PERIYAR UNIVERSITY
PERIYAR PALKALAI NAGAR
SALEM – 636011

DEGREE OF MASTER OF SCIENCE
CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR
M.SC. CHEMISTRY
(SEMESTER PATTERN)
(For Candidates admitted in the Colleges affiliated to Periyar University from 2017-2018 onwards)
1. **OBJECTIVES OF THE COURSE:**

The objectives of this course are the following:

(a) To impart knowledge in advanced concepts and applications in various fields of Chemistry.

(b) To provide wide choice of elective subjects with updated and new areas in various branches of Chemistry to meet the needs of all students.

2. **COMMENCEMENT OF THIS REGULATION:**

These regulations shall take effect from the academic year 2017-2018, that is, for students who are admitted to the first year of the course during the academic year 2017-2018 and thereafter.

3. **ELIGIBILITY FOR ADMISSION:**

A candidate who has passed B.Sc., Chemistry degree of this University or any other University accepted by the Syndicate equivalent thereto, subject to such condition as may be prescribed therefore are eligible for admission to M.Sc., Degree Programme and shall be permitted to appear and qualify for the Master of Science (M.Sc.) Degree Examination in Chemistry of this University.

4. **DURATION OF THE COURSE:**

The programme for the degree of Master of Science in Chemistry shall consist of two Academic years divided into four semesters.

5. **EXAMINATIONS:**

The examination shall be of three hours duration for each course at the end of each semester. The candidate failing in any subject(s) will be permitted to appear in the subsequent examination.

The practical / project should be an individual work. The University examination for practical / project work will be conducted by the internal and external examiners jointly at the end of every year.
# COURSE OF STUDY AND SCHEME OF EXAMINATION

## I SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course (Paper)</th>
<th>Subject Title</th>
<th>Hours / Week</th>
<th>Work Load per Semester (Hrs)</th>
<th>Exam Hours</th>
<th>University Examination</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Core - I</td>
<td>Organic Chemistry - I</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>2.</td>
<td>Core - II</td>
<td>Inorganic Chemistry - I</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>3.</td>
<td>Core - III</td>
<td>Physical Chemistry - I</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>4.</td>
<td>Elective - I</td>
<td>Polymer Chemistry/ Conducting Polymers</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>5.</td>
<td>Core Practical - I</td>
<td>Organic Chemistry Practical - I</td>
<td>4</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>Core Practical - II</td>
<td>Inorganic Chemistry Practical - I</td>
<td>3</td>
<td>45</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7.</td>
<td>Core Practical - III</td>
<td>Physical Chemistry Practical - I</td>
<td>3</td>
<td>45</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>30</strong></td>
<td><strong>450</strong></td>
<td><strong>400</strong></td>
<td><strong>19</strong></td>
<td></td>
</tr>
</tbody>
</table>

## II SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course (Paper)</th>
<th>Subject Title</th>
<th>Hours / Week</th>
<th>Work Load per Semester (Hrs)</th>
<th>Exam Hours</th>
<th>University Examination</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Core - IV</td>
<td>Organic Chemistry - II</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>2.</td>
<td>Core - V</td>
<td>Physical Chemistry -II</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>3.</td>
<td>Elective - II</td>
<td>Spectroscopy</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>4.</td>
<td>EDC Extra Disciplinary course</td>
<td></td>
<td>4</td>
<td>60</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>5.</td>
<td>Core Practical - I</td>
<td>Organic Chemistry Practical - I</td>
<td>3</td>
<td>45</td>
<td>6</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>6.</td>
<td>Core Practical - II</td>
<td>Inorganic Chemistry Practical - I</td>
<td>3</td>
<td>45</td>
<td>6</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>7.</td>
<td>Core Practical - III</td>
<td>Physical Chemistry Practical - I</td>
<td>3</td>
<td>45</td>
<td>6</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>8.</td>
<td>Common Paper</td>
<td>Human Rights</td>
<td>2</td>
<td>30</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>30</strong></td>
<td><strong>450</strong></td>
<td></td>
<td><strong>800</strong></td>
<td><strong>29</strong></td>
</tr>
<tr>
<td>S.No.</td>
<td>Course (Paper)</td>
<td>Subject Title</td>
<td>Hours / Week</td>
<td>Work Load per Semester (Hrs)</td>
<td>Exam Hours</td>
<td>University Examination</td>
<td>Credits</td>
</tr>
<tr>
<td>-------</td>
<td>----------------</td>
<td>---------------</td>
<td>--------------</td>
<td>-------------------------------</td>
<td>-----------</td>
<td>------------------------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Internal (25%)</td>
<td>External (75%)</td>
<td>Total</td>
</tr>
<tr>
<td>1.</td>
<td>Core - VI</td>
<td>Organic Chemistry - III</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>2.</td>
<td>Core - VII</td>
<td>Inorganic Chemistry - II</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>3.</td>
<td>Core - VIII</td>
<td>Physical Chemistry - III</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>4.</td>
<td>Elective - III</td>
<td>Experimental methods in Chemistry/Electroanalytical Techniques</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>5.</td>
<td>Core Practical-IV</td>
<td>Organic Chemistry</td>
<td>3</td>
<td>45</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>Core Practical - V</td>
<td>Inorganic Chemistry</td>
<td>4</td>
<td>60</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7.</td>
<td>Core Practical - VI</td>
<td>Physical Chemistry</td>
<td>3</td>
<td>45</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**TOTAL** 30 450 400 19

**III SEMESTER**

**IV SEMESTER**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course (Paper)</th>
<th>Subject Title</th>
<th>Hours / Week</th>
<th>Work Load per Semester (Hrs)</th>
<th>Exam Hours</th>
<th>University Examination</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Internal (25%)</td>
<td>External (75%)</td>
<td>Total</td>
</tr>
<tr>
<td>1.</td>
<td>Core - IX</td>
<td>Inorganic Chemistry - III</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>2.</td>
<td>Elective - IV</td>
<td>Nano and Green Chemistry/Medicinal Chemistry</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>3.</td>
<td>Core Practical-IV</td>
<td>Organic Chemistry</td>
<td>3</td>
<td>45</td>
<td>6</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>4.</td>
<td>Core Practical - V</td>
<td>Inorganic Chemistry</td>
<td>3</td>
<td>45</td>
<td>6</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>5.</td>
<td>Core Practical - VI</td>
<td>Physical Chemistry</td>
<td>3</td>
<td>45</td>
<td>6</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>6.</td>
<td>Project</td>
<td>Dissertation/Project work</td>
<td>11</td>
<td>165</td>
<td>-</td>
<td>-</td>
<td>200</td>
</tr>
</tbody>
</table>

**TOTAL** 30 450 700 25

**GRAND TOTAL** 120 1800 2300 92

The students can choose the Elective Paper from the choice given.
Note: I
Core Papers : 9
Core Practicals : 6
Elective papers : 4
EDC : 1
Human Rights : 1
Project : 1

Note: II

Distribution of Marks

Theory

University Examination (External) : 75 marks
Internal Assessment : 25 marks

Distribution of Internal Assessment mark
Test : 10 marks
Attendance : 5 marks
Assignment : 5 marks
Seminar : 5 marks

Total 25 marks

Passing Minimum : Internal Assessment : 50% - 12 marks
Passing Minimum : External Assessment : 50% - 38 marks
Total Passing Minimum - 50 marks

Practicals

University Examination (External) : 60 marks
Internal Assessment : 40 marks
Calculation of Internal Assessment mark
Number of Experiments : 10 marks
Experimental skill : 10 marks
Test : 20 marks

Total 40 marks

Passing Minimum : Internal Assessment : 50% - 20 marks
Passing Minimum : External Assessment : 50% - 30 marks
Total Passing Minimum - 50 marks

Everything should be supported by proper record
separate passing minimum is necessary for Internal and External
Question paper pattern

Theory

Time: 3 Hours

Max. marks : 75

Part - A : 5X5 = 25

(answer all questions)

(one question from each unit with internal choice)

Part - B : 5X10 = 50

(answer all questions)

(one question from each unit with internal choice)

Practical

Distribution of marks for practical

Experiment : 45 marks
Viva-voce in practical : 10 marks
Record : 5 marks
Total : 60 marks
Duration : 6 Hours

Project

Dissertation / Project : 150 marks
Viva - voce : 50 marks
Total : 200 marks
OBJECTIVES

- To learn about the stereochemistry of organic compounds
- To learn about the formation, stability and structure of intermediates and the effect of structure on reactivity.
- To learn about the mechanism of aliphatic and aromatic nucleophilic substitution reactions and aromatic electrophilic substitution reactions.
- To learn about the structural elucidation of alkaloids flavones and isoflavones.

UNIT I Stereochemistry (15 Hours)


Conformational analysis and stereochemical features of disubstituted cyclohexanes (1,2 ; 1,3 ; 1,4 dialkyl cyclo hexanes), conformation and stereochemistry of cis and trans decalins.

UNIT II Reaction intermediates, Structure and Reactivity (15 Hours)

Reaction intermediates: Formation, stability and structure of carbonium ions, carbanions, carbones, nitrenes and free radicals.

Free radical reactions: Sandmeyer reaction, Gomberg-Bachmann reaction, Pschorr reaction and Ullmann reaction, Hunsdiecker reaction.

Effect of structure on reactivity – resonance and fields effects, steric effects, quantitative treatment – the Hammett equation and linear free energy relationship, substituent and reaction constant, Taft equation. Thermodynamic and kinetic requirements for reactions, thermodynamically and kinetically controlled reactions, Hammonds postulate, transition states and intermediates, Kinetic & non kinetic methods of determining mechanisms, identification of products and determination of the presence of an intermediate, isotopic labeling, kinetic isotope effects.
UNIT III Aliphatic Nucleophilic Substitution Reactions (15 Hours)

The SN1, SN2 & SNi mechanisms. The neighbouring group mechanism, neighbouring group participation by π and σ bonds, anchimeric assistance. Nucleophilic substitution at an allylic, aliphatic trigonal and vinylic carbon.

Reactivity effects of substrates structure, attacking nucleophile, leaving group and reaction medium, ambident nucleophile, regioselectivity. Williamson reaction, Von-braun reaction, hydrolysis of esters, Claisen and Dieckmann condensation.

UNIT IV Aromatic electrophilic and nucleophilic substitution reactions (15 Hrs)

The arenium ion mechanism, typical reactions like nitration, sulphonation, halogenation, Friedel – Crafts alkylation, acylation and diazonium coupling, electrophilic substitution on monosubstituted benzene, orientation and reactivity – ortho, meta and para directing groups, ortho-para ratio, ipso attack, Gatterman, Gatterman- Koch, Vilsmeir, Houben Hoesch reaction.

Aromatic nucleophilic substitution reactions, the SNAr mechanism, the aryl cation mechanism, the benzyne intermediate mechanism, Ziegler alkylation, Chichibabin reaction.

UNIT V Alkaloids, Flavones and Isoflavones (15 Hours)

Synthesis and Structural elucidation of Quinine, Papaverine, Morphine and Reserpine.

Synthesis and structural elucidation of flavones, isoflavones and anthocyanins.
M.Sc - CHEMISTRY

TEXT BOOKS

REFERENCE BOOKS
OBJECTIVES

i) To learn about the various theories of complexes, mode of coordination with various geometry.

ii) To study the recent development in polymeric materials of coordination complexes.

UNIT I Structure and Bonding (15 Hours)

Hard and Soft acids and bases-classifications, Acid-Base strength, hardness, symbiosis, Theoretical basis of Hardness and Softness, applications of HSAB.

Rings-Phosphazenes-Structure, Craig and Peddock model, Dewar model, polyorganophosphazenes, Polysulphur–nitrogen compounds.

Inorganic polymers-Silicates-structure, Pauling’s rule, properties, correlation and application; Molecular sleves.

Polyacids- Isopolyacids of V, Cr, Mo and W; Heteropolyacids of Mo and W (only structural aspects).

UNIT II Metal - Ligand Bonding (15 Hours)

Crystal field theory – splitting of d- orbitals under various geometries, factors affecting splitting, CFSE, evidences for CFSE (Structural and thermodynamic effects), Spectrochemical series, Jorgensen relation, site preferences; Jahn – Teller distortion – Splitting pattern in trigonal pyramid, square pyramidal and cubic symmetries, Dynamic and Static J.T. effect, Jahn – Teller effect and Chelation; Limitations of CFT; Evidences for metal – ligand overlap; M.O. theory and energy level diagrams, concept of weak and strong fields, sigma and pi bonding in complexes, nephelauxetic effect, magnetic properties of complexes.

UNIT III Electronic Spectroscopy of transition metals and Inorganic Photochemistry (15 Hours)

Spectroscopic Term symbols for dn ions – derivation of term symbols and ground state term symbol, Hund’s rule; Selection rules – break down of selection rules, spin-orbit coupling, band intensities, weak and strong field limits- correlation diagram; Energy level diagrams; Orgel and Tanabe – Sugano diagrams; effect of distortion and spin orbit coupling on spectra; Evaluation of Dq and B values for octahedral complexes of Nickel; Charge transfer spectra. Spectral properties of Lanthanides and Actinides.

Inorganic photochemistry-Photosubstitution, Photoredox and isomerisation processes; application of metal complexes in solar energy conversion.
UNIT IV Inorganic Reaction mechanism (15 Hours)

Electron transfer reactions – Outer and inner sphere processes; atom transfer reaction, formation and rearrangement of precursor complexes, the bridging ligand, successor complexes; Cross reactions and Marcus – Hush theory (no derivation)

Reaction mechanism of coordination compounds – Substitution reactions, Labile and inert complexes. Substitution in square planar complexes – General mechanism; reactivity of Platinum complexes; influences of entering and leaving groups; the trans effect – theories, trans influence.

Substitution in octahedral complexes – general mechanism, discussion of A, D, IA, ID and DCB mechanism, replacement of coordinated water; mechanism of acid hydrolysis and base hydrolysis – Conjugate base mechanism; direct and indirect evidences in favour of the mechanism; application of substitution reaction in the synthesis of Platinum and Cobalt complexes.

UNIT V Boron compounds and Clusters (15 Hours)

Boron hydrides – polyhedral boranes, hydroborate ions – a general study of preparation, properties and structure, styx numbers, Wade’s rules.

Carboranes – types such as closo and nido – preparation, properties and structure. Metallo carboranes – a general study.

Metal clusters – Chemistry of low molecularity metal clusters only – structure of Re2Cl8; multiple metal – metal bonds.
TEXT BOOKS:

REFERENCE BOOKS:
M.Sc. CHEMISTRY
SEMESTER - I
CORE III - PHYSICAL CHEMISTRY – I

OBJECTIVES
i) To study in detail the basic concepts of classical thermodynamics and chemical kinetics
ii) To understand the principles of quantum chemistry and group theory

UNIT I Classical Thermodynamics – I (15 Hours)
Maxwell’s relations and thermodynamic equations of state – applications in the evaluation of $C_p - C_v$ for solids and for van der waals gases, $C_p - C_v$ in terms of coefficient of expansion and coefficient of compressibility – Partial molar properties — Partial molar free energy - Gibbs – Duhem equation (Chemical Potential) – Determination of chemical potential [Direct Method and Method of Intercepts]– variation of chemical potential with temperature and pressure- partial molar volume.

UNIT II Classical Thermodynamics – II (15 Hours)

UNIT III Chemical Kinetics – I (15 Hours)

UNIT IV Quantum Chemistry – I (15 Hours)
Planck’s theory of black body radiation – Photoelectric effect; de – Broglie equation – Heisenberg uncertainty principle – Compton effect; operators and commutation relations – quantum mechanical postulates – Schrodinger equation and its solution to the problem of a particle in one and three dimensional boxes – the harmonic oscillator.

UNIT V Group Theory – I (15 Hours)
**REFERENCE BOOKS:**
11. I.N.Levine, Quantum chemistry, Allyn and Bacon, Boston, 1983.

**TEXT BOOKS:**
6. M.W. Hanna, Quantum mechanics in chemistry, W.A. Benjamin INC, London (1965)
OBJECTIVES

i) To study the basic concepts in polymer chemistry.
ii) To learn about the kinetics and types of co-ordination polymerization.
iii) To study the measurement of molecular weight and the properties of polymers.
iv) To study about the polymer processing and properties of commercial polymers

UNIT I Basic Concepts (15 Hours)


UNIT II Co-ordination Polymerization (15 Hours)


UNIT III Molecular Weight and Properties (15 Hours)

Polydispersion – average molecular weight concept, number, weight and viscosity average molecular weights. Measurement of molecular weights. Viscosity, light scattering, osmotic and ultracentrifugation methods. Polymer structure and physical properties – crystalline melting point Tm. The glass transition temperature. Determination of Tg. Relationship between Tm and Tg.

UNIT IV Polymer Processing (15 Hours)

Plastics, elastomers and fibres. Compounding, processing techniques: calendering, die casting, rotational casting, film casting, injection moulding, blow moulding extrusion, moulding, thermoforming, foaming, reinforcing and fibre spinning.

UNIT V Properties of Commercial Polymers (15 Hours)

Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers, Fire retarding polymers and electrically conducting polymers. Biomedical polymers – contact lens, dental polymers, artificial heart, kidney, skin and blood cells.
REFERENCE BOOKS:


TEXT BOOKS:


OBJECTIVES

i) To study the basic concepts and synthetic methods.
ii) To learn about the Electrochemical Synthesis.
iii) To study about the Semiconducting and Metallic Polymers.
iv) To study about Doping.
v) To learn about the Catalytic Conducting Polymers.

UNIT – I Basic Concepts and Synthetic methods

Basics of conducting polymers - Organic - conjugated unsaturated hydrocarbons- Chemical Synthesis of conducting polymers – Other synthetic methods

UNIT – II Electrochemical Synthesis

Electrochemical synthesis of conducting polymers – monomers, electrolytic condition, electrodes and mechanism; Electrochemical synthesis of derivatives of poly pyrrole, polythiophene, polyazulene, polycarbazole, polyindole, polyaniline and polyphenylene.

UNIT – III Semiconducting and Metallic Polymers

Structural basis for semiconducting and metallic polymers – introduction; Organic meta polymers - Synthetic route, isomers and electronic structure (polymers like polyacetylene, poly(p-phenylene), polypyrrole, polythiophene, etc.).

UNIT – IV Doping

Electrochemical doping; deadline to the development of conducting polymers; role of reduction and oxidation potential in doping; polyacetylene as electrode materials.

UNIT – V Catalytic Conducting Polymers

Catalytic properties of conducting polymers; catalysis of electron donor-acceptor complexes; electrocatalysis by semiconducting polymers.
**TEXT BOOKS**


**REFERENCE BOOKS**

1) Jean-Pierre Farges, Organic Conductors, Marcel Dekkar, 1994


M.Sc. CHEMISTRY

SEMESTER - II

CORE IV - ORGANIC CHEMISTRY - II

OBJECTIVES

i) To learn the mechanism of Elimination reactions.

ii) To understand the basic concepts of aromaticity.

iii) To know the effects of light in organic reactions.

iv) To study the pericyclic reactions.

v) To learn the uses of oxidation and reducing reagents in organic synthesis.

UNIT  I Elimination Reactions (15Hours)

E1, E2, E1cB mechanisms, Orientation of the double bond- Hofmann and Saytzeff rule, competition between elimination and substitution, dehydration and dehydrohalogenation reactions, stereochemistry of E2 eliminations in cyclohexane ring systems, mechanism of pyrolytic eliminations, chugaev reaction and Cope elimination.

UNIT  II Aromaticity (15 Hours)

Aromatic character: Five-, six-, seven-, and eight-membered rings - other systems with aromatic sextets - Huckel’s theory of aromaticity, concept of homoaromaticity and antiaromaticity.

Electron occupancy in MO’s and aromaticity - NMR concept of aromaticity and antiaromaticity, systems with 2,4,8 and 10 electrons, systems of more than 10 electrons (annulenes), Mobius aromaticity.

Bonding properties of systems with (4n+2)π-electrons and 4nπ - electrons, alternant and non-alternant hydrocarbons (azulene type) - aromaticity in heteroaromatic molecules, sydnones and fullerenes.

UNIT  III Organic Photochemistry (15 Hours)

Photochemical reactions : Fate of excited molecules, Jablonski diagram, Norrish Type I and Norrish Type II reactions, photoreduction of ketone, photoaddition reactions, Paterno Buchi reaction, di –pi methane rearrangement, photochemistry of
arenes, Photooxidation (Formation of peroxy compounds), Photoisomerization (Cis – trans isomerization), Photo addition of olefins and amines to aromatic compounds, Photo rearrangements: Photo – Fries rearrangement and Photo rearrangement of 2,5 – Cyclohexadienones.

UNIT IV Pericyclic Reactions (15 Hours)

UNIT V Reagents in Organic Synthesis (15 Hours)
Reagents and their uses: DCC, DDQ, DBU, DIBAL, 9BBN, NBS, 1,3 – dithiane (umpolung), n-Butyl Lithium, trimethyl silyl iodide, trimethyl silyl chloride, Lithium dimethyl cuprate, Baker’s yeast and Gilman’s reagent.

TEXT BOOKS

REFERENCE BOOKS
OBJECTIVES
i) To study in detail the basic concepts of statistical thermodynamics and chemical kinetics
ii) To understand the principles of quantum chemistry and group theory
iii) To impart knowledge on surface chemistry and catalysis

UNIT I Statistical and Irreversible Thermodynamics (15 Hours)
Non equilibrium thermodynamics- Entropy production in heat flow and matter flow – Progogine’s principle of minimum entropy production – Forces and fluxes – microscopic reversibility and Onsager’s reciprocal relations.

UNIT II Chemical Kinetics – II (15 Hours)

UNIT III Surface Chemistry and Catalysis (15 Hours)
Adsorption-Physical and chemical adsorption – adsorption isotherms – Langmuir, Freundlich and B.E.T adsorption isotherms – measurement of surface area from BET;

UNIT IV Quantum Chemistry – II (15 Hours)

UNIT V Group Theory – II (15 Hours)
Symmetry selection rules for vibrational, Electronic and Raman Spectra – determination of vibrational modes in non-linear molecules such as H2O, NH3, CH4, XeF4, – symmetry of hybrid orbitals in non-linear molecules (H2O, NH3, CH4, XeF4, PCl5) 2Electronic spectra of formaldehyde.
REFERENCE BOOKS
11. I.N. Levine, Quantum chemistry, Allyn and Bacon, Boston, 1983.

TEXT BOOKS
6. M.W. Hanna, Quantum mechanics in chemistry, W.A. Benjamin INC, London (1965)
M.Sc - CHEMISTRY

M.Sc. CHEMISTRY
SEMESTER - II
ELECTIVE II - SPECTROSCOPY

OBJECTIVES

i) To understand the basic concepts of spectroscopic techniques and to solve the structures from the spectra

ii) To study in detail about UV-VIS, IR, ESR, PAS and NMR spectroscopic techniques

iii) To develop problem solving skills from various type of spectra

UNIT I UV-VIS AND IR SPECTROSCOPY (15 Hours)

UV-VIS: The nature of the electronic excitations, origin of UV band structure and the principle of absorption, chromophores and auxochromes, factors affecting intensity-solvent effects and position of absorption bands- dienes, polyenes and enones- Woodward- Fieser rules for dienes, enones and aromatics-calculation of $\lambda_{\text{max}}$ for organic molecules- applications of UV spectroscopy.

IR : IR absorption process, modes of stretching and bending vibrations, bond properties and their relations to absorption frequencies, Characteristic group frequencies of aliphatic and aromatic organic molecules, carbonyl, carboxylic acid, ester, alcohol, phenol and amides. Factors influencing vibrational frequencies, interpretation of IR spectra of organic molecules- applications of IR spectroscopy.

UNIT II NMR SPECTROSCOPY – I (15 Hours)

$^1$H NMR- principle - Shielding and deshielding - chemical shift, factors influencing chemical shift – magnetic anisotropy- Spin – spin splitting- (n+1rule), Coupling constant–Pascal’s triangle, calculation of coupling constants, mechanism of coupling (one bond, germinal, vicinal and long range coupling), First order & non first order spectra - Chemical & magnetic equivalence, shift reagents, NMR instrumentation –Applications

UNIT III NMR SPECTROSCOPY – II (15 Hours)

$^{13}$C NMR - The $^{13}$C nucleus – Chemical shifts – Spin – spin splitting –Double resonance techniques - Homonuclear & heteronuclear decoupling – NOE- Broad band decoupling – Off resonance decoupling – gauche effect -comparison of $^1$H and $^{13}$C NMR- elementary idea of 2D NMR
UNIT IV EPR AND MOSSBAUER SPECTROSCOPY (15 Hours)

EPR: introduction, factors affecting the g-value, limitations, instrumentation, electron nucleus interaction, hyperfine interactions-isotropic and anisotropic coupling constants – spin Hamiltonian-applications


UNIT V PHOTOACOUSTIC SPECTROSCOPY AND SPECTROSCOPIC APPLICATIONS (15 Hours)

PAS: Principle –Photoacoustic effect – Photoacoustic spectra – instrumentation –advantages of PAS over conventional absorption spectroscopy – Applications and surface applications of PAS.

Spectroscopic applications: Structural elucidation of simple organic molecules using UV-VIS, IR and NMR spectral

REFERENCE BOOKS

5. Instrumental methods of chemical analysis, G.W.Ewing, Mcgraw hill pub,1975
M.Sc. CHEMISTRY

SEMESTER - II

CORE PRACTICAL  I - ORGANIC CHEMISTRY PRACTICAL  I

OBJECTIVES

i) To perform the qualitative analysis of a given organic mixture.

ii) To carry out the preparation of organic compounds.

I. Identification of components in a two component mixture and preparation of their derivatives. Determination of boiling point/melting point for components and melting point for their derivatives.

II. Preparation.

1. Beta naphthyl methyl ether from beta naphthol
2. s-Benzyl isothiuronium chloride from benzylchloride
3. Beta glucose penta acetate from glucose
4. ortho-Benzoyl benzoic acid from phthalic anhydride
5. Resacetophenone from resorcinol
6. para-Nitrobenzoic acid from para nitrotoluene
7. meta-Nitroaniline from meta dinitrobenzene
8. Methyl orange from sulphanilic acid
9. Anthraquinone from anthracene
10. Benzhydrol from benzophenone.

REFERENCE BOOKS


M.Sc. CHEMISTRY

SEMESTER - II

CORE PRACTICAL II-INORGANIC CHEMISTRY PRACTICAL I

OBJECTIVES

i) To perform the semi micro qualitative analysis.

ii) To estimate the metal ions by colorimetric methods.

iii) To prepare inorganic complexes.

Part I

Semimicro qualitative analysis of mixtures containing two common and two rare cations. The following are the cations to be included: W, Tl, Mo, Te, Se, Ce, Th, Be, Zr, V, U and Li.

Part II

a) Colorimetric analysis: Visual and Photometric; determination of iron, nickel, manganese and copper.

b) Preparation of the following:

a) Potassium trioxalatoaluminate (III) trihydrate

b) Trithioureacopper(I) chloride

c) Potassium trioxalatochromate (III) trihydrate

d) Sodium bis (thiosulphato) cuprate (I)

e) Tetramminecopper (II) sulphate

f) Potassium Tetrachlorocuprate (II)

REFERENCES BOOKS


ii) To perform experiments in Conductivity measurements.

DETAILED LIST OF EXPERIMENTS

Typical list of possible experiments are given. Experiments of similar nature and other experiments may also be given. The list given is only a guideline. A minimum of 15 experiments have to be performed in a year.

1. Study the kinetics of acid hydrolysis of an ester, determination of the temperature coefficient of the reaction and determination of the activation energy of the hydrolysis of ethylacetate.

2. Study the kinetics of the reaction between acetone and iodine in acidic medium by half life method and determine the order with respect to iodine and acetone.

3. Study of the saponification of ethylacetate by sodium hydroxide conductometrically and determine the order of the reaction.

4. Determination of association factor of benzoic acid in benzene by distribution method.

5. Study the phase diagram for m-toluidine and glycerine system.

6. Construction of phase diagram for a simple binary system (naphthalene – phenanthrene and benzophenone – diphenylamine)
7. Construction of the phase diagram of the three component of partially immiscible liquid systems (DMSO – Water – Benzene; Water-Benzene – Acetic acid; Ethyl alcohol – Benzene – Water; Acetone-Chloroform – Water; Chloroform – Acetic acid – Water).

8. Determination of equivalent conductance of a weak acid at different concentrations and verify Ostwald’s dilution law and calculation of the dissociation constant of the acid.

9. Determination of equivalent conductivity of a strong electrolyte at different concentrations and examine the validity of the Onsager’s theory as limiting law at high dilutions.

10. Conductometric titrations of a mixture of HCl and CH3COOH against Sodium hydroxide.

11. Compare the relative strength of acetic acid and monochloroacetic acid by conductivity method.

Reference Books


M.Sc. CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSES

LIST OF EXTRA DISCIPLINARY COURSE PAPERS

I. Industrial Chemistry
II. Agricultural Chemistry
III. Food and Medicinal Chemistry
IV. Pharmaceutical Chemistry
V. Dye Chemistry
VI. Water Chemistry
UNIT-I Glass and Ceramics


1.2 Ceramics: Definition. Manufacture and applications.

UNIT-II Cement


UNIT-III Dyes and Paints

3.1 Dyes: Classifications of dyes, application of dyes in other areas-medicine, chemical analysis, cosmetics, colouring agents, Food and beverages.

3.2 Paints: Constituents of paints, Manufacture of paints, Setting of paints, requirement of a good paint, paint failure.

UNIT-IV Synthetic fibres and Plastics

4.1 Synthetic fibres: Difference between natural and synthetic fibres, Applications of synthetic fibres-Rayon, Terylene, Nylon, Taflon.

4.2 Plastics: Domestic and industrial applications of all types of plastics.

UNIT-V Oils, Fats and Waxes

Classification of oils, fats and waxes, distinction between oils, fats and waxes, Uses of essential oils and fats. Soap and its manufacture toilet and transparent soaps cleansing action of so ap Detergent – classification and uses.
M.Sc - CHEMISTRY

TEXT BOOKS

REFERENCE BOOKS
M.Sc. CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSE

PAPER- II- AGRICULTURAL CHEMISTRY

(60 Hours)

UNIT-I Water source for Agriculture (12 hours)

Water treatment and water analysis-acidity, alkalinity, pH, Biological oxygen demand (BOD). Chemical oxygen demand (COD) and their determinations, Recycling of water, water management.

UNIT - II Chemistry of soil, soil classification and soil analysis (12 Hours)

Definition, classification and properties of soil, Soil erosion, Soil fertility, Soil organic matter and their influence on soil properties, Soil reactions- soil pH, acidity, alkalinity, buffering of soils and its effect on the availability of N, P, R. Ca and Mg.

UNIT-III Irrigation (12 Hours)

Crop Seasons-seed, seed development organization, natural seeds projects phase-III, new policy on seed development; Soil- soil reclamation, alkali soil, saline soils, methods for soil reclamation; Irrigation Environmental degradation and Irrigation projects.

UNIT-IV Fertilizers (12 Hours)

4.1 Fertilizers: Effect of Nitrogen, potassium and phosphorous on plant growth. Secondary nutrients – micronutrients- their functions in plants classification of fertilizers, natural fertilizers, artificial fertilizers, phosphate fertilizers; Manufacture of urea and triple super phosphate

4.2 Manures: Bulky organic manures- Farm yard manure- handling and storage, oil cakes. Blood meal, fish manures.

UNIT-V Pesticides and Insecticides (12 Hours)

5.1 Pesticides; Classification of Insecticides, fungicides herbicides as organic and inorganic, general methods of application and toxicity, safety measures when using pesticides.
M.Sc - CHEMISTRY

Insecticides: Plant products-Nicotine, pyrethrin, Inorganic pesticides-borates organic pesticides - D.D.T and BMC.

5.2 Fungicide and Herbicides:

Fungicide: Sulphur compounds, copper compounds, Bordeaux mixture,
Herbicides: Acaricides- Rodenticides, Attractants- Repellants, Preservation of seeds.

TEXT BOOKS


REFERENCE BOOKS

3. B.K. Sharma, Industrial Chemistry.
M.Sc. CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSE

PAPER- III- FOOD AND MEDICINAL CHEMISTRY

(60 Hours)

UNIT I - I Food

1.1 Food Adulteration
Sources of food, types, advantages and disadvantages, constituents of foods, carbohydrates, proteins, fats and oils, colours, flavours, natural toxicants.

1.2 Food poisoning
Sources, causes and remedy- Causes and remedies for acidity, gastritis, indigestion and constipation.

1.3 Food preservation
Food spoilage, causes of food spoilage, types of food spoilage, food preservation.

UNIT-II Vitamins and minerals

2.1 Vitamins: Sources, requirement, deficiency diseases of A. B. C. H and K.

2.2 Minerals: Mineral elements in food-principal mineral elements - Source- Function - Deficiency and daily requirements- Na, K. Mg. Fe, S. P and I.

UNIT-III

3.1 Antibiotics: Definition, Classification as broad and narrow spectrum, mode of action and uses of penicillin, Chloramphenicol, tetracyclines, ciphalosporin, ampicillin and erythromycin.

3.2 Sulphonamides: Mechanism and action of sulpha drugs, preparation and uses of sulphadiazine, sulphathiazole, sulphapyridine and sulphafurazole.


UNIT-IV

4.1 Antiseptics and disinfectants- definition and distinction- phenol coefficient, phenol as disinfectant, chlorhexidinc, formaldehyde and nitrofurazone- uses.
4.2 Anaesthetics- definition- classification- local and general- volatile, nitrous oxide, ether, chloroform, cyclopropane- uses and disadvantages- nonvolatile- intravenous- thiopental sodium, methohexitone, propanidide, local anaesthetics- cocaine and benzocaine- uses and disadvantages.

UNIT-V (12 Hours)

5.1 Drugs affecting CNS- Definition and one example for tranquilisers, sedatives, hypnotics, psychedelic drugs- chlorpromazine and barbitone- uses

5.2 Hypoglycemic agents- Diabetes- types- causes- symptoms- Insulin- uses. Oral hypoglycemic agents- sulphonyl ureas- action and uses.

5.3 Antineoplastic drugs- Causes for cancer, Antineoplastic agents, cytotoxic. anti-metabolites, plant products, harmones- one example and uses

5.4 AIDS-causes, prevention and control.

5.5 Indian medicinal plants and uses- tulasi, kilanelli, mango, semparuthi, adadodai and thoothuvalai.

TEXT HOOKS


REFERENCE BOOKS


7. G.R. Chatwal, Pharmaceutical Chemistry Organic. Vol-II,

M.Sc. CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSE

PAPER-IV-PHARMACEUTICAL CHEMISTRY

(60 Hours)

UNIT -I

(12 Hours)

Introduction: Importance of Chemistry in pharmacy. Important terminologies used, their meaning- molecular pharmacology, pharmacodynamics, phamacophore, metabolites, antimetabolites, bacteria, virus, fungi, actinomycetes.


Drug delivery systems, sustained release of drugs. Physiological effects of different functional groups in drugs.

UNIT-II

(12 Hours)

2.1 Indian Medicinal plants and trees- adathoda, tulsi, thooothuvalai, shoeflower, neem. mango, kizhanelli. Ocimum, grass and greens.

2.2 Antibiotics: Definition. Structure- uses of chlorarnphenicol- ampicillin. streptomycin, tetracyline- ritaniycin, Macrolidcs- Erythromycin- properties and uses.

Structural features- SAR- functional group responsible for drug action. Structural modification that changes the potency of the above drugs. Conditions for their use as therapeutic agents. Fields of application.

2.3 Sulphonamides: Substituents in the amide group. General properties and drug action. Preparation and uses of sulphadiazine, sulphapyridine, sulphathiazole, sulphafurazole and prontosil.

UNIT-III

(12 Hours)

3.1 Antineoplastic drugs: Causes for cancer, Antineoplastic agents, cytotoxic. antimetabolites, plant products, harmones.


Salicylic acid and its derivatives, indolyl derivatives, aryl-acetic acid derivatives, pyrazole. p-aminophenol derivatives- mechanism of action.
3.3 Antiseptics and disinfectants: Definition. Standardization of disinfectants, Use of phenols, dyes, chloramines, chlorohexadiene, Organomercurials, Dequalinium chloride, formaldehyde. Cationic surface active reagents, chloraminet-nitrofurazone.
Distinction between antiseptics and disinfectants.

UNIT – IV
(12 Hours)
4.2 Anaesthetics: Definition, Classification. Uses of volatile anaesthetics - nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloroethylene, ethyl chloride - storage, advantages and disadvantages, intravenous anaesthetics-thiopental sodium, methohexitone, propanidide.

UNIT-V
(12 Hours)
5.1 Haematological agents: Coagulants and anticoagulants; Coagulants: vitamin K, Protamine sulphate, dried thrombin, Proteins, amino acids, Anticoagulants - Coumarins, indanediols. citric acid, 2-sulphonyl acids, quinoxaline, throm lodyn, Haemostatics - amino caproic acid, transexamic acid, Anaemia: Causes, detection, antianaemic drugs.
5.2 Cardio Vascular drugs: Cardiac glycosides, antiarrhythmic drugs, antihypertension drugs, antianginal agents, vasodilators, lipid lowering agents. One example for each.

TEXT BOOKS
2. Ashutosh Kar, Medicinal Chemistry, Ne\v Age International. 1996.

REFERENCE BOOKS
M.Sc. CHEMISTRY
SEMESTER II
EXTRA DISCIPLINARY COURSE
PAPER-V- DYE CHEMISTRY
(60 Hours)

Unit I  Introduction (12 Hours)
Colour and chemical constitution - chromophore, auxochrome and resonance, various theories; History of natural and synthetic dyes; Names of commercial dyes; Study of raw materials and dyestuff intermediates; Unit operations - nitration, sulphonation, halogenation, amination, diazotisation and alkali fusion; Colour index and its significance; Classification of dyes based on chemical constitution and method of applications; General properties - linearity, coplanarity and fastness.

Unit II  Direct, Acid and Basic Dyes (12 Hours)
Direct cotton dyes (substantive dyes) – Classification, properties, structure and mechanism of dyeing, post treatment of dyeing; Acid dyes and Basic dyes – Classification, Characteristics, trade names, Mechanism of dyeing, Nature of affinity on cellulose and protein fibres.

Unit III  Mordant, Azo and Vat Dyes (12 Hours)
Mordant dyes – classification, methods of application; Metal complex dyes – types of bond formation between dye and various fibres; Azo dyes – Azoic coupling components, protective colloids, electrolytes, stabilisation of diazonium salts, principles and application; Vat dyes and solubilised vat dyes – classification, methods of application, trade names, principles and application, Stripping agents and correction of faulty dyeing.

Unit IV  Other Dyes (12 Hours)
Chemistry involved in the production of Aniline black; Prussian black; Sulphur colours; phthalocyanines; Disperse dyes - classification based on chemical structure, properties and principles of application; Solvent soluble dyes - Nigrosines and Indulines; Cyanine dyes.

Unit V  Colour and Brightening (12 Hours)
Fluorescent brightening agents (FBA) - Theory and applications; Identification and estimation of dyes on fibres; The action of light on dyes and dyed fibres; Mechanism of fading.
M.Sc - CHEMISTRY

TEXT BOOKS:

REFERENCE BOOKS:
M.Sc. CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSE

PAPER-VI- WATER CHEMISTRY

(60 Hours)

Unit I  Introduction (12 Hours)

Sources of Water; Physical and chemical characteristics of water; Water analysis;
Potable water – WTO standard: uses of water

Unit II  Water Pollution (12 Hours)

Water pollution – wastewater generation - classification of water pollutants;
constituents and characteristics of wastewater; measurement techniques – sampling,
colour & odour, dissolved oxygen, BOD, COD, TOC, N & P, suspended solids and
bacteriological measurements.

Unit III  Wastewater Treatment (12 Hours)

Wastewater treatment: Pretreatment – screening, grit removal and pre-chlorination;
Primary treatment – settling and sedimentation; Secondary treatment – trickling filter
process, activated sludge process; Aeration.

Unit IV  Industrial Wastewater Treatment (12 Hours)

Industrial wastewater treatment: Activated sludge treatment plants – mass balances,
with and without recycle plants; Types of plants – single tank, contact stabilization,
biosorption plants.

Biofilters: Hydraulic film diffusion, two component diffusion; Types of plants –
trickling filters, submerged filters and rotating disc; removal of particulate organic
matter.

Unit V  Treatment Plants (12 Hours)

Treatment plants for nitrification – mass balances, nitrifying plants and types of
plants.

Treatment plant for denitrification - mass balances, denitrifying plants and types of
plants; redox zones in the biomass.

Anaerobic wastewater treatment: Plant types – pretreatment, plant with suspended
sludge and filter process.
M.Sc - CHEMISTRY

TEXT BOOKS

REFERENCE BOOKS
Model question paper  
(For the candidates admitted from 2012-2013 onwards) M.Sc/ M.A/ M.Com/ M.C.A Degree Examinations Second Semester  
EDC - PAPER-I - INDUSTRIAL CHEMISTRY  
Time: 3hrs Maximum: 75 marks

PART-A

Answer all questions, either (a) or (b)

1. a) Write an account of optical glass and photosensitive glass (Or)
   b) Explain the raw materials used in the manufacture of glass

2. a) Explain the theory of setting of cement (Or)
   b) What is Portland cement? Give its rough composition

3. a) How are dyes classified? (Or)
   b) What are paints? Discuss the essential components of a good paint.

4. a) Distinguish between natural fibres and synthetic fibres? (Or)
   b) Write notes on Rayon and Nylon.

5. a) i) What are essential oils? Give an example.
    ii) Give two examples for waxes. (Or)
   b) Explain the cleansing action of soaps.

PART-B (10x5=50 Marks)

Answer all questions, either (a) or (b)

6. a) How is glass manufactured? (Or)
    b) Discuss the manufacture and uses of ceramics.

7. a) How is cement manufactured? (Or)
    b) i) What are the types of cement ((4)
        i i) Write an account of the factors affecting the quality of cement(6)

8. a) Give an account of the application of dyes (Or)
    b) i) How is paint manufactured? (6)
        ii) What are the qualities of good paint?-(4)

9. a) Write notes on synthetic fibres (Or)
    b) Describe in detail the applications of plastics.

10. a) i) How are waxes classified?(3)
     ii) Discuss the steps involved in the process of soap making(7) (Or)
     b) i) Distinguish between soups and detergents(6)
         i i ) Write briefly about the various types of soaps.(4)
Model Question Paper
M.Sc. Branch IV (D) - Organic Chemistry
First Semester
Core Paper - I
Organic Chemistry - I

Time: 3 Hours

Maximum: 75 Marks

PART - A (5X5=25 Marks)
Answer all the questions

1. a) Discuss briefly the optical activity of allenes and spiranes. (Or)
   b) Discuss the conformation and stability of decalins.
2. a) Discuss the mechanism of sandmeyer reaction (Or)
   b) State and explain Hammonds postulate with potential energy diagram
3. a) What are known as ambident nucleophiles? Mention some important ambident nucleophiles (Or)
   b) Explain the nature of attacking nucleophile and mention the important principles.
4. a) What is Zeigler alkylation? Comment on the uses of this reaction. (Or)
   b) Explain the mechanism of vilsmeir reaction.
5. a) How is the position of methoxy group in reserpine established? (Or)
   b) Give the synthesis of Anthocyanins.

PART - B (5X10=50 Marks)
Answer all the questions

6. a) Explain the homotopic, enantiotopic and diastereotopic H atoms and groups in organic molecules. (10) (Or)
   b) Discuss the conformation, relative stability and optical activity of 1,2 and 1,3 dimethyl cyclohexanes.
7. a) i) Explain Fischer projection with an example.
        ii) Discuss the optical activity of biphenyls. (5+5) (Or)
   b) Discuss the mechanism of the following reactions
8. a) Explain SN1 and SN2 mechanism with suitable examples. (10) (Or)
   b) Describe the mechanism of the following reactions.
      I Williamson's reaction
      ii) Dieckmann condensation
      iii) Von - braun reaction (3+4+3)
9. a) Explain arenium ion mechanism with evidences and energy profile diagram(10) (Or)
   b) Explain the mechanism of the following reactions
9. a) Elucidate the structure of Papaverine. (10) (Or)
   b) Elucidate the structure of flavones.
M.Sc. CHEMISTRY
SEMESTER - III
CORE VI - ORGANIC CHEMISTRY - III

OBJECTIVES

i) To learn the mechanism of addition to Carbon - Carbon and Carbon - Hetero atom multiple bonds.

ii) To learn the mechanism of molecular rearrangements.

iii) To study the mechanism of oxidation and reduction reactions.

iv) To study the structural elucidation of steroids.

v) To study ORD, CD and mass spectrometry of organic compounds.

UNIT I Addition to Carbon – Carbon and Carbon – Hetero atom multiple bonds. (15 Hours)

Addition of halogen and nitrosyl chloride to olefins, hydration of olefins and acetylenes, hydroboration, hydroxylation - cishydroxylation (OsO4 & KMnO4), transhydroxylation (Prevost reaction and Woodward modification), epoxidation, Michael addition, 1,3 dipolar addition, carbenes and their additions, Diels- Alder reaction.

Mechanism and applications of Mannich, Stobbe, Darzen Glycidic ester condensation. Benzoin condensation, Peterson olefination (Silyl Wittig reaction), Strecker synthesis, Wittig, Wittig - Horner, Perkin, Thorpe, Ritter, Prins reactions.

UNIT II Molecular Rearrangements (15 Hours)

A detailed study of the mechanism of the following rearrangements. Wagner – Meerwin, Demyanov, Dienone- Phenol, Favorisky, Baeyer – Villiger, Wolff, Stevens, Von – Richter, Beckmann, Hydroperoxide, Smiles, Jacobsen, Hofmann - Martius rearrangements (a few examples in each rearrangement are to be studied).

UNIT III Oxidation and Reduction Reactions (15 Hours)

Study of the following oxidation reactions with mechanism: Oxidation of alcohols by CrO3, DMSO alone, DMSO in combination with DCC; acetic anhydride and oxalyl chloride, oxidation of arylmethane, oxidation of methylene alpha to carbonyl, allylic oxidation of olefins, oxidative cleavage of glycols, oxidative cleavage of double bonds by ozonolysis.

Study of the following reduction reactions with mechanism; Reduction of carbonyl compounds by complex metal hydrides (LAH, NaBH4, NaBH3CN), clemmensen and Wolff Kishner reductions, Birch reduction, MPV reduction.
UNIT IV Steroids (15 Hours)


UNIT V ORD - CD and Mass Spectrometry (15 Hours)

ORD-CD: Definition, deduction of absolute configuration, octant rule for ketones, Cotton effect-axial haloketone rule.

Mass spectra – Basic principle, molecular ion peak, base peak, meta stable ion peak, isotopic peaks, Nitrogen rule, ring rule, McLafferty rearrangement, rules for fragmentation pattern, Examples of mass spectral fragmentation of organic compounds (alkanes, aromatic hydro carbons, alkyl halides, aldehydes, ketones, alcohols, acids and esters).

TEXT BOOKS


REFERENCE BOOKS

M.Sc. CHEMISTRY
SEMESTER - III
CORE VII - INORGANIC CHEMISTRY-II

OBJECTIVES

i) To study about the X-ray crystal structure of the compounds
ii) To learn about the analytical tools which are used in nuclear chemistry

UNIT I Crystal Systems and Structural Analysis (15 Hours)
The growth and form of crystals - the crystal systems and Bravais lattices - Miller indices and labelling of planes - symmetry properties - crystallographic point groups and space groups - fundamentals of X-ray diffraction - powder and rotating crystal methods - systematic absences and determination of lattice types - analysis of X-ray data for cubic system - structure factor and Fourier synthesis - electron and neutron diffraction and structure determination.

UNIT II Solid State - I (15 Hours)

UNIT III Solid State - II (15 Hours)
Metallic state - free electron and band theories - non-stoichiometry - point defects in solids - Schottky and Frenkel defects - linear defects - dislocations - effects due to dislocations - electrical properties of solids - insulators - intrinsic semiconductors - impurity semiconductors (n and p-type) and superconductors - elementary study of liquid crystals.

UNIT III Nuclear Chemistry - I (15 Hours)
UNIT V Nuclear Chemistry - II (15 Hours)

Different type of nuclear reactions with natural and accelerated particles - transmutation - stripping and pick-up - spallation - fragmentation, etc. - fission - characteristics of fission reaction - product distribution and theories of fission - fissile and fertile isotopes - $^{235}\text{U}$, $^{238}\text{U}$, $^{232}\text{Th}$ and $^{239}\text{Pu}$ - atom bomb - nuclear fusion - stellar energy - synthesis of new elements - principles underlying the usage of radioisotopes in analysis - agriculture - industry and medicine - mechanism of chemical reactions - uses of radioisotopes in analytical chemistry - isotopic dilution analysis - neutron activation analysis and dating methods.

TEXT BOOKS

1. W.J. Moore – Physical Chemistry
2. L.V. Azroff – Introduction to solids
3. S. Glasstone – Source book on atomic energy

REFERENCE BOOKS

1. W.E. Addision – structural principles of Inorganic Chemistry
2. N.B. Hannay – Solid state chemistry
3. R.A. Albery – Physical chemistry
4. G. Friedlander, J.W. Kennedy, - Nuclear and Radiochemistry
   E.S. Macias and J.M. Miller
OBJECTIVES

i) To impart knowledge on electrochemistry, photochemistry, quantum chemistry, and spectroscopy

ii) To study the concepts and principles of electrochemistry, photochemistry, quantum chemistry, and spectroscopy

UNIT I Electrochemistry – II (15 Hours)


UNIT II Electrochemistry – II (15 Hours)


UNIT III Photochemistry (15 Hours)


UNIT IV Quantum Chemistry – III (15 Hours)

UNIT V Spectroscopy (15 Hours)

TEXT BOOKS

REFERENCE BOOKS
M.Sc. CHEMISTRY
SEMESTER - III
ELECTIVE III

PAPER I - EXPERIMENTAL METHODS IN CHEMISTRY

OBJECTIVES
i) To study in detail the fundamental aspects of various experimental and instrumental methods in chemistry
ii) To understand the principles and instrumentation of destructive and non-destructive techniques
iii) To understand the various techniques in Chromatography

UNIT I SURFACE IMAGING (15 Hours)
Basic concepts in surface imaging – Principle, Instrumentation and Applications – secondary electron microscopy(SEM), secondary Auger microscopy(SAM), scanning probe microscopy(SPM), scanning tunneling microscopy(STM), transmission electron microscopy(TEM).

UNIT II CHEMICAL ANALYSIS (15 Hours)
Non-destructive techniques – X-ray absorption, Diffraction and fluorescence spectroscopy – theory, instrumentation and applications.

UNIT III ELECTROANALYTICAL TECHNIQUES (15 Hours)
Polarography – Theory, apparatus, DME, diffusion, kinetic and catalytic currents, current voltage curves for reversible and irreversible systems, qualitative and quantitative applications to inorganic systems.
Amperometric titrations – Theory, apparatus, types of titration curves, successive titrations and two indicator electrodes, applications – Complexometric titrations – chelating agents, types of EDTA titration – direct and back titrations, replacement titrations – masking and demasking reagents.

UNIT IV SEPARATION METHODS - I (15 Hours)
UNIT V SEPARATION METHODS – II (15 Hours)

Gel chromatography or Gel Permeation Chromatography – Principle, Materials, Gel preparation, column Packing and Detectors – applications and advantages of gel chromatography.

Ion Exchange Chromatography – Definition, Principle, cation and anion exchangers – regeneration - column used in separations - Ion exchange capacity and techniques - Applications

TEXT BOOKS

2. Frank A. Settle, Handbook of instrumental techniques for analytical chemistry, Prince Hall, Newjersey, 1997
M.Sc. CHEMISTRY
SEMESTER - III
ELECTIVE III

PAPER II - ELECTROANALYTICAL TECHNIQUES

OBJECTIVES

i) To understand the basic concepts of electroanalytical chemistry

ii) To study the principles and instrumentation of various electroanalytical techniques

UNIT I Basic Electrochemical principles (15 Hours)


UNIT II Methods Based on Diffusion (15 Hours)

Principle, instrumentation and applications of the following techniques: Chronoamperometry; Polarography - Ilkovic equation - Square wave polarography; Linear Sweep voltammetry – Randles Sevrik equation; Cyclic voltammetry - Normal pulse, Differential pulse and Squarewave voltammetry.

UNIT III Coulometric and Potentiometric Methods (15 Hours)

Galvanostatic and potentiostatic methods. Principle, instrumentation and applications of the following techniques: Controlled potential coulometry and electrolysis; Chronocoulometry; Potentiometry and Chronopotentiometry.

UNIT IV Stripping voltammetry (15 Hours)

Principle, instrumentation and applications of Anodic stripping voltammetry, Cathodic stripping voltammetry and Adsorptive stripping voltammetry.

UNIT V Sine wave methods (Electrochemical Impedance Spectroscopy) (15 Hrs)

Principle of Impedance technique - Analysis of Faradaic impedance – Bode Diagrams.

Dynamic electrode techniques, Principle, instrumentation and applications of RDE and RRDE techniques.
M.Sc - CHEMISTRY

TEXT BOOKS
2. Willard, Merit, Dean and Settle, Instrumental Methods of Analysis, CBS Publishers and Distributors, IV Edn. 1986

REFERENCE BOOKS
OBJECTIVES

i) To learn the detailed study of synthetic organometallic complexes owing to the preparation as well as their reactivity and application which is very useful in the modern era.

UNIT I Bonding in Organometallic Complexes and metal carbonyls (15 Hours)

UNIT II Metal alkyl, Alkylidene and Alkylidyne complexes (15 Hours)

UNIT III Metal Alkene and Alkyne complexes(15 Hours)
UNIT IV Organometallic Sandwich complexes (15 Hours)


UNIT V Organometallic Chemistry applications in catalysis. (15 Hrs)

Organometallic compounds in homogeneous catalytic reactions - coordinative unsaturation - acid-base behaviour reaction - migration of atoms or groups from metal to ligand - insertion reaction - reactions of coordinated ligands - catalytic reactions of alkenes - isomerisation of alkenes - hydrogenation - hydroformylation and hydrosilation of alkenes - fluxional molecules.

TEXT BOOKS


REFERENCE BOOKS


OBJECTIVES

i) To understand the characterization of nanomaterials
ii) To understand carbon clusters and nanostructures
iii) To understand the green concepts of organic reactions

UNIT I INTRODUCTION TO NANOSCIENCE (15 Hours)

Definition, classification, a historical perspective, nanoparticles, nanocrystal, quantum dot, nanometer, new properties of nanomaterials, nanomaterials in medicine, information storage, sensors, new electronic devices, environmental remediation, clean catalyst. Metal nanoparticles, chemical bonding and properties of bulk metals as well as metal nano particles. Gas phase and chemical synthetic methods to metal nanoparticles, nanoelectrons, conductivity of nanoelectrons.

UNIT II TOOLS OF THE NANOSCIENCES (15 Hours)

Tools to measuring nanostructures – scanning probe instruments – spectroscopy – electrochemistry – electron microscopy (Basic ideas only).


UNIT III PROPERTIES AND APPLICATIONS OF NANAOPARTICLES (15 Hours)

Nanotubes(CNT), nanocrystal shape, sequestration of gases, destructive adsorption of environmental toxins, optical properties and magnetic properties of nanoscale materials. Size dependent properties such as coercivity(magnetic memory) and saturation magnetization, nanoparticles in polymers, ink, fluids, dyes and catalysis. Nanoparticles as colorants, ultraviolet absorbers, electronics and in biomedical applications.

UNIT IV INTRODUCTION TO GREEN CHEMISTRY (15 Hours)

UNIT V SOLVENT FREE ORGANIC SYNTHESIS (15 Hrs)

Reactions on solid supports, phase transfer catalysis, solvent free esters saponification, reactions without support or catalyst, examples – microwave assisted reactions in water – oxidation of toluene to benzoic acid, microwave assisted reactions in organic solvent - Diels alder reaction, coupling reactions (stille, Suzuki, heck, sonogashira) - Solvent free microwave assisted organic synthesis – microwave activation and heating, advantages of microwave exposure and specific effects of microwaves - Organic synthesis under microwaves – benefits and limitations.

TEXT BOOKS

3. Mick Wilson, Kannangara, Geoff Smith, Michelle simmons and Burkhard Raguse, Nanotechnology basic science and emerging technologies, overseas press.
M.Sc. CHEMISTRY
SEMESTER - IV
ELECTIVE IV
PAPER II - MEDICINAL CHEMISTRY

OBJECTIVES
i) To understand the basic concepts of medicinal chemistry
ii) To understand the structure activity relationships of selected drug molecules

UNIT I Basic Concepts (15 Hours)
Drug design - analogues and pro-drugs, factors governing drug design, rational approach, method of variation and tailoring of drugs; Physical properties - factors governing drug action at active site, factors governing ability of drugs to reach active site, dissociation constants, isosterism and bioisosterism; general anaesthetics - inhalation anaesthetics, intravenous anaesthetics and basal anaesthetics; mode of action; local anaesthetics - classification and syntheses, sedatives and hypnotics - classification, synthesis, mode of action and structure-activity relationship.

UNIT II Anticonvulsants, Stimulants and Antipyretic Analgesics (15 Hours)
Anticonvulsants - classification, synthesis and mode of action; Muscle relaxants - classification, synthesis and mode of action. Central nervous system stimulants - classification, synthesis and mode of action; Antipyretic analgesics - classification, synthesis and mode of action;

UNIT III Other Analgesics (15 Hours)
Narcotic or Opiate analgesics - classification, preparation and mode of action; Narcotic antagonists; Cardiovascular drugs - classification, synthesis and mode of action; Autonomic drugs - synthesis and mode of action of sympathomimetic drugs, antiadrenergic drugs, cholinomimetic drugs, antimuscarinic drugs, ganglionic blocking agents and adrenergic neurone blocking agents; Diuretics - synthesis and mode of action of mercurial and non-mercurial diuretics.

UNIT IV Antihistamines, Anti-inflammatory and Antiparkinson drugs (15 Hours)
Antihistaminics - synthesis and mode of action of histamine H1 receptor antagonists and histamine H2-receptor blockers; prevention of histamine release; structure-activity relationships amongst H1-receptor blockers. Non-steroidal anti-inflammatory drugs (NSAID) - synthesis and mode of action of heteroarylacetic acid analogues, arylacetic acid analogues, arylopropionic acid analogues, naphthalene acetic acid analogues, gold compounds, salicylic acid analogues and pyrazolones and pyrazolodiones; Antiparkinsonism agents - synthesis and mode of action of piperidine analogues, pyrolidine analogues and phenothiazine analogues.
UNIT V Other drugs (15 Hrs)


TEXT BOOKS


REFERENCE BOOKS

OBJECTIVES

i) To perform organic estimations
ii) To prepare organic compounds involving two stages.

I. Organic Estimation
1. Phenol
2. Aniline
3. Methyl Ketone
4. Glucose
5. Iodine value of an oil

II. Organic Preparation, Involving Two stages
1. Sym-tribromobenzene from aniline.
2. m- Nitrobenzoic acid from methyl benzoate.
3. para – Nitroaniline from acetanilide.
4. Benzilidene from benzophenone.
5. Aspirin from methyl salicylate
6. Anthraquinone from phthalic anhydride.

III. Extraction of Natural Products:
1. Caffeine from tea leaves.
2. Citric acid from lemon.

IV Chromatographic Separations
1. Column chromatography : separation of a mixture of ortho and para-Nitroanilines.
2. Thin layer Chromatography: separation of a mixture of ortho and para – Nitroanilines.

REFERENCE BOOKS
OBJECTIVES

i) To perform quantitative estimation of inorganic mixture.
ii) To perform analysis of ores and alloys
iii) To prepare inorganic complexes.

Part I Quantitative analysis of complex materials
Quantitative analysis of the following mixture
1. Iron and magnesium
2. Iron and nickel
3. Copper and nickel
4. Copper and Zinc

B) Analysis of Ores
1. Determination of percentage of calcium and magnesium in dolomite.
2. Determination of percentage of MnO2 in pyrolusite
3. Determination of percentage of lead in galena.

C) Analysis of Alloys
1. Determination of tin and lead in solder
2. Determination of copper and zinc in brass.
3. Determination of Chromium and nickel in stainless steel.

Part II: Preparations of the following:
1. Sodium hexanitrocobaltate (III)
2. Sodium Trisoxalatoferrate (III)
3. Prussian blue Fe4[Fe(CN)6]3
4. Bis (acetylacetanato) Copper (II)
5. Hexamminecobalt (III) chloride
6. Hexamminenickel (II) chloride

REFERENCE BOOKS:
**EMF Measurements**

1. Determination of standard potentials (Cu and Ag)
2. Determination of thermodynamic quantities from EMF measurements
3. Potentiometric titrations.
5. Determination of stability constant of complex.
7. Precipitation titration of mixture of halides by emf measurements.

**DETAILED LIST OF EXPERIMENTS**

Typical list of possible experiments are given. Experiments of similar nature and other experiments may also be given. The list given is only a guideline. A minimum of 15 experiments have to be performed.

1. Determination of the activity coefficient of an electrolyte at different molalities by emf measurements.
2. Determination of the dissociation constant of acetic acid by titrating it with sodium hydroxide using quinhydrone as an indicator electrode and calomel as a reference electrode.
3. Determination of the strength of a given solution of KCl using differential potentiometric titration technique.
4. Determination of the pH of the given solutions with the help of the indicators using buffer solutions and by colorimetric method.
5. Determination of the pH of a given solution by emf method using hydrogen electrode and quinhydrone electrode.
6. Determination of the composition and instability constant of a complex by mole ratio method.
7. Calculation of the thermodynamic parameters for the reaction Zn + H2SO4 \(\rightarrow\) ZnSO4 + H2 by emf method.
8. Determination of the formation constant of silver ammonia complex and stoichiometry of the complex potentiometrically.
10. Determination of the activity coefficient of Zinc ions in the solution of 0.002M Zinc sulphate using Debye - Huckel Limiting law.
11. Determination of solubility product of Silver bromide and calculate its solubility in water and 0.1 M and 0.01 M KBrO3 using Debye-Huckel limiting law.
12. Determination of the electrode potentials of Zn and Ag electrodes in 0.1 M and 0.001M solutions at 298 K and find the standard potentials for these electrodes and test the validity of Nernst equations.
13. Study the inversion of cane sugar in presence of acid using polarimeter.
14. Determination of the rate constant and order of reaction between potassium persulphate and potassium iodide and determine the temperature coefficient and energy of activation of the reaction.
15. Study the primary salt effect on the kinetics of ionic reactions and test the Bronsted relationship (iodide ion is oxidized by persulphate ion.)
16. Determination of the viscosities of mixtures of different compositions of liquids and find the composition of a given mixture.
17. Determination of the partial molar volume of glycine/methanol/formic acid/sulphuric acid by graphical method and by determining the densities of the solutions of different compositions.
18. Study the surface tension – concentration relationship of solutions (Gibb’s equation)
M.Sc - CHEMISTRY

REFERENCE BOOKS


M.Sc - CHEMISTRY