2 ligands- Applications of NMR to inorganic compounds - NMR of metal hydrides (1H NMR), metal carbonyls(13C NMR), NQR spectroscopy : principle and Applications of NQR spectroscopy to the study of complexes- ESR-zero- field splitting - Krammer's degeneracy - pattern for number of lines of complexes having d1-d9 systems -bis(salicylaldimine) Cu(II), Mn(II) complexes- Mossbauer spectroscopy - quadrupole splitting – applications of Mossbauer spectroscopy – iron complex ,sodium nitroprusside.. | | **CO3** |
| **UNIT-IV** | **THE CHEMISTRY OF SOLID STATE** | **Periods: 12** |
| Structure of solids- X-ray diffraction method – powder method- single crystal method (rotating crystal method)- comparison of X-ray diffraction and Neutron Diffraction - structure of pyrovoskite, cadmium iodide and nickel arsenide - spinels and antispinels- defects in solids, non-stoichometeric compounds. Electrical, magnetic and optical | | **CO4** |

properties of solids- band theory- Semiconductors, superconductors, solid state electrolytes- Types of magnetic behaviour, dia, para, ferro, antiferro and ferrimagnetism.

| **UNIT-V** | **BIOINORGANIC CHEMISTRY** | **Periods: 12** |
|---|---|---|

Metal ions in biology and its significance –metallobiomolecules-structure and function of haemoglobin - cooperative effect in haemoglobin - role of globin - structure and function of myoglobin –metalloenzymes and their functions-carboxy peptidase- carbonic anhydrase- cytochrome P-450 enzymes-vitamin B12 –ferredoxins- blue copper proteins-photosynthesis- nitrogen fixation **CO5**

| **Lecture Periods: 45** | **Tutorial Periods:-15** | **Practical Periods:-** | **Total Periods:60** |
|---|---|---|---|

## Text Books


1. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Advanced Inorganic Chemistry; 6th ed.; Wiley Interscience: New York,1988.
2. J. E. Huheey, E. A. Keiter, and R. L. Keiter, Inorganic Chemistry; 4th ed.; Harper and Row: New York,1983.
3. K. F. Purcell, and J. C. Kotz, Inorganic Chemistry; Saunders: Philadelphia,1976.
4. R.Gopalan V Ramalingam , Concise coordination chemistry, edition , Vikas Publishing House PVT LTD,2007


## Reference Books


1. D. F. Shriver, P. W. Atkins, and C. H. Langford, Inorganic Chemistry; 3rd ed.; Oxford University Press: London,2001.
2. T. Moeller, Inorganic Chemistry, A Modern Introduction; John Wiley: New York,1982.
3. W. L. Jolly, Modern Inorganic Chemistry, 2nd Edn, McGraw-Hill International Edition,1991.
4. G. S. Girolami, T. B. Rauchfuss, and R. J. Angelici, Synthesis and Technique in Inorganic Chemistry, 3rded., University Science Books, Sausalito,1999.
5. W. L. Jolly, The Synthesis and Characterization of Inorganic Compounds, Prentice Hall, New Jercy,1970


## Web References

1. https://www.chem.uci.edu/~lawm/11-25.pdf
2. https://egyankosh.ac.in/bitstream/123456789/71755/3/Unit-3.pdf
3. https://www.shivajicollege.ac.in/Study/Bioinorganic%20Chemistry%20(1).pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Third** | Course Category Code: **DSC** *End Semester Exam Type: **TE** | | | | | | |
| Course Code | **A23PCHT308** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **ORGANIC CHEMISTRY III** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |

| | | | |
|---|---|---|---|
| Prerequisite | Basic Knowledge studied in the UG Level | | |
| Course Objectives | • Mechanisms and evidences for aromatic electrophilic and nuleophilic substitutions, addition reactions, elimination reactions and rearrangements | | |
| | • Effect of substrate structure, leaving group and attacking species in the above reactions. | | |
| | • Understand the concept of aromaticity | | |
| | • Synthesis and applications of selected reagents used for various organic transformations. | | |
| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping(Highest Level) |
| | **CO1** | Understand the pericyclic reactions. | **K3** |
| | **CO2** | Recall the organic photochemistry | **K3** |
| | **CO3** | Utilize the retrosynthesis used for various organic synthesis. | **K3** |
| | **CO4** | Know the applications of UV-Visible and IR Spectroscopy | **K3** |
| | **CO5** | Understand the basic principles and instrumentation of mass specrtometry | **K3** |

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|---|---|---|
| **UNIT-I** | **PERICYCLIC REACTIONS** | **Periods: 12** |
| Characteristics and types of pericyclic reactions- Electrocyclic reactions: - FMO and PMO methods - thermal and photochemical reactions (ethylene, butadiene,1,3,5- hexatriene and their substituted compounds) - Cyclisation and ring opening-Woodward-Hoffman rules – conrotation and disrotation- electrocylic reactions of charged species - Cycloaddition reactions: FMO method- stereochemistry of Diels-Alder reactions - substituent effects on reactivity, regioselectivity and stereochemistry -- 1,3-dipolar additions - [2+2] cycloaddition reactions- sigmatropic rearrangement-correlation diagram method- electrocyclic interconversion of 1,3-butadiene and cyclobutene- [4+2] cycloaddition of ethylene to butadiene. | | **CO1** |
| **UNIT-II** | **ORGANIC PHOTOCHEMISTRY** | **Periods: 12** |
| photo chemistry of carbonyl compounds: Narrish type -I and Narrish type –II reactions- photocycloaddition: Paterno Buchi reaction, photochemical dimerization (photo reduction)- photochemistry of alkenes –cis-trans isomerisation, photodimerisation photochemical rearrangements: rearrangement of 1,4 diene - photolysis of diazo compounds - photo substitution reactions: - photochemistry of dienes and aromatic compounds- photo oxygenation. | | **CO2** |
| **UNIT-III** | **RETRO SYNTHESIS** | **Periods: 12** |
| Synthons and synthetic equivalents - types of synthons: donor and acceptor synthons - umpolung reactions - typical examples. Protectinggroups-Functional Group Interconversion (FGI), Functional Group Addition (FGA) - monofunctional disconnection: alcohol disconnection - alkene disconnection - ketone disconnection - acid and their derivatives disconnection - alkane disconnection - amine disconnection - bifunctional 1,2-, 1,3-, 1,4-, 1,5-, and 1,6-disconnections. | | **CO3** |
| **UNIT-IV** | **UV- VISIBLE SPECTROSCOPY AND IR SPECTROSCOPY** | **Periods: 12** |
| UV- VISIBLE SPECTROSCOPY**:** Basic principles-chromophore and Auxochrome concept- absorption and intensity shifts-types of absorption bands- solvent effects-absorption in conjugated and unconjugated systems-Woodward – fieser rules for calculating absorption maximum in dienes and α,β-unsaturated carbonyl compounds-applications of UV-Visible spectroscopy in organic compounds<br>IR SPECTROSCOPY: Basic Principles-Finger print region and functional group region – characteristic infrared absorption- detection of functional groups-applications of infrared spectroscopy- study of hydrogen bonding-progress of reaction- study of keto-enol tautomerism- geometrical isomerism-conformational analysis –qualitative and quantitative analysis. | | **CO4** |

| | | |
|---|---|---|
| **UNIT-V** | **MASS SPECTROMETRY** | **Periods: 12** |
| Basic principles - instrumentation - sampling techniques - ionization methods: EI, CI, desorption ionization techniques (SIMS, FAB, and MALDI), ESI - Mass analysis: magnetic, double focusing, quadrupole and ToF mass analysers - detection and quantization - determination of molecular weight - molecular ion peak - base and meta stable peaks - calculation of molecular formula - fragmentation and structural analysis - fundamental fragmentation processes -Stevenson's rule - α-cleavage-inductive cleavage - two bond cleavage - retro Diels-Alder cleavage - McLafferty rearrangements -fragmentation of hydrocarbons - alcohols, phenols, thiols - ethers and sulfides - carbonyl compounds – amines - and nitrogen compounds - halides. (18 Hours) | | **CO5** |

| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |
|---|---|---|---|

**Text Books**

1. P. S. Kalsi, Organic Reactions and their mechanism, 5th edition, New Age International Publishers, 2021
2. R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee Organic Chemistry, 7th edition, Pearson Education, 2010.
3. V.K.Ahluwalia, R.K Parashar, Organic reaction mechanisms, Ane Books India Publications, 3rd edition, 2009.
4. Y.R.Sharma , Elemetary organic spectroscopy,5th edition,S Chand And Company Limited, 2018
5. P. S. Kalsi, spectroscopy of organic compounds , 7th edition, New Age International Publishers,2016.

**Reference Books**

1. Jonathan Clayden, Nick Greeves and Stuart Warren, Organic Chemistry, Oxford University Press, 2nd edition, 2016..
2. S. M. Mukherji and S. P. Singh, Reaction Mechanism in Organic Chemistry, 3rd edition, Macmillan India Ltd.1984.
3. J. March and M. Smith, Advanced Organic Chemistry, 5th edition, John-Wiley and Sons.2001.
4. Robert. M.Silverstein 6th edition John Wiley & Sons 2007

**Web References**

1. https://www.alchemyst.co.uk/pdf/Organic/pericyclics.pdf
2. https://nowgonggirlscollege.co.in/attendence/classnotes/files/1628057189.pdf
3. https://www.nou.ac.in/econtent/Msc%20Chemistry%20Paper%20IX/MSc%20Chemistry%20Paper-IX%20Unit-7.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Semester | **Third** | Course Category Code: **DSC** | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHT309** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **PHYSICAL CHEMISTRY III** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To understand the structure of electric double layer<br>• To know about polarography and cyclic voltametry<br>• To construct the characterisation table and know applications of group theory.<br>• To solve Schrodinger equation for multi electron systems and know about approximation methods<br>• To study about molecular spectroscopy | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
|---|---|---|
| | **CO1** Understand the behaviour of electrical double layer | **K3** |
| | **CO2** Know about the partial molar thermodynamics properties and fugacity | **K3** |
| | **CO3** Categorize the molecules based on the symmetry and group. | **K3** |
| | **CO4** Solve Schrodinger equation for multi electron systems and know about | **K3** |
| | **CO5** Study about molecular spectroscopy | **K3** |

| **UNIT-I** | **ELECTROCHEMISTRY – II** | **Periods: 12** |
|---|---|---|
| Potentiometric titrations-types-theories of acid-base, redox and precipitation titration-Theories of electrical double layer – outer Helmholtz plane - Helmholtz –Perrin model of double layer - Gouy - Chapman diffused charged model of the double layer- Stern's model-kinetics of electrode reactions - derivation and verification of the equations - Butler-Volmer equation - Tafel equation-over voltage and its applications | | **CO1** |
| **UNIT-II** | **ELECTROANALYTICAL TECHNIQUES - I** | **Periods: 12** |
| Polarography - experimental setup - advantages of dropping mercury electrode - supporting electrolyte - polarographic peak maxima - types of peak maxima - polarographic peak maxima suppressor - residual current - migration current - diffusion current - polarogram - half wave potential - Ilkovic equation (derivation is not required) - outline of applications (Polarogram of Zn2+ and Cd2+) - cyclic voltametry, principle, experimental set up - cyclic voltammogram of Fe2+ in H2SO4 - anodic peak current - cathodic peak current - electrochemically reversible couple - cathodic peak potential - anodic peak potential - electrochemically irreversible couple - outline of applications. | | **CO2** |
| **UNIT-III** | **GROUP THEORY - II** | **Periods: 12** |
| Multiplication table, Great orthogonality theorem - construction of character table (C2V, C3V )- explanation of a character table. Applications of group theory - Normal modes of vibration of poly atomic molecules ($H_2O$, $NH_3$ and BF3) - IR & Raman active - vibration modes -mutual exclusion rule . | | **CO3** |
| **UNIT-IV** | **SURFACE CHEMISTRY AND HETEROGENEOUS CATALYSIS** | **Periods: 12** |
| Surface phenomenon - physical and chemical adsorption - adsorption and free energy relations at interface - Langmuir adsorption isotherm - Gibbs adsorption isotherm - BET isotherm - measurement of surface area - heterogeneous catalysis - mechanism - Langmuir Hinshelwood mechanism - Langmuir-Rideal bimolecular mechanism - role of surface in catalysis. | | **CO4** |
| **UNIT-V** | **MOLECULAR SPECTROSCOPY - II** | **Periods: 12** |
| NMR - hydrogen nuclei - chemical shift and spin-spin splitting - coupling constant - splitting with and without chemical exchange - interaction between spin and magnetic field - gyro magnetic ratio - instrumentation of NMR - FT NMR- applications. ESR - principle - position of ESR absorptions - g value - hyperfine splitting - zero fieldsplitting - ESR spectrum of free radicals. | | **CO5** |

| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |
|---|---|---|---|

**Text Books**


1. B.R.Puri , L.R Sharma Madan S Pathania, Principles of Physical Chemistry, 2022, Vishal Publishing co, 48th edition.
2. Gupta M. C., 1993, Statistical Thermodynamics, Wiley Eastern limited, New Delhi.
3. Lee, Sears, Tercotte, 1973, Statistical Thermodynamics, Addision Wesley Publishing Co., London – 1st Edition.
4. R.K.Prasad, Quantum Chemistry, New age international publishers, 4th revised edition , 2020.
5. P.K.Bhattacharya, Group Theory and its applications, Himalaya Publishers. 3rd edition. 2014.


**Reference Books**


1. Antropov L., 1999, Theoretical electrochemistry, MIR Publications, New Delhi.
2. Glasstone S., 2002, An Introduction to Electrochemistry, Von Nostrand Co. Inc., Toronto.
3. Kuriakose J. C., Rajaram, J. 1999, Thermodynamics, III edition, Shobanlal Nagin Chand, New Delhi, India.
4. H.W. Hanna, 1993, Quantum Mechanics in Chemistry-Benjamin –CummizaLondon Publishing Company, New Delhi, India.
5. Chandra A. K., 1988, Introductory Quantum Chemistry, 3rd edition, Tata McGraw-Hill Publishing Co, New Delhi, India


**Web References**

1. https://www.ccri.edu/chemistry/courses/chem_1100/terezakis/notes/Chapter_19_Lecture_Notes.pdf
2. https://pages.mtu.edu/~kreher/ABOUTME/syllabus/GTN.pdf
3. https://www.uou.ac.in/lecturenotes/science/MSCPHY-17/Spectroscopy%20by%20Dr.%20Papia%20Chowdhury.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
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| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Third** | Course Category Code: **DSE** *End Semester Exam Type: **TE** | | | | | | |
| Course Code | **A23PCHE307** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **BIOORGANIC CHEMISTRY** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To apply a range of computational tools to address toxicological questions<br>• To give students skills in the retrieval, processing, dissemination, and use of information systems for chemical/biological information and structures<br>• To prepare for a career in in-silico toxicity prediction in the pharma, industry etc. | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
|---|---|---|
| | **CO1** Understand the reactivity of heterocycles. K1 | **K3** |
| | **CO2** Outline the structure and functions of DNA and RNA. K2 | **K3** |
| | **CO3** Apply the separation concepts on aminoacids. K3 | **K3** |
| | **CO4** Iidentify the mechanism of preparation and reactions of heterocycles. | **K3** |
| | **CO5** Compare the organic reaction mechanism with enzyme mechanism | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **HETEROCYCLES 1** | **Periods: 12** |
| Hantzsch pyridine synthesis - electrophilic aromatic substitution in pyridine and activated pyridine - nucleophilic substitution in pyridine - pyridone in nucleophilic substitutions - pyridine as catalyst and reagent - pyrones - structures of triazoles, and tetrazole and their tautomers - quinoline and isoquinoline - electrophilic and nucleophilic substitution reactions.. | | **CO1** |
| **UNIT-II** | **HETEROCYCLES 2** | **Periods: 12** |
| Preparation of imidazole- only the structures, numbering and naming of diazins (pyrazine, pyrimidine and pyrazine), azines (oxazine and azepine)-electrophilic aromatic substitution reactions in five membered heterocycles - pyrrole, furan, thiophene and indole - electrophilic addition in furan - lithiation in furan and thiophene - five membered heterocycles in DielsAlder reactions. | | **CO2** |
| **UNIT-III** | **NUCLEIC ACIDS** | **Periods: 12** |
| Structures and names of nucleosides and nucleotides - ATP - carrier of chemical energy - phosphoryl transfer reaction-mechanisms for phosphoryl transfer reactions - structures of dinucleotides - NAD+ , NADP+ , NADH, NADPH and GTP - Nucleic acids - DNA and RNA - primary and double helical structures - base pair - replication - transcription - ribosomal RNA - transfer RNA - translation -base sequencing of DNA - DNA fingerprinting - AZT drug in HIV treatment | | **CO3** |
| **UNIT-IV** | **CARBOHYDRATES AND AMINO ACIDS** | **Periods: 12** |
| Carbohydrates: The reactions of monosaccharides in basic solutions - oxidation and reduction reactions of monosaccharides - the Wohl degradation - measuring the blood glucose level in diabetes - anomeric effect in glucose. Amino acids: Separation of amino acids - electrophoresis - TLC - Ion exchange chromatography - Synthesis of amino acids - HVZ reaction - N-Phthalimidomalonic ester synthesis - Resolution of racemic mixtures of amino acids - Peptide bonds and disulfide bonds | | **CO4** |
| **UNIT-V** | **ENZYME CATALYSIS AND LIPIDS** | **Periods: 12** |
| Enzyme Catalysis: Types of enzymes - names - Active site - molecular recognition - lock and key model - mechanism of carboxypeptidase A. Lipids: Fatty acids - omega fatty acids - waxes - fats and oils - PUFA - phospholipids -- prostaglandins - biosynthesis of prostaglandins, thromboxanes, and prostacyclins. | | **CO5** |

| | | | |
|---|---|---|---|
| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |

## Text Books

1. Clayden J, Greeves N and Warren S, Organic Chemistry, 2nd Edition, Oxford University Press, New York, 2012.
2. Bruice P Y, Organic Chemistry, 4th Edition, Pearson Education, New Delhi, 2012

## Reference Books

1. Rodwell D, Bender D and Botham K, Harper's Illustrated Biochemistry, 31st Edition, McGraw Hill Professional, New York, 2018.
2. Stryer L, Berg J M, Tymoczko J L and Gatto G, Biochemistry, 9th Edition, W. H. Freeman and Company, New York, 2019.

## Web References

1.https://www.uou.ac.in/lecturenotes/science/MSCCH-17/CHEMISTRY%20LN.%203%20HETEROCYCLIC%20COMPOUNDS-converted%20(1).pdf

2.https://www.hansrajcollege.ac.in/hCPanel/uploads/elearning/elearning_document/imgtopdf_generated_1604201747031.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Third** | Course Category Code: **DSE** | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHE308** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **BASICS OF FORENSIC SCIENCE** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To create awareness about the importance of chirality for organic synthesis and for biological activity<br>• Apply the important principles of stereochemistry and understand them. | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
|---|---|---|
| | **CO1** Understand the basic concept of asymmetric Synthesis | **K3** |
| | **CO2** Able to synthesize on chiral substrate | **K3** |
| | **CO3** Use chiral substrate to synthesize asymmetric compounds | **K3** |
| | **CO4** Utilysze chiral auxiliary to synthesize asymmetric compounds | **K3** |
| | **CO5** handle chiral catalyst to synthesize asymmetric compounds | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **CONCEPTS OF FORENSIC SCIENCE** | **Periods: 12** |
| Forensic Science- History and Development of Forensic Science - What Is a Forensic Scientist? - Career Information – Indian and Other Forensic Science Systems - The Organization of Forensic Science Laboratories- The Functions of the Forensic Scientist -Crime Scene Investigation - The Crime Scene as Recent History - Preserving and Recording the Crime Scene - Crime Scene Investigation Process - Recognition of Bloodstain Patterns – other examples. | | **CO1** |
| **UNIT-II** | **FORENSIC SCIENCE IN THE LABORATORY** | **Periods: 12** |
| The Forensic Laboratory - Identification and Characterization of Blood and Bloodstains Identification of Biological Fluids and Stains - Techniques of DNA Analysis - Microanalysis and Examination of Trace Evidence – Fingerprints - Forensic Footwear Evidence - Forensic Tire Impression and Tire Track Evidence - Firearm and Tool Mark Examinations - Questioned Documents - Analysis of Controlled Substances. | | **CO2** |
| **UNIT-III** | **FORENSIC ENGINEERING AND INVESTIGATION** | **Periods: 12** |
| Forensic Pathology - How to Become a Forensic Pathologist - Investigation of Death: Coroners and Medical Examiners - Death Investigation Process - The Postmortem Interval (PMI)—Time of Death – Exhumations - The Teamwork Approach - The Human Skeleton - Identification of Skeletal Remains - The Significance of Age - The Biological Profile -Individualization of Human Bone - Collection of Bones - Forensic Odontology | | **CO3** |
| **UNIT-IV** | **FORENSIC TRACE EVIDENCES** | **Periods: 12** |
| Forensic Analysis of Metals, soils, Plants, Paints – The Chemistry of fire and analysis of flammable residues - Explosions and Explosives - Collection and Analysis of Evidence of Explosives – Fingerprints – History of Fingerprints - Classification of Fingerprints - Automated 97 Fingerprint Identification Systems- Methods of Detecting Fingerprints - Preservation of Developed Prints- Digital Imaging for Fingerprint Enhancement - Document Examination - The Document Examiner - Handwriting Comparisons-Typescript Comparisons-Alterations, Erasures, and Obliterations | | **CO4** |
| **UNIT-V** | **LEGAL ASPECTS OF FORENSIC SCIENCE** | **Periods: 12** |
| Forensic Science and the Law - Admissibility of Evidence - Laboratory Reports - Expert Testimony - Countering Chaos- Logic, Ethics, and the Criminal Justice System - Forensic Science and the Law - Legal Issues in Forensic DNA | | **CO5** |

| Lecture Periods: 60 | Tutorial Periods:- | Practical Periods:- | Total Periods:60 |
|---|---|---|---|

**Text Books**

1. Jay A. Siegel, Kathy Mirakovits, Forensic Science: The Basics, 2 nd Edition, CRC Press, 2010.

2. Stuart H. James, Jon J. Nordby, Suzanne Bell, Stuart H. James, Jon J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, CRC Press, 2002.

3. Richard Saferstein, Forensic Science, An Introduction, Pearson Education, Inc. (Pearson Prentice Hall), 2011.

**Reference Books**

1. Robert Milne, Forensic Intelligence, Taylor and Francis Group, 2013.
2. Robert Bruce Thompson and Barbara Fritchman Thompson, An Illustrated Guide to Home Forensic Science Experiments-DIY Science-O'Reilly Media Inc., 2012.
3. Louis B. Schlesinger, Sexual Murder Catathymic and Compulsive Homicides, CRC Press, 2004.
4. Terrence F. Kiely, Forensic Evidence: Science and The Criminal Law, CRC Press LLC, 2001.

**Web References**

1.http://ijapc.com/upload/MNAPC-13-I3-17-P-75-82.pdf
2.https://www.ojp.gov/pdffiles1/Digitization/143821NCJRS.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| 4 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 |
| 5 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Third** | Course Category Code: **DSE** *End Semester Exam Type: **TE** | | | | | | |
| Course Code | **A23PCHE309** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **POLYMER AND PLASTICS** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | To make the students learn the concept of polymers and plastics. | | | | | | | |
| | To understand the classification of polymers. | | | | | | | |
| | To understand the methods of molecular weight determination. | | | | | | | |
| | To learn the importance of freons and rubber | | | | | | | |
| | To make the students learn the concept of polymers and plastics. | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
|---|---|---|
| **CO1** | Classify the different types of polymers. | **K3** |
| **CO2** | Illustrate the importance of stereochemistry of polymers | **K3** |
| **CO3** | Apply the methods for determination of molecular weight | **K3** |
| **CO4** | Acquire knowledge on the various types of rubber | **K3** |
| **CO5** | Differentiate thermoplastic and thermosetting plastic | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **BASIC CONCEPTS** | **Periods: 12** |
| An introduction to polymers and macro molecules. Natural and synthetic polymers. Classification of Polymers-addition and condensation polymers. General methods of preparation of polymers. Polymerization through functional groups, multiple bonds and ring opening. Coordination polymerization. Synthesis of high | | **CO1** |
| **UNIT-II** | **STRUCTURE OF POLYMERS** | **Periods: 12** |
| linear, branched and cross linked Stereochemistry of polymers-Isotactic , Syndiotactic and Atactic. properties of polymers : The crystalline melting point. The glassy state and glass transition temperature | | **CO2** |
| **UNIT-III** | **COPOLYMERISATION** | **Periods: 12** |
| Definitions – homo and copolymers. Block copolymers and Graft copolymers. Molecular weight of polymers. Number average molecular weight and weight average molecular weight. Determination of molecular weight by Viscosity and Osmometry methods | | **CO3** |
| **UNIT-IV** | **POLY OLEFINS** | **Periods: 12** |
| -polythene , PTFE , Freons ,PVC ,polypropylene and polystyrene. 4.2. Natural and synthetic rubbers.-Constitution of natural rubber. Butyl, Buna, Buna-S , BunaN, Neoprene , SBR, Thiocol, Polyurethane and silicone rubbers. | | **CO4** |
| **UNIT-V** | **PLASTICS AND RESINS DEFINITIONS.** | **Periods: 12** |
| Thermoplastic and thermosetting resins. Constituents of plastic-fillers, dyes, pigments, plasticizers, Lubricants and catalysts. Uses of thermoplastic resins and thermo setting resins. | | **CO5** |

| | | | |
|---|---|---|---|
| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |

**Text Books**

1.V. R. Gowrikar ,N.V.Viswanathan : Polymer Science- Wiley Eastern Limited ,New Delhi. 1986
2. S.S.Dara , A Text Book in Engineering Chemistry, S.Chand & Company Ltd, New Delhi. Third Edition ,!992.

**Reference Books**

1. R.B.Seymour, Introduction to Polymer Chemistry, MC Craw Hill, New York 1971.

**Web References**

1. https://unacademy.com/content/wp-content/uploads/sites/2/2022/10/33.-Polymer-Notes.pdf
2. https://www.vssut.ac.in/lecture_notes/lecture1541230922.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| **1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **3** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| **4** | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| **5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Semester | **Third** | Course Category Code: **DSC** | | | *End Semester Exam Type: **PE** | | | |
| Course Code | **A23PCHL305** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **ORGANIC CHEMISTRY LAB – II** | **-** | **-** | **4** | **2** | **50** | **50** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To learn about critical solution system and distribution coefficient | | | | | | | |
| | • To understand rate constant of the reaction and Comparison of acid strengths | | | | | | | |
| | • To Analyse the activation and frequency factor | | | | | | | |
| | • To learn about Molecular weight of the compound | | | | | | | |
| | • To analyze phase diagram of compound | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping (Highest Level) |
|---|---|---|---|
| | **CO1** | Learn about critical solution system and distribution coefficient | **K3** |
| | **CO2** | Understand rate constant of the reaction and Comparison of acid strengths | **K3** |
| | **CO3** | Analyse the activation and frequency factor | **K3** |
| | **CO4** | Learn about Molecular weight of the compound | **K3** |
| | **CO5** | Analyze phase diagram of compound | **K3** |

**List of Experiments**

**ORGANIC ESTIMATIONS**

1.Estimation of phenol

2. Estimation of aniline.

3.Estimation of glucose

4. Estimation of ascorbic acid.

5. Estimation of ketone.

6.Determination of iodine value of an oil

7.Determination of saponification value of an oil

Extraction of natural products

8.Isolation of citric acid from lemon

| **Lecture Periods: -** | **Tutorial Periods:-** | **Practical Periods:-30** | **Total Periods:30** |
|---|---|---|---|

**Reference Books**

1.N.S.Gnanapragasam, G.Ramamurthy (2022) Organic chemistry lab manual, Ananda Book Depot,chennai
2.Venkateswaran, V., Veeraswamy, R. &Kulandaivelu, A. R. (1997). Basic Principles of Practical Chemistry, (2nd Ed.). Sultan Chand & Sons.
2. Furniss B S, Hannaford A J, Smith P W G, and Tatchell A R, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Pearson publication

**Web References**

1.https://jru.edu.in/studentcorner/lab-manual/bpharm/3rd-sem/Lab%20Manual%20of%20Organic%20Chemistry%20II.pdf
2.https://mlrip.ac.in/wp-content/uploads/2022/03/PHARMACEUTICAL-ORGANIC-CHEMISTRY-II-LAB-MANUAL.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| **1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **3** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| **4** | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| **5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|
| | Observation | Model Exam | Viva Voce | Attendance | | |
| Marks | 15 | 15 | 10 | 10 | 50 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Third** | Course Category Code: **DSC** | | | *End Semester Exam Type: **PE** | | | |
| Course Code | **A23PCHL306** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **PHYSICAL CHEMISTRY LAB – II** | **-** | **-** | **4** | **2** | **50** | **50** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To understand and develop the practical experience on conductometric experiments | | | | | | | |
| | • To learn practical knowledge on potentiometric experiments | | | | | | | |
| | • To understand the practical knowledge on PH metry | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping (Highest Level) |
|---|---|---|---|
| | **CO1** | Gain knowledge on Conductometric titration | **K3** |
| | **CO2** | Develop skill on Verifying De Bye - Huckel- Onsagar equation | **K3** |
| | **CO3** | Improve practical experience l on Verifying the Ostwald's Dilution law | **K3** |
| | **CO4** | Understand the potentiometric titration | **K3** |
| | **CO5** | Learn the determination of ionisation constant using pH meter | **K3** |

**List of Experiments**

## CONDUCTOMETRIC EXPERIMENTS

1. Mixture of acids Vs Strong Base Titration [(HCl+$CH_3COOH$) Vs NaOH

2. Precipitation titration [mixture of halides Vs silver nitrate]

3.Verifying De Bye - Huckel- Onsagar equation and Determination of equivalent conductance of a strong electrolyte at infinite dilution

4.Verifyng the Ostwald's Dilution law and determination of ionisation constant of a weak electrolyte (oxalic acid) by conductivity method

## POTENTIOMETRIC EXPERIMENTS

5.Precipitation titration [Chloride ion Vs silver nitrate]

6.Precipitation titration [iodide ion Vs silver nitrate]

7.Precipitation titration [mixture of halides Vs silver nitrate]

8.Redox titration [Iron (II) Vs $K_2Cr_2O_7$]

9. Redox titration [Iron (II) Vs Ce (IV)]

10.Dissociation Constant of weak electrolyte using quin hydrone electrode

## pH METRY

11. Determination of first and second ionisation constant of a dibasic acid (oxalic acid) using pH Meter.

| | | | |
|---|---|---|---|
| **Lecture Periods: -** | **Tutorial Periods:-** | **Practical Periods:-30** | **Total Periods:30** |

**Reference Books**

1. Lab Manual, Department of Chemistry, SMVEC (Autonomous), Madagaipattui.
2. Venkateswaran V, Veeraswamy R and Kulandaivelu A R., Basic Principles of Practical Chemistry, 2nd Edition, Sultan Chand & sons, New Delhi, 1997.
3. Daniels, Mathews F, Howard J and John Warren W, Experimental Physical Chemistry, 7th Edition, Mc Graw Hill, New York, 1970.
4. Findlay A, Practical Physical Chemistry, 7th Edition, Longman, London, 1959.

**Web References**

1.https://people.iitism.ac.in/~download/lab%20manuals/chemistry_chembio/CYC%20517%20%20%20Physical%20Chemistry%20Lab%20II%20MSC%203rd%20SEM.pdf

2.http://kuno.crc.nd.edu/wordpress/wp-content/uploads/2018/02/Chem332_Spring_13.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|
| | Observation | Model Exam | Viva Voce | Attendance | | |
| Marks | 15 | 15 | 10 | 10 | 50 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Semester | **Third** | Course Category Code: SEC | | | *End Semester Exam Type: | | | |
| Course Code | **A23PCHS301** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **ADVANCE RESEARCH METHODOLOGY IN CHEMISTRY** | **2** | **-** | **-** | **2** | **100** | **-** | **100** |

| | |
|---|---|
| Prerequisite | Basic mathematical and reasoning knowledge |
| Course Objectives | • To know about research, aim, objectives and principles<br>• To know about conduct of research work<br>• To gain the knowledge on separation and characterization techniques<br>• To gain the knowledge about evaluation and statistical treatment of analytical data<br>• To know the concept of thesis writing |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping (Highest Level) |
|---|---|---|
| | **CO1** Learn about the research, aim, objectives and principles | **K3** |
| | **CO2** Understand the research work | **K3** |
| | **CO3** Gain the knowledge on separation and characterization techniques | **K3** |
| | **CO4** Gain the knowledge about evaluation and statistical treatment of analytical data | **K3** |
| | **CO5** know the concept of thesis writing | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **INTRODUCTION** | **Periods: 6** |
| Nature and importance of research - aims, objective, principles and problems - selection of research problem - survey of scientific literature - primary and secondary sources - citation index for scientific papers and journals - patents. | | **CO1** |
| **UNIT-II** | **CONDUCT OF RESEARCH WORK** | **Periods: 6** |
| Chemistry of working with hazardous materials - acid / base / water sensitive, corrosive, toxic, explosive and radioactive materials(storage and handling of chemicals)-first aid techniques- hazards in laboratory- laboratory safety measures – weighing process in using electronic balance- errors in weighing- weighing bottles- preparation of different concentration of molarity, molality, normality solution- Physical properties useful in analysis. | | **CO2** |
| **UNIT-III** | **SEPARATION AND CHARACTERISATION TECHNIQUES** | **Periods: 6** |
| Methods of separation prior to analysis - Isolation techniques - extraction - Soxhlet extraction, crystallization, sublimation – distillation-methods for vacuum sublimation and distillation under reduced pressure .Chromatography-working principle and applications of TLC , Column chromatography, HPLC- applications only for UV-Visible , IR, $^{1}H$, $^{13}C$ spectroscopy, mass spectrometry, XRD,SEM and TEM in the analysis of chemical compounds. | | **CO3** |
| **UNIT-IV** | **EVALUATION AND STATISTICAL TREATMENT OF ANALYTICAL DATA** | **Periods: 6** |
| Precision and accuracy – errors - types - determinate and random errors – rules for improving accuracy of data - distribution of random errors -normal distribution curve –rejection of data - criteria for rejection of an observation - the Q test -significant figures - reporting data and presentation of tabulated data- data plotting - scatter diagrams-least square analysis- correlation coefficient. | | **CO4** |
| **UNIT-V** | **THESIS WRITING** | **Periods: 6** |
| Conventions of writing - the general format - page and chapter format - use of quotations and footnotes - preparation of tables and figures - referencing - appendices - revising editing and evaluating the final product - proof reading - meanings and examples of commonly used abbreviations. | | **CO5** |

| | | | |
|---|---|---|---|
| **Lecture Periods: 30** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:30** |

**Reference Books**

1. Douglas A. Skoog and Donald, M. West, Fundamental of analytical chemistry, Halt Saundersons International Edition.
2. J. Anderson, H.M. Durston and M.Poole, Thesis and assignment writing - Wiley Eastern Ltd., (1970).

## Text Books

1. J. March, Advanced organic chemistry - reactions, Mechanism & Structure. McGraw Hill Student Edition.
2.Vogel's Textbook of quantitative chemical analysis, ELBS edition.
3. Rajammal P. Devados, Research Methodolgy

## Web References

1.http://ndl.ethernet.edu.et/bitstream/123456789/78707/1/Research%20Methodology%20and%20Scientific%20Writing%20%28Chem%20453%29.pdf

2.https://www.vidyawarta.com/01/wp-content/uploads/2017/02/Research_Methodology.pdf

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | CAT 3 | Assignment* | Attendance | | |
| Marks | 70 | | | 20 | 10 | - | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Fourth** | Course Category Code: **DSC** *End Semester Exam Type: **TE** | | | | | | |
| Course Code | **A23PCHT410** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **ORGANIC CHEMISTRY IV** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To improve knowledge on the NMR Spectroscopy<br>• To understand NMR Techniques and identification of Organic compounds<br>• To know about structure , synthesis and applications of heterocycles and steroids<br>• To understand about classification, structure , synthesis and applications of terpenes and alkaloids<br>• To improve knowledge on the proteins and nucleic acids | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
|---|---|---|
| | **CO1** Improve knowledge on the NMR Spectroscopy | **K3** |
| | **CO2** Understand NMR Techniques and identification of Organic compounds | **K3** |
| | **CO3** Know about structure , synthesis and applications of heterocycles and steroids | **K3** |
| | **CO4** Understand about classification, structure , synthesis and applications | **K3** |
| | **CO5** Improve knowledge on the proteins and nucleic acids | **K3** |

| **UNIT-I** | **$^{1}$H - NMR & $^{13}$C-NMR SPECTROSCOPY** | **Periods: 12** |
|---|---|---|

Nuclear spin - magnetic moment of a nucleus - nuclear energy levels in the presence of magnetic field - basic principles of NMR experiments - CW and FT NMR - 1H NMR - Chemical shift - factors influencing proton chemical shift, spin- spin coupling- coupling constant- geminal coupling –vicinal coupling-Karplus equation – long range coupling-$^{1}$H NMR spectra of simple AX and AB spin systems- Nuclear Overhauser effect (NOE). Chemical exchange. $^{13}$C NMR – proton decoupled and off-resonance spectra. $^{13}$C NMR spectra of simple organic molecules- DEPT Experiment. **CO1**

| **UNIT-II** | **2D NMR TECHNIQUES AND SPECTROSCOPIC IDENTIFICATION OF ORGANIC COMPOUNDS** | **Periods: 12** |
|---|---|---|

Basic principles of two dimensional NMR spectroscopy – $^{1}$H -$^{1}$H COSY, $^{1}$H -$^{13}$C COSY, HETCOR, HSQC, HMBC, NOESY spectra- Identification of organic compounds using UV, IR and NMR spectroscopy and mass spectrometry – problems. **CO2**

| **UNIT-III** | **HETEROCYCLES AND STEROIDS** | **Periods: 12** |
|---|---|---|

**HETEROCYCLES**: Structure and Synthesis of imidazole, flavones, isoflavones, anthocyanins, pyrimidines (cytocine, uaracil only) and purines (adenine, guanine only). Steroids: Structural elucidation of cholesterol-Bio synthesis of cholesterol-Conversion of cholesterol to progesterone. **CO3**

| **UNIT-IV** | **TERPENES AND ALKALOIDS** | **Periods: 12** |
|---|---|---|

TERPENES: Introduction - classification - isoprene rule - structural determination of terpenoids - Citral, geraniol – farnesol,α-pinene and camphor. ALKALOIDS: Introduction - isolation of alkaloids – Structure and synthesis of quinine – morphine. **CO4**

| **UNIT-V** | **PROTEINS AND NUCLEIC ACIDS** | **Periods: 12** |
|---|---|---|

Nucleic acids: Types of nucleic acids – DNA & RNA polynucleotide chain. Components – Structure and role of (genetic code) DNA and RNA (Nucleotides only). Proteins: Biosynthesis of proteins -Peptides and their synthesis – synthesis of tripeptide. Merrifield synthesis, End group analysis of peptides, Primary, Secondary and tertiary structure of proteins, Determination of tertiary structure of proteins. **CO5**

| Lecture Periods: 60 | Tutorial Periods:- | Practical Periods:- | Total Periods:60 |
|---|---|---|---|

**Text Books**


1. Y.R.Sharma , Elemetary organic spectroscopy,5th edition,S Chand And Company Limited, 2018
2. P. S. Kalsi, spectroscopy of organic compounds , 7th edition, New Age International Publishers,2016.
3. I. L. Finar, Organic Chemistry Vol-2, 5th edn, Pearson Education Asia, 1975.
4. D.N. Sathyanarana, "Handbook of Molecular Spectroscopy", Wiley pub. Second Edition-2019.
5. O. P. Agarwal, Chemistry of Organic Natural Products, Vol. 1, Goel Publishing House, Meerut, 1997


**Reference Books**


1. Robert. M.Silverstein 6th edition John Wiley & Sons 2007
2. Jonathan Clayden, Nick Greeves and Stuart Warren, Organic Chemistry, Oxford University Press, 2nd edition, 2016..
3. O. P. Agarwal, Chemistry of Organic Natural Products, Vol. 2, Goel Publishing House, Meerut, 1997.
4. Shoppe, Chemistry of the steroids, Butterworthes, 1994
5. W. Kemp, Applications of Spectroscopy, English Language Book Society, 1987


**Web References**

1.https://www.vanderbilt.edu/AnS/Chemistry/Rizzo/chem220a/Ch13slides.pdf
2.https://kud.ac.in/admin_panel/dept/lms/NMR.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Fourth** | Course Category Code: **DSC** | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHT411** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **PHYSICAL CHEMISTRY IV** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |

| | | |
|---|---|---|
| Prerequisite | Basic Knowledge studied in the UG Level | |
| Course Objectives | • To understand the structure of electric double layer | |
| | • To know about polarography and cyclic voltametry | |
| | • To construct the characterisation table and know applications of group theory. | |
| | • To solve Schrodinger equation for multi electron systems and know about approximation methods | |
| | • To study about molecular spectroscopy | |
| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
| | **CO1** Understand the behaviour of electrical double layer | **K3** |
| | **CO2** Know about the partial molar thermodynamics properties and fugacity | **K3** |
| | **CO3** Categorize the molecules based on the symmetry and group. | **K3** |
| | **CO4** Solve Schrodinger equation for multi electron systems and know about | **K3** |
| | **CO5** Study about molecular spectroscopy | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **SOLID STATE** | **Periods: 12** |
| Structure of solids- X-ray diffraction method – powder method- single crystal method (rotating crystal method)- Neutron Diffraction -. Electrical, magnetic and optical properties of solids- band theory of solids- Semiconductors, superconductors, solid state electrolytes- Types of magnetic behaviour, dia, para, ferro, antiferro and ferrimagnetism. | | **CO1** |
| **UNIT-II** | **PHASE EQUILIBIYA** | **Periods: 12** |
| Physical equilibria involving phase transition: Two component system - Congruent system (phenol-aniline) and Incongruent system (sodium chloride- water) - Peritectic reactions. Three component system: Solid - Liquid equilibria - hydrate formation (sodium chloride - sodium sulphate - water); Liquid - Liquid equilibria - one pair of partially miscible liquids (acetic acid - chloroform - water and alcohol - benzene - water); two pairs of partially miscible liquids (water - ethyl alcohol - succinic nitrile). | | **CO2** |
| **UNIT-III** | **KINETICS OF COMPLEX REACTIONS & FAST REACTIONS** | **Periods: 12** |
| Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions, general treatment of chain reactions - chain length - Rice Herzfeld mechanism - explosion limits. Study of fast reactions - relaxation methods - temperature and pressure jump methods stopped flow and flash photolysis methods. | | **CO3** |
| **UNIT-IV** | **ANALYTICAL TECHNIQUES - II** | **Periods: 12** |
| Thermoanalytical methods – principle , instrumentation and applications of Thermogravimetric analysis (TGA),Differential Thermal analysis (DTA) , Differential Scanning Calorimetry (DSC) – principle and applicatins of Thermometric titration and amperometric titrations | | **CO4** |
| **UNIT-V** | **MACROMOLECULES** | **Periods: 12** |
| Macromolecules – classification of polymers –molar masses of polymers –methods of determination of molar mases of polymer : viscometry, osmometry, ultracentrifugation, light scattering kinetics of polymerization :kinetics of addition and condensation polymerization – properties of polymers: glass transition temperature – crystallinity polymers-polymer processing techniques. | | **CO5** |

| | | | |
|---|---|---|---|
| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |

**Text Books**

1. B.R.Puri , L.R Sharma Madan S Pathania, Principles of Physical Chemistry, 2022, Vishal Publishing co, 48th edition.
2. Gupta M. C., 1993, Statistical Thermodynamics, Wiley Eastern limited, New Delhi.
3. Lee, Sears, Tercotte, 1973, Statistical Thermodynamics, Addision Wesley Publishing Co., London – 1st Edition.
4. R.K.Prasad, Quantum Chemistry, New age international publishers, 4th revised edition , 2020.
5. P.K.Bhattacharya, Group Theory and its applications, Himalaya Publeshers. 3rd edition. 2014.

**Reference Books**

1. Antropov L., 1999, Theoretical electrochemistry, MIR Publications, New Delhi.
2. Glasstone S., 2002, An Introduction to Electrochemistry, Von Nostrand Co. Inc., Toronto.
3. Kuriakose J. C., Rajaram, J. 1999, Thermodynamics, III edition, Shobanlal Nagin Chand, New Delhi, India.
4. H.W. Hanna, 1993, Quantum Mechanics in Chemistry-Benjamin –CummizaLondon Publishing Company, New Delhi, India.
5. Chandra A. K., 1988, Introductory Quantum Chemistry, 3rd edition, Tata McGraw-Hill Publishing Co, New Delhi, India

**Web References**

1.https://www.mlsu.ac.in/econtents/2454_macromolecules.pdf
2.https://www.etsu.edu/uschool/faculty/tadlockd/documents/apbio_chp_5_detaillectout.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Semester | **Fourth** | Course Category Code: **DSE** | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHE410** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **PHARMACEUTICAL CHEMISTRY** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |

| | |
|---|---|
| Prerequisite | Basic Knowledge studied in the UG Level |
| Course Objectives | • To study the chemistry of bioregulatory drugs<br>• To understand the therapeutic uses of drugs containing heterocycles.<br>• To identify the common diseases and their treatments employed.<br>• To classify drugs based on their biological, chemical characteristics.<br>• To apply the concept of chemical reactions in designing the drugs. |

| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
|---|---|---|
| | **CO1** Recall the chemistry of bioregulatory drugs | **K3** |
| | **CO2** Understand the therapeutic uses of drugs containing heterocycles. | **K3** |
| | **CO3** Identify the common diseases and their treatments employed. | **K3** |
| | **CO4** Classify drugs based on their biological, chemical characteristics. | **K3** |
| | **CO5** Apply the concept of chemical reactions in designing the drugs. | **K3** |

| **UNIT-I** | **INTRODUCTION TO CHEMISTRY OF DRUGS** | **Periods: 12** |
|---|---|---|
| Drugs - definition- sources- study of drugs -classification (biological, chemical, commercial and utility)-nomenclature of drugs- biotransformation-drug design - factors affecting the stability of drugs- encapsulation - drug delivery systems and sustained release of drugs. | | **CO1** |

| **UNIT-II** | **DRUGS CONTAINING HETEROCYCLES** | **Periods: 12** |
|---|---|---|
| Structures and their therapeutic uses of drugs containing pyridine: nikethamide, isoniazid, mepyramine and niacin-thiazole: niridazole, thiabendazole and sulfathiazole - imidazole: azomycin, metronidazole and clotrimazole - indole: seratonine, reserpine, ergotamine and indomethacin- quinoline: chinofon, chloroquine and primaquine. | | **CO2** |

| **UNIT-III** | **COMMON DISEASES AND THEIR TREATMENT** | **Periods: 12** |
|---|---|---|
| Insect borne diseases - Treatment using drugs - Air borne diseases-Treatment using drugs - water borne diseases-Treatment using drugs-Digestive disorders - treatment- diseases of respiratory system- treatment-diseases of nervous system - treatment - other common diseases- treatment. | | **CO3** |

| **UNIT-IV** | **NAME REACTIONS IN DRUG SYNTHESIS** | **Periods: 12** |
|---|---|---|
| Mechanism and uses of Beckmann rearrangement- Fries rearrangement- Schmidt reactionMPV reduction-Clemmensen Reduction-Birch Reduction-Darzen's reaction-Reiley Reaction-Mannich reaction-Michael reaction | | **CO4** |

| **UNIT-V** | **BIOREGULATORY DRUGS** | **Periods: 12** |
|---|---|---|
| Cardiovascular drugs - Cardiac glycosides - anti arrhythmic drugs -antihypertensive agents - antianginal agents. Diabetes and Hypoglycaemic drugs - two types of diabetes - Diabetes insipidus and diabetes mellitus -Control of diabetes - Insulin -Hypoglycaemic agents. Anticonvulsants -Cancer and antineoplastic drugs - Common causes - antimetabolites. | | **CO5** |

| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |
|---|---|---|---|

**Text Books**


1. Clayden J, Greeves N and Warren S, Organic Chemistry, 2 nd Edition, Oxford University Press, New York, 2012
2. Gosh J, Text Book of Pharmaceutical Chemistry, 3rd Edition, S. Chand & Chand Publications, New Delhi, 1997.
3. George M and Joseph L, Text Book of Pharmaceutical Chemistry, Viva Books, New Delhi, 2009

**Reference Books**


1. Srivastava, S K, A Complete Text Book of Medical Pharmacology, Volume I, 2nd Edition, Avichal Publishing Company, Kolkatta, 2012.
2. Srivastava, S K, A Complete Text Book of Medical Pharmacology, Volume II, 2nd Edition, Avichal Publishing Company, Kolkatta, 2012.
3. Deb A C, Fundamentals of Biochemistry, New Central Book Agency, Calcutta, 1994.
4. Satake M and Mido Y, Chemistry for Health Science, Discovery Publishing House, New Delhi, 2003.
5. Kar A, Medicinal Chemistry, Wiley Easterns Limited, New Delhi, 1993


**Web References**

1.https://tech.chemistrydocs.com/Books/Medicinal/Chemistry-of-Drugs-by-David-E-Newton.pdf
2.https://www.chem.uzh.ch/zerbe/MedChem/MedChem1_Intro.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Semester | **Fourth** | Course Category Code: **DSE** | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHE411** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **INORGANIC CHEMISTRY-IV** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |

| | |
|---|---|
| Prerequisite | Basic Knowledge studied in the UG Level |
| Course Objectives | • To know about Applications of UV, Visible, IR and Raman Spectroscopy |
| | • To improve the know on Applications of NMR, NQR and Mossebauer Spectroscopy |
| | • To gain information about ESR and Photoelectron spectroscopy |
| | • To understand about AAS, AES , AFS, ICP GLC and HPLC |
| | • To develop the knowledge on Laser Raman spectroscopy , Magnetic susceptibility, Polarography and Amperometry |

| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping(Highest Level) |
|---|---|---|---|
| | **CO1** | Know about Applications of UV, Visible, IR and Raman Spectroscopy | **K3** |
| | **CO2** | Improve the know on Applications of NMR, NQR and Mossebauer Spectroscopy | **K3** |
| | **CO3** | Gain information about ESR and Photoelectron spectroscopy | **K3** |
| | **CO4** | Understand about AAS, AES , AFS, ICP GLC and HPLC | **K3** |
| | **CO5** | Develop the knowledge on Laser Raman spectroscopy , Magnetic susceptibility, Polarography and Amperometry | **K3** |

| **UNIT-I** | **INORGANIC SPECTROSCOPY - I** | **Periods: 12** |
|---|---|---|
| Applications to inorganic systems of the following: ultra violet, visible, infra-red and Raman spectra of metal complexes, organometallic and simple inorganic compounds with special reference to coordination sites and isomerism. | | **CO1** |
| **UNIT-II** | **INORGANIC SPECTROSCOPY - II** | **Periods: 12** |
| Application to Inorganic systems of the followings NMR, NQR and Mossebauer spectra - NMR of 31P, 19F, NMR shift reagents. NQR - Nitrosyl compounds. Mossebauer spectra of Fe and Sn systems. | | **CO2** |
| **UNIT-III** | **INORGANIC SPECTROSCOPY - III** | **Periods: 12** |
| ESR Introduction - Zeeman equation, g-value, nuclear hyperfine splitting, interpretation of the spectrum, simple carbon centered free radicals. Anisotropy - g-value and hyperfine splitting constant. McConnell's equation, Kramer's theorem.ESR of transition metal complexes of copper, manganese and vanadyl complexes. Photoelectron spectroscopy (UV and X-ray) - photo electron spectra - Koopman's theorem, fine structure in PES, chemical shift and correlation with electronic charges. | | **CO3** |
| **UNIT-IV** | **INSTRUMENTAL ANALYSIS - I** | **Periods: 12** |
| AAS, AES and AFS – Principle, instrumentation and applications, advantages of AAS, interferences; GLC and HPLC – Principle, instrumentation and working, types of detectors; Inductively coupled plasma spectroscopy (ICP)- introduction, instrumentation, interferences and applications. | | **CO4** |
| **UNIT-V** | **INSTRUMENTAL ANALYSIS - II** | **Periods: 12** |
| Laser Raman spectroscopy - principle, interfaces, advantages and applications. Magnetic susceptibility and its determination - Guoy method, Faraday method and applications. Polarography and Amperometry - Principle, instrumentation and applications. | | **CO5** |

| **Lecture Periods: 60** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:60** |
|---|---|---|---|

**Text Books**

1. A. Earnshaw, Introduction to Magneto Chemistry, Academic Press, London, (1968).
2. C.N.R. Rao, I.R. Ferraro, Spectroscopy in Inorganic Chemistry, Vol. I and Vol. II, Academic Press, (1970).
3. D. A. Skoog and D.M.West, Principles of Instrumental Methods of Analysis, Saunder's College Publ. III Edition, (1985).

**Reference Books**

1D.N. Sathyanarayana, Electronic Absorption Spectroscopy and Related Techniques, Universities Press (India) Ltd., Hyderabad (2001).
2.FA Cotton and G Wilkinson, Advanced Inorganic Chemistry, John Wiley and Sons, V Edition (1988).
3 AI Vogel, Text book of Qualitative Analysis - IV Edition (1985).
4. C. N. Banwell and E.M. Mc Cash, Fundamentals of Molecular Spectroscopy, IV edition, Tata McGraw Hill, New Delhi (1994)

**Web References**

1.https://www.yorku.ca/jilchen/files/Chem%203031_spectroscopy.pdf
2.https://www.iau.edu.sa/sites/default/files/inorganic_spectroscopy_-tyf_gyr_dwy.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| **1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **2** | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| **3** | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| **4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 |
| **5** | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Fourth** | Course Category Code: **DSE** | | | *End Semester Exam Type: **TE** | | | |
| Course Code | **A23PCHE412** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **STEREOCHEMISTRY** | **4** | **-** | **-** | **4** | **25** | **75** | **100** |

| | | |
|---|---|---|
| Prerequisite | Basic Knowledge studied in the UG Level | |
| Course Objectives | • To assign R or S configuration for the chiral centres of organic compounds | |
| | • To comprehend the techniques in the determination of reaction mechanisms of elimination reactions | |
| | • To understand the methods of resolution to form chiral compounds | |
| | • To correlate and appreciate the Fischer, Newmann and Sawhorse formulae of organic compounds | |
| | • To design asymmetric synthesis using chiral auxillaries, chiral reagents and chiral catalysts. | |
| Course Outcome | **On completion of the course, the students will be able to** | BT Mapping(Highest Level) |
| | **CO1** Find the configuration and understand the importance of stereochemical aspects of organic molecules | **K3** |
| | **CO2** Find conformational isomers and justify conformational analysis of cyclic and acyclic systems. | **K3** |
| | **CO3** Outline chiral auxiliaries in asymmetric synthesis and design diastereoselectivity in selective organic reactions | **K3** |
| | **CO4** Use the absolute configuration and design techniques of resolution. | **K3** |
| | **CO5** Assess the importance of protecting groups and categorize Chemo-, regio-, and stereoselectivity in selective organic synthesis | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **CONFIGURATION** | **Periods: 12** |
| Double bonds - cyclic systems - tetrahedral atoms - with multiple stereogenic centres - other types of stereogenic centres - axial chirality - biphenyls, allenes, spiranes - assigning R/S - chirality and symmetry concept of atropisomerism - helicity and chirality - topocity and prostereo isomerism - topocity of ligands and faces - enantiotopic ligands and faces - diastereotopic ligands and faces - configuration at prochiral centers. | | **CO1** |
| **UNIT-II** | **RESOLUTION** | **Periods: 12** |
| Absolute configuration - enantiomers - diastereomers - polarimeter - resolution - methods - chiral shift reagents and chiral solvating agents - separation of enantiomers - enzymatic resolution and disymmetrization - the anomeric effect in cyclic compounds. | | **CO2** |
| **UNIT-III** | **CONFORMATIONAL ANALYSIS** | **Periods: 12** |
| Conformational isomerism in ethane and n-butane - projection formula - Fischer, Newmann and Sawhorse - conformational isomerism in cycloalkanes - Baeyer's strain theory- mono and disubstituted three-, four-, five- and six- membered ring systems and their optical activity - conformations of decalin - chirality in molecules with non-carbons stereocenters (N, S and P). | | **CO3** |
| **UNIT-IV** | **STEREOSELECTIVITY** | **Periods: 12** |
| Chemoselectivity: Chemo-, regio-, and stereoselectivity - reactivity of carbonyl groups towards nucleophiles - selectivity of hydrides in reduction - selectivity in oxidations - Protecting groups - hydroxyl, amino, carbonyl and carboxylic acid protecting groups.<br>Regioselectivity: Regioselectivity in electrophilic and nucleophilic aromatic substitution, regioselectivity in elimination reactions, electrophilic attack on alkenes, regioselectivity in radical reactions, nucleophilic attack on allylic compounds, electrophilic attack on conjugated dienes and conjugate addition. | | **CO4** |

| UNIT-V | ASYMMETRIC SYNTHESIS | Periods: 12 |
|---|---|---|
| Chiral auxiliaries: Alkylation of chiral enolates - enantiomeric excess - optical purity - chiral reagents and chiral catalysis - asymmteric hydrogenation - asymmetric epoxidation - asymmetric dihydroxylation. Diastereoselectivity: Prochirality, Cram's rule and chelation effect, diastereoselective in aldol reaction, diastereoselective epoxidation. | | CO5 |

| Lecture Periods: 60 | Tutorial Periods:- | Practical Periods:- | Total Periods:60 |
|---|---|---|---|

**Text Books**

1. Carey, F.A., Sundberg, R. J. (2007). Advanced Organic Chemistry, Part A: Structure and mechanisms, (5th Ed.). Springer (India) Pvt Ltd, New Delhi
2. Clayden, J., Greeves, N., & Warren, S. (2012). Organic Chemistry, (2nd Ed.). Oxford University Press, New York,.
3. Carey, F.A., & Sundberg, R.J. (2007). Advanced Organic Chemistry, Part B: Structure and Mechanisms, (5th Ed.). Springer (India) Pvt Ltd, New Delhi.

**Reference Books**

1. Bruckner, R. (2010). Organic Mechanisms - Reactions, Stereochemistry and Synthesis, SpringerVerlag, Berlin, Heidelberg.
2. 2. Gould, E.S. (1959). Mechanism and Structure in Organic Chemistry, Holt-Reinhart and Winston, New York.
3. Eliel, E.L. (1998). Stereochemistry of Carbon Compounds, Tata-McGraw Hill Publishing Company, New Delhi.
4. 4. Nasipuri, D. (1996). Stereochemistry of Carbon Compounds, (2nd Ed.). New-Age International Publishers, New Delhi.

**Web References**

1. https://www.youtube.com/watch?v=B23i9_jC5T8
2. https://www.youtube.com/watch?v=fLXyKLVd6Hc

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| 4 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 |
| 5 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
| Semester | **Fourth** | Course Category Code: **DSC** | | | *End Semester Exam Type: **PE** | | | |
| Course Code | **A23PCHL407** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **INDUSTRIAL CHEMISTRY LAB** | **-** | **-** | **4** | **2** | **50** | **50** | **100** |
| Prerequisite | Basic Knowledge studied in the UG Level | | | | | | | |
| Course Objectives | • To understand and develop the practical experience on conductometric experiments | | | | | | | |
| | • To learn practical knowledge on potentiometric experiments | | | | | | | |
| | • To understand the practical knowledge on PH metry | | | | | | | |

| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping (Highest Level) |
|---|---|---|---|
| | **CO1** | Gain knowledge on Conductometric titration | **K3** |
| | **CO2** | Develop skill on Verifying De Bye - Huckel- Onsagar equation | **K3** |
| | **CO3** | Improve practical experience l on Verifying the Ostwald's Dilution law | **K3** |
| | **CO4** | Understand the potentiometric titration | **K3** |
| | **CO5** | Learn the determination of ionisation constant using pH meter | **K3** |

**List of Experiments**

1.Estimation of total hardness of water by EDTA method.

2.Determination of dissolved oxygen in water

3.Estimation of alkalinity of of water by mixed indicator method

4.Estimation of chloride in water by Mohr's method

5.Estimation of available chlorine in bleaching powder.

6.Determination of CaO in cement solution.

7.Estimation of molecular weight and degree of polymerisation using viscometry.

8.Estimation of sodium in water by flame photometry.

9.Estimation of ferric iron by spectrophotometry

10.Estimation of iron by colorimetry.

**CHROMATOGRAPHIC SEPARATIONS**

1. Column chromatography - Separation of anthracene and picric acid from anthracene picrate.

2. Thin layer chromatography - Separation of green leaf pigments.

3. Paper chromatography - Identification of amino acid.

| **Lecture Periods: -** | **Tutorial Periods:-** | **Practical Periods:-30** | **Total Periods:30** |
|---|---|---|---|

**Reference Books**

1. Lab Manual, Department of Chemistry, SMVEC (Autonomous), Madagaipattui.
2. Venkateswaran V, Veeraswamy R and Kulandaivelu A R., Basic Principles of Practical Chemistry, 2nd Edition, Sultan Chand & sons, New Delhi, 1997.
3. Daniels, Mathews F, Howard J and John Warren W, Experimental Physical Chemistry, 7th Edition, Mc Graw Hill, New York, 1970.
4. Findlay A, Practical Physical Chemistry, 7th Edition, Longman, London, 1959.

**Web References**

1. http://ndl.ethernet.edu.et/bitstream/123456789/78703/1/Industrial%20Chemistry%20II%20module%20%20Chem451%20fina%28Submitted%29-1.pdf
2. https://diposit.ub.edu/dspace/bitstream/2445/180999/1/Applied%20Chemistry%20II%20Laboratory%20Handbook.pdf

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 4 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 |
| 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|
| | Observation | Model Exam | Viva Voce | Attendance | | |
| Marks | 15 | 15 | 10 | 10 | 50 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| Department | **Chemistry** | Programme: M.Sc. Chemistry | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Semester | **Fourth** | Course Category Code: **SEC** | | | *End Semester Exam Type: | | | |
| Course Code | **A23PCHS402** | Periods/Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **HEALTH SCIENCE** | **2** | **-** | **-** | **2** | **100** | **0** | **100** |

| | | | |
|---|---|---|---|
| Prerequisite | Basic Knowledge studied in the UG Level | | |
| Course Objectives | • To create awareness about the importance of chirality for organic synthesis and for biological activity | | |
| | • Apply the important principles of stereochemistry and understand them. | | |
| Course Outcome | **On completion of the course, the students will be able to** | | BT Mapping(Highest Level) |
| | **CO1** | Understand the basic concept of asymmetric Synthesis | **K3** |
| | **CO2** | Able to synthesize on chiral substrate | **K3** |
| | **CO3** | Use chiral substrate to synthesize asymmetric compounds | **K3** |
| | **CO4** | Utilysze chiral auxiliary to synthesize asymmetric compounds | **K3** |
| | **CO5** | handle chiral catalyst to synthesize asymmetric compounds | **K3** |

| | | |
|---|---|---|
| **UNIT-I** | **UNIT-I HEALTH** | **Periods: 6** |
| Health - mental health and physical health - food pyramid - types of malnutrition - causes and remedies - macro and micronutrients - carbohydrates - classification and their biological functions, proteins-classification and their biological functions, vitamins - classification and their biological functions - dietary elements (Na, K, Ca, P, Mg, S, Fe, Zn, Se, Mo) | | **CO1** |
| **UNIT-II** | **DRUGS** | **Periods: 6** |
| Drugs - classification of drugs - drugs acting on CNS - general anaesthetics, hypnotics & sedatives, narcotics, antipyretics, antirheumatics, analgesics, anticonvulsants and antitussives - chemotherapeutic drugs - antibiotics, antiseptics and disinfectants - cardiovascular agents - anti cancer drugs - adverse effects of drugs. | | **CO2** |
| **UNIT-III** | **BODY FLUIDS** | **Periods: 6** |
| composition of blood- blood volume, blood groups, functions of blood, blood pressure, anaemia, blood sugar - respiration - oxygen and carbon dioxide transport in blood - haemoglobin -myoglobin - composition of urine - electrolyte balance - Na/K pump. | | **CO3** |
| **UNIT-IV** | **ENZYMES AND HORMONES** | **Periods: 6** |
| Enzymes - types and their roles in biochemical reactions - hormones - types and functions - digestion in mouth, stomach, intestine and pancreas . | | **CO4** |
| **UNIT-V** | **COMMON AND VITAMIN DEFICIENCY DISEASES** | **Periods: 6** |
| Jaundice, cancer, kidney stone - typhoid, dengue, ulcer, goiter, diabetes, rickets, scurvy, beriberi, pellagra, night blindness, Covid-19 - causes - symptoms - diagnosis - vaccines/treatment. | | **CO5** |

| | | | |
|---|---|---|---|
| **Lecture Periods: 30** | **Tutorial Periods:-** | **Practical Periods:-** | **Total Periods:30** |

**Text Books**

1. Ramani A V, Food Chemistry, MJP Publishers, Chennai, 2009.
2. Ghosh, J A, Text book of Pharmaceutical Chemistry, S. Chand and Co. Ltd, 1999.
3. Comprehensive Asymmetric Catalysis (Jacobsen, E. N,Pfaltz, A. Yamamoto, H. Eds.) Springer 2000.

**Reference Books**

1. Ashutosh Kar, Medicinal Chemistry, Wiley Easterns Limited, New Delhi, 1993.
2. Deb A C, Fundamentals of Biochemistry, New Central Book Agency, Calcutta, 1994.
3. Parul R. Sheth, Chemicals of Life, National Institute of Science Communication (CSIR), 2000.
4. Satake M and Mido Y, Chemistry for Health Science, Discovery Publishing, House, New Delhi, 2003

**Web References**

1.https://www.academia.edu/6875053/LECTURE_NOTES_For_Health_Science_Students
2. https://www.academia.edu/9183720/LECTURE_NOTES_For_Health_Science_Students_Medical_Biochemistry

**COs/POs/PSOs Mapping**

| COs | Program Outcomes (POs) | | | | | Program Specific Outcomes | | |
|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PSO1 | PSO2 | PSO3 |
| 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| 4 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 |
| 5 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |

**Correlation Level: 1 - Low, 2 - Medium, 3 – High**

**Evaluation Method**

| Assessment | Continuous Assessment Marks (CAM) | | | | | End Semester Examination (ESE) Marks | Total Marks |
|---|---|---|---|---|---|---|---|
| | CAT 1 | CAT 2 | Model Exam | Assignment* | Attendance | | |
| Marks | 10 | | 5 | 5 | 5 | 75 | 100 |

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

| Department | **Chemistry** | Programme: **M.Sc. Chemistry** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Semester | **Fourth** | Course Category Code: DSE | | | *End Semester Exam Type: L**E** | | | |
| Course Code | **A23PCHP401** | Periods / Week | | | Credit | Maximum Marks | | |
| | | L | T | P | C | CAM | ESE | TM |
| Course Name | **Project Work** | **0** | **0** | **10** | **6** | **40** | **60** | **100** |

- As part of our curriculum requirement, our students have to do Project work in the college or chemical company to learn various chemical synthesis process, characterization process and explore the applications of the compounds to solve various problems.
- Based on the student's interest the topic shall be chosen by the students
- Moreover the entire process to be monitored and guided by the faculty. The periodical assessment shall be done to evaluate the performance of the students.

**Evaluation Method**

| **Assessment** | **Continuous Assessment Marks (CAM)** | | | | **End Semester Examination (ESE) Marks** | **Total Marks** |
|---|---|---|---|---|---|---|
| | **Review 1** | **Review 2** | **Review 3** | **Attendance** | | |
| Marks | 10 | 10 | 10 | 10 | 60 | 100 |