PERIYAR UNIVERSITY

SYLLABUS FOR M.Sc. CHEMISTRY

DEGREE OF MASTER OF SCIENCE

CHOICE BASED CREDIT SYSTEM

(For candidates admitted in the colleges affiliated to Periyar University from 2021-2022 onwards)
REGULATIONS

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 2021-2022, that is, for students who are admitted to the first year of the course during the academic year 2021-2022 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

<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>Internal (25%)</th>
<th>External (75%)</th>
<th>Total</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Internal</td>
<td>External</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(25%)</td>
<td>(75%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<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></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<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></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### I SEMESTER

<p>| | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></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>
<td>100</td>
<td>5</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>
<td>100</td>
<td>5</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>
<td>100</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>Elective - I</td>
<td>Polymer Chemistry / Nano and Green Chemistry</td>
<td>5</td>
<td>75</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</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>
<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>
<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>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>30</td>
<td>450</td>
<td></td>
<td>40</td>
<td>0</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

### II SEMESTER

<p>| | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></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>
<td>100</td>
<td>5</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>
<td>100</td>
<td>5</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>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>EDC</td>
<td>Extra Disciplinary course</td>
<td>4</td>
<td>60</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</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>
<td>100</td>
<td>3</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>
<td>100</td>
<td>3</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>
<td>100</td>
<td>3</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>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Add-On Course</td>
<td>Chemistry in Health Science</td>
<td>-</td>
<td>450</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>30</td>
<td>450</td>
<td></td>
<td>800</td>
<td></td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>S. No.</td>
<td>Course (Paper)</td>
<td>Subject Title</td>
<td>Hours / Week Work Load per Semester (Hrs)</td>
<td>Exam Hours</td>
<td>University Examination</td>
<td>Credits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>----------------</td>
<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>University</td>
<td>Internal (25%)</td>
<td>External (75%)</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III SEMESTER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Core - VI</td>
<td>Organic Chemistry - III</td>
<td>5 75 3 25 75</td>
<td>100</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Core - VII</td>
<td>Inorganic Chemistry - II</td>
<td>5 75 3 25 75</td>
<td>100</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Core - VIII</td>
<td>Physical Chemistry - III</td>
<td>5 75 3 25 75</td>
<td>100</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Elective - III</td>
<td>Experimental methods in Chemistry/Electroanalytical Techniques</td>
<td>5 75 3 25 75</td>
<td>100</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Core</td>
<td>Organic Chemistry</td>
<td>3 45 - - -</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical-IV</td>
<td>Practical – II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Core</td>
<td>Inorganic Chemistry</td>
<td>4 60 - - -</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical - V</td>
<td>Practical – II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Core</td>
<td>Physical Chemistry</td>
<td>3 45 - - -</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical-VI</td>
<td>Practical - II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>30 450</td>
<td>400</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV SEMESTER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Core - IX</td>
<td>Inorganic Chemistry - III</td>
<td>5 75 3 25 75</td>
<td>100</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Elective – IV</td>
<td>Medicinal Chemistry</td>
<td>5 75 3 25 75</td>
<td>100</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Core</td>
<td>Organic Chemistry</td>
<td>3 45 6 40 60</td>
<td>100</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical-IV</td>
<td>Practical – II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Core</td>
<td>Inorganic Chemistry</td>
<td>3 45 6 40 60</td>
<td>100</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical - V</td>
<td>Practical – II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Core</td>
<td>Physical Chemistry</td>
<td>3 45 6 40 60</td>
<td>100</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical-VI</td>
<td>Practical - II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Project</td>
<td>Dissertation/Project work</td>
<td>11 165 - - -</td>
<td>200</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>30 450</td>
<td>700</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GRAND TOTAL</td>
<td></td>
<td>120 1800</td>
<td>2300</td>
<td>93</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>University Examination(External)</td>
<td>75 marks</td>
</tr>
<tr>
<td>Internal Assessment</td>
<td>25 marks</td>
</tr>
</tbody>
</table>

Distribution of Internal Assessment mark

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>10 marks</td>
</tr>
<tr>
<td>Attendance</td>
<td>5 marks</td>
</tr>
<tr>
<td>Assignment</td>
<td>5 marks</td>
</tr>
<tr>
<td>Seminar</td>
<td>5 marks</td>
</tr>
</tbody>
</table>

-------------------------------
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: 15 X 1 = 15**
(Answer all questions)
(Three multiple choice questions from each unit)

**Part - B: 2 X 5 = 10**
(Answer any two questions) (one question from each unit)

**Part – C: 5X 10 = 50**
(Answer all questions)
(one question from each unit with internal choice)
## Practical

<table>
<thead>
<tr>
<th>Component</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>45</td>
</tr>
<tr>
<td>Viva-voce in practical</td>
<td>10</td>
</tr>
<tr>
<td>Record</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
</tr>
<tr>
<td>Duration</td>
<td>6 Hours</td>
</tr>
</tbody>
</table>

## Project

<table>
<thead>
<tr>
<th>Component</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissertation / Project</td>
<td>150</td>
</tr>
<tr>
<td>Viva - voce</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>200</strong></td>
</tr>
</tbody>
</table>
OBJECTIVES

1. To learn about the stereochemistry of organic compounds and ORD and CD.
2. To learn about the formation, stability and structure of intermediates and the mechanism of aliphatic electrophilic substitution.
3. To learn about the effect of structure on reactivity.
4. To learn about the mechanism of aliphatic nucleophilic substitution reactions.
5. To learn about the structural elucidation of alkaloids, flavones, isoflavones and anthocyanins.

Unit I  Stereochemistry, ORD and CD (15 Hours)

Wedge, Fischer, Newmann and Saw-horse formulae and their inter conversion, R and S notation, axial chirality (biphenyls, allenes and spiranes), planar chirality (cyclophanes, ansa compounds and trans cyclooctene), chirality due to helical shape, stereo selective and stereo specific reactions, asymmetric synthesis- Cram's rule. Homotopic, enantiotopic and diastereotopic atoms, groups in organic molecules. ORD & CD curves, octant rule, cotton effect, axial halo ketone rule and its applications.

UNIT II Reaction intermediates and aliphatic electrophilic substitution (15 Hours)

Reaction intermediates - Formation, stability and structure of carbonium ions, carbanions, carbenes, nitrenes and free radicals.

Aliphatic electrophilic substitution- SE1, SE2 and SEi mechanisms and electrophilic substitution by double bond shift, hydrogen electrophile-keto-enol tautomerism, halogen electrophile-halogenation of aldehydes and ketones, nitrogen electrophile- aliphatic diazonium coupling, sulphur electrophile- sulphonation and carbon electrophile- Stork-enamine reaction.

Unit III Effect of structure on reactivity (15 Hours)

Resonance and field effects, resonance and steric effects, quantitative treatment- the Hammett equation- linear free energy relationship, substituent constant and reaction constant and limitations of Hammett equation, Taft equation, thermodynamically and kinetically controlled reactions, Hammond's postulate, Non-kinetic methods of determining mechanism - isolation, trapping and detection of intermediates, isotopic labeling, crossover experiments, product analysis, stereo chemical evidence, kinetic method -kinetic isotope effect.

Unit IV Aliphatic nucleophilic substitution (15 Hours)

The SN1, SN2, SNi and neighbouring group mechanisms, the neighbouring group participation by pi and sigma bonds, Non classical carbocations, nucleophilic substitution at an allylic, aliphatic trigonal and vinylic carbon. Reactivity- effect of substrates structure, attacking nucleophile, leaving group and
reaction medium. Ambident nucleophile, Swain-Scott, Grunwald-Winstein relationship, phase transfer catalysis.

**Unit V Alkaloids and Anthocyanins (15 Hours)**


**TEXT BOOKS**


**REFERENCE BOOKS**

M.Sc. CHEMISTRY SEMESTER – I  
CORE II - INORGANIC CHEMISTRY – I  
(75 Hours)

OBJECTIVES
1. To learn about the basic concepts of structure and bonding in Inorganic polymers and polyacids
2. To understand the different metals used in Bioinorganic Chemistry
3. To learn the basics of nuclear chemistry and different types of nuclear reactions

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, polyorgano phosphazenes, 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 Bioinorganic chemistry (15 Hours)
Bioinorganic chemistry- Biological significances of metals- alkali and alkaline earth metals, Na/K pump, Transition metal storage and transport of Fe, Cu, Zn, Biological oxygen transport systems, Structure and function of heme and non- heme proteins (Mb, Hb, Hc, Hr ), Non-redox metalloenzymes-carboxy peptidase and carbonic anhydrase. Functions of Fe,Cu, Fe, sulphur proteins, cytochrome C and cytochrome P-450, Fundamental reactions of metals with nucleic acids and nitrogen fixation.

UNIT III 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. Metallocarboranes – a general study.
Metal clusters– Chemistry of low molecularity metal clusters only –structure of Re₂Cl₈; multiple metal –metal bonds.

UNIT IV - Nuclear Chemistry – I (15 Hours)
The nucleus-subatomic particles and their properties-mass defect - binding energy - n/ p ratio in stable and metastable nuclei-Different types of nuclear forces-Liquid drop model and shell model.
Modes of radioactive decay-Theory of alpha decay, beta decay and gamma radiation, Orbital electron capture, nuclear isomerism-internal conversion.
UNIT V - Nuclear Chemistry – II (15 Hours)
Nuclear Reactions: Q-value, columbic barrier- nuclear cross section-different types of nuclear reactions-projectile capture-particle emission, spallation, fission and fusion-product distributions - Theories of fission, use of fission products, fissile and fertile isotopes - U-238, U-235, PU-239, Th232 -stellar energy-synthesis of new elements.

TEXT BOOKS
1. F.A Cotton & Wilkinson, Advanced Chemistry
2. Emelius and Sharpe, Modern Aspects of Inorganic Chemistry.
3. J.D. Lee, Concise Inorganic Chemistry.
4. S.F.A. Kettle, Physical Inorganic Chemistry, Oxford University

REFERENCE BOOKS
OBJECTIVES

i) To study in detail the basic concepts of classical thermodynamics and statistical thermodynamics

ii) To learn about theories of reaction rates and kinetics of reactions in solution phase

ii) To understand the principles of quantum chemistry and group theory

UNIT I Classical Thermodynamics – I (15 Hours)

UNIT II –Statistical Thermodynamics – I (15 Hours)
Concept of Mathematical probability and thermodynamic probability - States of maximum thermodynamic probability of systems involving energy levels. Distinguishable and indistinguishable particles-microstates and macrostates. Ensembles– definition- microcanonical, canonical and grand canonical ensembles. Maxwell’s distribution law of molecular velocities - Evaluation of average velocity, root mean square velocity and most probable velocity from distribution law of molecular velocities - molecular velocities and energies of an ideal gas.

UNIT III Chemical Kinetics – I (15 Hours)
Theories of reaction rates-Hard sphere collision theory and transition state theory of reaction rates– Comparison of collision theory and activated complex theory – Lindemann and Hinshelwood theories of unimolecular reaction rates-Potential energy surface -Reactions in
solutions – comparison between gas phase and solution reactions – cage effect-influence of solvent, ionic strength, and pressure on reactions in solution – Kinetic isotope effects.

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 – Schrödinger 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)

TEXTBOOKS
REFERENCE BOOKS
5. I.N. Levine, Quantum chemistry, Allyn and Bacon, Boston, 1983.
OBJECTIVES
1. To study the basic concepts in Polymer chemistry.
2. To study the determination of molecular weight and properties of polymers.
3. To know about the polymer processing and polymerization techniques.
4. To learn about the synthesis and applications of commercial polymers and conducting polymers.

UNIT I Basic Concepts (15 Hours)
Monomers, repeat units, degree of polymerization, Linear, branched and network polymers, Addition polymerization, Condensation polymerization, Mechanism of free radical, cationic and anionic polymerization and co-ordination polymerization. Ziegler-Natta catalyst. Kinetics of free radical, cationic, anionic and co-polymerisation. Determination of Reactivity ratio, Reactivity ratio and co-polymerisation behavior.

UNIT II Molecular Weight and Physical Properties (15 Hours)
Concept of Average molecular weight, number- average, weight- average molecular weight and viscosity-average molecular weights. Determination of molecular weight - viscosity, light scattering, osmotic and ultracentrifugation methods. Physical properties- crystalline melting point, glass transition temperature, relationship between Tm and Tg and Determination of Tg.

UNIT III Polymer Processing and Polymerization Techniques (15 Hours)
Polymers processing- Plastics, elastomers and fibres. Compounding, Processing techniques- calendaring, die casting, injection molding, thermofoaming and fibre spinning. Polymerization techniques- Bulk polymerization, solution polymerization, suspension polymerization, emulsion polymerization and melt polycondesation.

UNIT IV Commercial Polymers (15 Hours)
Synthesis and applications of polyethylene, polyvinyl chloride, polyamide, polyester, phenol resins, epoxy resins, silicone polymers, polybenoxazoles, polyimidazole, polyurethane, polymethylmethacrylate, poly (tetrafluoro ethylene) and polyacrylonitrile.

UNIT V Conducting Polymers (15 Hours)
Conducting polymers- Introduction, Electrochemical doping, Electrochemical synthesis and applications of polypyrrole, polythiophene, polyindole, polyaniline, polyacetylene and poly(p-phenylene).
REFERENCE BOOKS
2. L. Gupta, Pragathi Prakashan Polymer Science, Publication.
OBJECTIVES
1. To learn about the synthesis, properties and applications of Nanomaterials.
2. To learn the tools for Characterisation of Nanomaterials.
3. To understand the green concept of organic reactions.

UNIT I Introduction and Synthesis of Nano materials (15 Hours)

Unit II Properties and applications of Nanomaterials (15 Hours)

UNIT III Tools for Characterisation of Nano Materials (15 Hours)
Spectroscopy: UV-visible spectroscopy- FTIR –Raman spectroscopy-x-ray photo electron spectroscopy- Luminescence-Photoluminescence

Unit IV Introduction to Green chemistry (15 Hours)
Choice of starting materials, Choice of reagents, Choice of catalysts- biocatalyst, polymer supported catalysts, Choice of solvents. Synthesis involving basic principles of green chemistry,examples-Synthesis ofAdipic acid, Methylmethacrylate, Paracetamol, Ultrasoundassisted reactions- Esterification, Reductions, Coupling reactions, Strecker synthesis and Reformatsky reactions.
Unit V Solvent free organic synthesis (15 Hours)
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- Diel's - 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.

REFERENCE BOOK
M.Sc. CHEMISTRY SEMESTER - II
CORE IV - ORGANIC CHEMISTRY – II
(75 Hours)

OBJECTIVES
1. To understand the basic concepts of aromaticity
2. To learn the mechanism of Elimination reaction and free radical reactions.
3. To study the mechanism of Aromatic electrophilic and Nucleophilic substitution reactions
4. To know the effects of light in organic reactions.
5. To study the basic concepts of the pericyclic reactions

Unit I Aromaticity
Aromaticity - Aromaticity in benzenoid, non-benzoid, (2, 6, 10 & 18 electrons systems) and hetero cyclic compounds. NMR concept of Aromaticity and non-aromaticity, systems of 10 electrons and more than 10 electrons (14, 18) annulunes, concept of antiaromaticity and homoaaromaticity, antiaromaticity in (12, 14) annulunes, non- aromaticity, alternate and non-alternant hydrocarbons, Aromaticity in fullerenes, Mobius Aromaticity.

Unit II Elimination and Free radicals
The E1, E2,E1CB mechanisms, orientation of the double bond- Hofmann, Zaitsev’s and Bredt rules, competition between Elimination and substitution, mechanism of pyrolytic elimination, Chugaev and Cope Elimination reactions.

Reactions of free radicals- polymerization, addition, halogenation, aromatic substitution and rearrangement. Reactivity - reactivity on aliphatic, aromatic substrate, reactivity in the attacking radical and effect of solvents.

Unit III Aromatic electrophilic and nucleophilic substitution
The arenium ion mechanism, orientation and reactivity in monosubstituted benzene ring-o, m, p-directing groups, ortho, para ratio, ipso attack, Vilsmeier- Haack, Jacobson and Scholl’s reactions. The SNAr,SN1 and benzene mechanisms, Reactivity - effect of substrate structure, leaving group and attacking nucleophiles.

UNIT IV Organic Photo chemistry
The fate of excited molecules, Jablonski diagram, Norrish type I and type II reactions, photo reduction of ketones, Paterno-Buchi reactions, photo chemistry of arenes, photo oxidation (formation of peroxy compounds), photo isomerisation (cis- trans), photo addition of olefin and amines to aromatic compounds. Fries, di-pi methane rearrangements, rearrangement of 4,4-diphenyl cyclohexadienone.
Unit V Pericyclic reactions

Classification, basic concept of orbital symmetry, Woodward- Hofmann rules. Electrocyclic reactions- concept of con and disrotation, cyclisation of butadiene and 1,3,5 -hexatriene- correlation diagram and FMO approach. Cycloaddition reactions- superfacial and antarafacial addition, theory of (2+2) and (4+2) cycloaddition reactions- correlation diagram and FMO approach. Sigmatropic migration of hydrogen and carbon, Sommelet- Hauser, Cope and Claisen rearrangements.

TEXT BOOKS


REFERENCE BOOKS


OBJECTIVES
1. To gain knowledge about the distribution laws in statistical thermodynamics and partition function
2. To study about the kinetics of complex and fast reactions
3. To understand the principles of quantum chemistry and group theory

UNIT I Statistical Thermodynamics-II (15 Hours)

UNIT II Partition functions (15 Hours)
Definition explanation- molecular partition function- molar partition function- Relationship between partition function and thermodynamic properties- internal energy, entropy, enthalpy, equilibrium constant, molar heat capacities of ideal gas molecules – translational, rotational, vibrational, and electronic partition functions- Sackur-Tetrode equation

UNIT III Chemical Kinetics – II (15 Hours)
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 and XeF₄, – symmetry of hybrid orbitals in non-linear molecules (H₂O, NH₃, CH₄, XeF₄ and PCl₅) 2 Electronic spectra of formaldehyde.

TEXT BOOKS :
3. Ashley, Classical and Statistical Thermodynamics Pearson Education 2012

REFERENCE BOOKS
5. I.N. Levine, Quantum chemistry, Allyn and Bacon, Boston, 1983.
OBJECTIVES
1. To study in detail about UV-VIS, IR, NMR, 13C NMR, EPR, Mossbauer spectroscopic and Mass spectrometry techniques
2. To develop problem solving skills from various types of spectra

UNIT I UV-VIS AND IR SPECTROSCOPY (15 Hours)
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)
1H 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)
13C NMR - The C 13 nucleus – Chemical shifts –Modes of couplings and multiplicity- proton coupled 13C spectra, Homonuclear & heteronuclear decoupling – NOE- Broad band decoupling – Off resonance decoupling–intensity of signals, Chemical shift equivalence, equivalent carbons, chemical shifts of 13C nuclei, DEPT technique, comparison of 1H and 13C NMR, 2D NMR-COSY and HETCOR techniques-simple molecules and applications of 13C 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 MASS SPECTROMETRY AND SPECTROSCOPIC APPLICATIONS (15 Hours)
Mass spectra- Basic principle, molecular ion peak, base peak, meta stable ion peak, isotopic peaks, Nitrogen rule, ring rule, Mc-Lafferty rearrangement, rules for fragmentation pattern, Examples of mass spectral fragmentation of organic compounds (alkanes, aromatic hydrocarbons, alkyl halides, aldehydes, ketones, alcohols, acids and esters).
Spectroscopic applications: Structural elucidation of simple organic molecules using UV-VIS, IR, 1H NMR spectroscopy and Mass spectrometry.

REFERENCE BOOKS
OBJECTIVES

To develop analytical skill in

1. Separation of organic mixture
2. Organic qualitative analysis
3. Preparation of organic compound involving in single stage.

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
1. To improve the skill in the qualitative analysis of mixture of four cations containing two common and two rare.
2. To impart the skill in estimation of metal ions by colorimetric method.

Part I
Semimicro qualitative analysis of mixtures containing the following cations to be tested W, Tl, Pb, Se, Te, Mo, Cu, Bi, Cd, Tl, Ce, Th, Zr, V, Cr, Fe, Ti, Zn, Ni, Co, Mn, Ca, Ba, Sr, Li and Mg.

Part II
Colorimetric analysis
Visual and Photometric determination of Iron, Nickel, Manganese and Copper

REFERENCES BOOKS
OBJECTIVES
Enable the students to
1) Understand the principle of conductivity experiments and carry out conductometric titrations.
2) Determine the rate constant for acid and base hydrolysis of esters.
3) Learn the kinetics of adsorption of oxalic acid on charcoal.

List of experiments
Conductivity Experiments
1. Determination of equivalent conductance of a strong electrolyte & the verification of DHO equation.
2. Verification of Ostwald’s Dilution Law & Determination of pKa of a weak acid
3. Verification of Kohlrausch’s Law for weak electrolytes.
5. Acid-base titration (strong acid and weak acid vs NaOH)
6. Precipitation titrations (mixture of halides only)
7. Determination of hydrolysis constant of aniline hydrochloride.
8. Saponification value of ethylacetate by conductivity measurements.
9. Comparison of the relative strength of chloroacetic acid and acetic acid by conductance method

Kinetics
1. Study the kinetics of acid hydrolysis of an ester, determine the temperature coefficient and also the activation energy of the reaction
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
**Phase diagram**

Construction of phase diagram for a simple binary system (naphthalene-pheanthrene or benzophenone- diphenyl amine)

**Adsorption**

Adsorption of oxalic acid on charcoal & determination of surface area (Freundlich isotherm only.

**REFERENCES 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. Water Chemistry
OBJECTIVES

1. To learn the basic concepts of Glass, Ceramics and Cement and its manufacture.

2. To gain the knowledge of Dyes, Paints, Synthetic fibers, Plastics, Oils, Fats and Waxes and their applications.

UNIT I Glass and Ceramics


Ceramics: Definition, Manufacture and applications.

UNIT II Cement


UNIT III Dyes and Paints

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

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

UNIT IV Synthetic fibres and Plastics

Synthetic fibres: Difference between natural and synthetic fibres, Synthesis and applications of Rayon, Terylene, Nylon and Taflon.

Plastics: Classification, properties and applications of plastics.

UNTIV Oils, Fats and Waxes

TEXT BOOKS


REFERENCE BOOKS

M.Sc. CHEMISTRY
SEMESTER II
EXTRA DISCIPLINARY COURSE
PAPER- II- AGRICULTURAL CHEMISTRY
(60 Hours)

OBJECTIVES
1. To learn the Analysis of Water and Soil.
2. To gain the knowledge of Soil treatment, Irrigation Fertilizer, Pesticides and Insecticides.

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 (12 Hours)

UNIT III Soil treatment and Irrigation (12Hours)
Soil treatment-Soil erosion- causes and prevention,soil reclamation, alkali soil, saline soils, methods for soil reclamation, Environmental degradation-causes and prevention, Methods of irrigation and Irrigation projects.

UNIT IV Fertilizers (12Hours)
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 superphosphate
Manures: Bulky organic manures- Farm yard manure- handling and storage, oil cakes. Blood meal, fish manures.

UNIT V Pesticides and Insecticides (12Hours)
Pesticides-Classification of Insecticides, fungicides, herbicides as organic and inorganic, general methods of application and toxicity, safety measures when using pesticides.
Insecticides: Plant products-Nicotine, pyrethrin, Inorganic pesticides-borates organic pesticides - D.D.T and BHC.
Fungicide: Sulphur compounds, copper compounds, Bordeaux mixture,
Herbicides: Acaricides- Rodenticides- Attractants- Repellants-Preservation of seeds.
TEXT BOOKS


REFERENCE BOOKS


M.Sc. CHEMISTRY
SEMESTER II
EXTRA DISCIPLINARY COURSE
PAPER- III- FOOD AND MEDICINAL CHEMISTRY
(60 Hours)

OBJECTIVES

1. To understand the importance of Food, its constituents, Food poisoning, Food preservatives, Vitamins and Minerals.
2. To gain the knowledge of various types of Drugs, AIDS and Medicinal plants.

UNIT I Food and its constituents (12 Hours)
Sources of food, types, advantages and disadvantages, constituents of foods, carbohydrates, proteins, fats and oils, colours, flavours, natural toxicants. Food poisoning- Sources, causes and remedy. Causes and remedies for acidity, gastritis, indigestion and constipation and food adulterations. Food spoilage- causes of food spoilage, types of food spoilage, food preservation.

UNIT II Vitamins and minerals (12 Hours)
Vitamins: Sources, requirement, deficiency diseases of A, B,C, H and K. Minerals: Mineral elements in food- principal mineral elements - Source- Function - Deficiency and daily requirements- Na, K, Mg, Fe, S, P and I.

UNIT III Antibiotics, sulphonamides and analgesics (12 Hours)

UNIT IV Antiseptics, Disinfectants and anaesthetics (12 Hours)
Antiseptics and disinfectants- definition and distinction- phenol coefficient, phenol as disinfectant, chlorhexidine, formaldehyde and nitrofurazone-uses.
Anaesthetics- definition- classification- local and general- volatile, nitrous oxide,ether, chloroform, cyclopropane- uses and disadvantages- nonvolatile- intravenous thiopental sodium, methohexitone, propanidid, local anaesthetics- cocaine and benzocaine- uses and disadvantages.
UNITV  
(12Hours)

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


Antineoplastic drugs- Causes of cancer, Antineoplastic agents, cytotoxic. anti-metabolites, plant products, hormones- one example and uses

AIDS-causes, prevention and control. Indian medicinal plants and uses- tulasi, kilanelli, mango, semparuthi, adadodai and thouthuvalai.

TEXT BOOKS

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

OBJECTIVES

1. To gain the knowledge of Characteristics of water, Analysis of water, Treatment of industrial water and Treatment plants

Unit I Introduction (12Hours)
Sources of Water; Physical and chemical characteristics of water; Water analysis; Potable water – WTO standard: uses of water

Unit II Water Pollution (12Hours)
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 Waste water Treatment (12Hours)
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 (12Hours)
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 (12Hours)
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.
TEXT BOOKS

REFERENCE BOOKS
CHEMISTRY IN HEALTH SCIENCE

OBJECTIVE

- To acquire knowledge about good physique fitness, skin care, hair care, clinical chemistry and diagnostic tools.

UNIT I

HEALTH MAINTENANCE (7 hours)


UNIT II

SKIN CARE AND HAIR CARE (8 hours)

Skin Care - Structure and functions of skin - Skin care products - raw materials - its characterisation and formulation. Herbal extracts and essential oils in skin care.

Hair Care – Structure - Types and functions - characterisation and formulation of shampoo and anti-dandruff shampoos - classification and formulation of hair colorants.

UNIT III

CLINICAL CHEMISTRY (8 hours)

Determination of sugar in serum and urine - detection of cholesterol - estimation of red cell count, Na, K, Ca, bicarbonates and phosphates in serum and their significance. Reason for abnormal value of sugar, cholesterol, urea, creatinine - control measures.

UNIT IV

DIAGNOSTIC TOOLS (7 hours)

Principle and uses of Microscopy, Endoscopy, Differential cell counter, X-Ray, ECG, Scanning, Ultrasound, Echo, CT and MRI.
References.


4. Rammik Sood, Medical Laboratory Technology: Methods and Interpretation, 3\textsuperscript{rd} Edn, Jaypee Brothers medical publishers, 1995.


M.Sc. CHEMISTRY
SEMESTER - III
CORE VI - ORGANIC CHEMISTRY – III
(75 Hours)

OBJECTIVES

1. To learn the mechanism of addition to Carbon - Carbon and Carbon - Hetero atom multiple bonds.
2. To learn the mechanism of molecular rearrangements.
3. To study the mechanism of oxidation and reduction reactions.
4. To study the structural elucidation of steroids.
5. To learn the uses of reagents in organic synthesis.

Unit I Addition to carbon-carbon and carbon-hetero multiple bonds (15 Hours)

Electrophilic addition to carbon-carbon multiple bonds- Hydroboration, Addition of NOCl to olefins, Michael addition, 1,3-dipolar addition, carbene and their addition and Diel's-Alder reaction

Nucleophilic addition to C=O bond-Mechanism and application of Mannich, Stobbe, Darzenglycidic ester condensation, Benzoin condensation, Peterson olefination, Wittig, Wittig- Horner Thrope, Ritter and Prins reactions

Unit II Molecular rearrangements (15 Hours)

Study of the following rearrangements with mechanism Wagner-Meerwin, Demjanov, Dienone-phenol, Favorski, Baeyer-Villiger, Wolff, Stevens, Von-Richter, Beckmann, Smiles, Neber and Hofmann- Martius

Unit III Oxidation and reduction reactions (15 Hours)

Study of the following reactions with mechanism- Oxidation of alcohols by CrO₃, K₂Cr₂O₇, CrO₂Cl₂, DCC, KMnO₄, MnO₂, DMSO alone, DMSO in combination with DCC, Acetic anhydride and oxalyl chloride, Oxidation of aryl methane, oxidation of methylene group alpha to carbonyl, allylic oxidation of olefins, oxidative cleavage of glycols, ozonolysis, hydroxylation of olefins -OsO₄, KMnO₄, Prevost and Woodward dihydroxylation.

Catalytic hydrogenation, Homogenous and heterogenous catalytic reductions, Dissolving metal reductions including Birch reduction, Bouveault-Blanc reduction, Metal hydride reductions- NaBH₄, LiAlH₄, LTBA, BH₃, Bu₃SnH and Sodium cyano borohydride.
Unit IV Steroids and steroid hormones (15 Hours)
Structural elucidation of cholesterol, ergosterol, oesterone, testosterone and progesterone. Conversion of cholesterol into oesterone, testosterone and progesterone. Artificial hormones- stilbestrol and hexoestrol.

Unit V Reagent in organic chemistry (15 Hours)
Reagents and their uses – LDA, DCC, DDQ, DBU, DIBAL, 9-BBN, NBS, 1,3- dithiane (umpolug), trimethylsilylchloride, trimethylsilyliodide, Baker's yeast, Gilman's reagent and Wilkinson's catalyst

TEXT BOOKS

REFERENCE BOOKS
M.Sc. CHEMISTRY CORE PAPER-VII  
SEMESTER – III INORGANIC CHEMISTRY – II (75 Hours)  
(SOLID STATE &COORDINATION CHEMISTRY)

OBJECTIVES
1. To develop the basic concepts of solid state.
2. To understand the different studies used in solid state chemistry.
3. To learn the various theories of coordination compounds
4. To study the various reaction of coordination compounds

Unit I Solid State - I (15 Hours)
Electrical properties of solids: Conductors and non-conductors, Conductivity in pure metals and alloys– superconductors –Occurrence of superconductivity- BCS theory-Type-I and Type-II and High temperature (HT) superconductors- Preparation of HT superconductors-critical temperature– persistent currents-Meissner effect.
Magnetic properties – dia, para, ferro, antiferro and ferrimagnetism; hysterisis; Optical properties –solid – state lasers and Inorganic phosphors. 
Reactions in solid state and phase transitions – diffusion coefficient, diffusion mechanism, vacancy and interstitial diffusions, formation of spinels; solid solutions, order-disorder transformations and super structure.

Unit II Solid State–II
Types of solids-close packing of atoms and ions-bcc, fcc and hcp, voids and their types- Goldschmidt radius ratio-derivation-its influence on structures.
Structures of NaCl, NiAs, CdI₂ ,Pevoskite, rutile, fluorite and antifluorite-zinc blende and wurtzite.
Defects in solids- Point defects, line defects and surface defects; Dislocations-Non-stoichiometric compounds; Use of X-ray powder data in identifying inorganic crystalline solids.

Unit III Theories of coordination compounds (15 Hours)
VB theory-CFT-Splitting of d orbital in ligand field and different symmetries-CFSE-Factors affecting the magnitude of 10 DQ-Evidence for crystal field stabilization (Structural and thermodynamic effects) - Spectrochemical series – Site selection in spinels - tetragonal distortion from octahedral symmetry-John Teller distortion - Nephelauxetic effect-Mo theory octahedral-tetrahedral and Square planar complexes-pi bonding and molecular orbital theory- experimental evidence for pi bonding.

UNIT IV Stability andStereochemicalAspects (15Hours)
Stability of complexes - thermodynamic aspects of complex formation, factors affecting stability, stability correlations, statistical and chelate effects; Determination of stability constants - polarographic, photometric and potentiometric methods.
Stereochemical aspects - stereoisomerism in inorganic complexes,isomerism arising out of ligand distribution and ligand conformation,chirality.
Macroyclic ligand types - porphyrins, corins, Schiff bases, crown ethers, cryptates and catenands. (simple complexes).
UNIT V Reaction Mechanism of transition metal complexes (15Hours)

TEXT BOOKS

REFERENCE BOOKS
7. R. A. Alberty and Silbey : Solid State Chemistry
OBJECTIVES

1. To impart knowledge on theoretical electrochemistry and applications of electrochemical cells
2. To impart knowledge on photochemistry
3. To understand the concepts and principles of quantum chemistry and spectroscopy

UNIT I Electrochemistry – I


UNIT II Electrochemistry – II


UNIT III Photochemistry


UNIT IV Quantum Chemistry III

UNIT V Spectroscopy (15 Hours)

TEXT BOOKS
5. N.J. Turro, Modern molecular photochemistry, Benjamin / Cummings, Menlo park, California (1978)

REFERENCE BOOKS
M.Sc. CHEMISTRY

SEMESTER - III ELECTIVE III

PAPER I - EXPERIMENTAL METHODS IN CHEMISTRY (75 Hours)

OBJECTIVES

1. To study in detail the fundamental aspects of various experimental and instrumental methods in chemistry
2. To understand the principles and instrumentation of destructive and non-destructive techniques
3. 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 (75 Hours)

OBJECTIVES

1. To understand the basic concepts of electroanalytical chemistry
2. 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 – RandlesSevrik 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 Hours)

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

Dynamic electrode techniques, Principle, instrumentation and applications of RDE and RRDE techniques.
TEXT BOOKS


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

REFERENCE BOOKS


OBJECTIVES

1. To understand the bonding in organometallic complexes and metal carbonyls.
2. To learn the synthesis, bonding and reactions of organometallic complexes.
3. To understand the importance of catalysis and applications.
4. To understand the basics of Supramolecular chemistry and photochemistry and its applications.
5. To understand the basics behind the origin and principle of electronic spectra.

UNIT I Bonding in Organometallic Complexes and metalcarbonyls (15 Hours)


UNIT II Organometallic and Organometallic Sandwichcomplexes (15 Hours)


UNIT III Catalysis (15 Hours)

Hydrogenation of olefins (Wilkinson’s catalyst)- hydroformylation of olefins using Cobalt or Rhodium catalysts (oxo process)- Oxidation of olefins to aldehydes and ketones (Wacker process); polymerization (Zeigler- Natta catalyst)- Cyclooligomerization of acetylene using Nickel catalyst (Reppe’s catalyst)- polymer bound catalysts - metalloocene and stereospecific polymerisation of 1-alkenes.
UNIT IV Supramolecular Chemistry and PhotoChemistry  
(15 Hours)

Supramolecular chemistry-Introduction, supermolecules, supramolecules, supramolecular interactions (ion-ion, ion-dipole, H-bonding, cation-pi, anion-pi, pi-pi and Vanderwalls interactions), Ionophore and molecular receptors. Structure, reactions and applications of crown ethers, beta-cyclodextrin, clays, zeolite and dentrimers.

Photo chemistry- Photo substitution, Photo redox and isomerisation processes, Photo chemistry of d3 and d6 complexes and Applications of metal complexes in solar energy conversion.

UNIT V Electronic Spectra of Complexes  
(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.

TEXT BOOKS

**REFERENCE BOOKS**

5. Accounts of Chemical Research, Volume 28, No.3, 1995-(cyclodextrins)
OBJECTIVES

1. To understand the basic concepts of the drugs.
2. To study the classification, synthesis and mode of action of various types of drugs.

UNIT I Basic Concepts of Drugs (15 Hours)
Drug design- analogues and pro- analogues, factors governing drug design, rational approach, method of variation and tailoring of drugs. Classification of drugs, mechanism of action of drugs, metabolism of drugs, absorption of drugs, factors affecting adsorption of drugs and SAR relationships.

UNIT II Drugs Acting on CNS (15 Hours)

UNIT III Drugs Affecting the Cardiovascular System (15 Hours)

UNIT IV Drugs Affecting the Harmonal System and Immune System (15 Hours)
Histamine, Classification, SAR amongst H1-receptor blockers, prevention of histamine release, synthesis and mode of action of Diphenhydramine hydrochloride and Promethazine hydrochloride. Antiulcers-Histamine H2 Receptor Antagonists, SAR, synthesis and Characteristic features of Cimetidine and Ranitidine.
UNIT V Chemotherapeutic Agents (15 Hours)

Antibiotics- Classification, synthesis and mode of action of Penicillins, Chloramphenicol and Azithromycin.

TEXT BOOKS

7. Chatwal, Medicinal Chemistry.

REFERENCE BOOKS

M.Sc. CHEMISTRY CORE PRACTICAL - IV
ORGANIC CHEMISTRY PRACTICAL – II

OBJECTIVES

To develop analytical skill in Estimation of organic compounds, Preparation of organic compounds involving two stages, Extraction of natural products and Separation of mixture of organic compounds using Chromatographic technique.

I. Organic Estimation
1. Phenol
2. Aniline
3. MethylKetone
4. Glucose
5. Iodine value of anoil

II. Organic Preparation involving Two stages
1. Sym-tribromobenzene from aniline.
2. m- Nitrobenzoic acid from methylbenzoate.
3. para – Nitroaniline from acetanilide.
4. Benzanilide from benzophenone.
5. Aspirin from methyl salicylate
6. Anthraquinone from phthalicanhydride.

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

IV Chromatographic Separations
2. Thin layer Chromatography: separation of a mixture of ortho and para –nitroanilines.
REFERENCE BOOKS


M.Sc. CHEMISTRY SEMESTER - IV
CORE PRACTICAL - V INORGANIC CHEMISTRY PRACTICAL – II

OBJECTIVES
To develop analytical skill in Quantitative analysis of complex materials, Analysis of Ores and Alloys and Preparation of 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 Preparation of the following
1. Sodium hexanitrocobaltate (III)
2. Sodium Trisoxalatoferrate(III)
3. Prussian blue Fe₄[Fe(CN)₆]₃
4. Bis (Actylacetanato) Copper(II)
5. Hexamminecobalt (III)chloride
6. Hexamminenickel (II)chloride

REFERENCE BOOKS
OBJECTIVE

1) To perform experiments in viscosity, surface tension, potentiometry and chemical kinetics.

List of Experiments

1. **Viscosity** Variation of viscosity of liquids with temperature
2. 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.
3. Study the surface tension-concentration relationship of solutions (Gibb’s equation)
4. **Electromotive Force**
5. Determination of Standard Potentials (Cu, Ag &Zn)
6. Evaluation of Thermodynamic Quantities from EMF data (Daniel Cell)
7. Determination of PH values using Quinhydrone electrodes
8. Determination of PKa values using Quinhydrone electrodes
9. Determination of activity coefficient an electrolyte at different molalities by emf measurements.
10. Determination of dissociation constant of acetic acid by titrating it with sodium hydroxide using quinhydrone as an indicator electrode and calomel as a reference electrode.
11. Determination of the composition and instability constant of the complex.
12. Determination of solubility product of sparingly soluble salt by (Concentration cell method and EMF method)

**Potentiometric Titrations**

i) Titration of mixture of acids against strong base
ii) Titration of Ferrous ammonium sulphate against potassium permanganate.
iii) Titration of mixture of halides Vs AgNO₃
Chemical Kinetics

1. Determination of rate constant and order of reaction between potassium persulphate and potassium iodide and determine the temperature coefficient and energy of activation of the reaction.

2. Study the primary salt effect on the kinetics of ionic reactions and test the bronsted relationship (iodide ion is oxidised by persulphate ion)

3. Polarimetry Study the inversion of cane sugar in presence of acid using polarimeter

*From the list of above experiments a minimum of 15 experiments to be performed.

REFERENCE BOOKS

3. Practical Physical Chemistry, B. Viswanathan, P.S.Raghavan