THIAGARAJAR COLLEGE MADURAI - 625009
(An Autonomous Institution, affiliated to Madurai Kamaraj University)
(Re-Accredited with ‘A’ Grade by NAAC)
Department of Chemistry

B.Sc., Chemistry
(Aided & SF)

M.Sc., Chemistry

M.Sc., Chemistry
(SPL -SF)

M.Phil Chemistry
THIAGARAJAR COLLEGE, MADURAI- 9  
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)
BACHELOR OF CHEMISTRY

BACHELOR OF CHEMISTRY
Semester – I

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AECC : Ability Enhancement Compulsory Course.
SEC : Skill Enhancement Course
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : B.Sc. Chemistry (Core-1)  Int. Marks : 25
Class : I Year  Ext. Marks : 75
Semester : I  Max. Marks : 100
Sub. Code : MC11  Hours/Week : 3
Title of the Paper : Fundamental Concepts in Organic Chemistry  Credits : 3

COURSE OUTCOMES
On the successful completion of the course, students will be able to
• Remember nomenclature, structure and shape of organic molecules.
• Understand the reaction mechanism, isomerism and stereochemistry of organic molecules.
• Gain the knowledge of purification of organic compounds.

UNIT-I: 11 Hrs
IUPAC NOMENCLATURE, STRUCTURE AND PROPERTIES
Classification and nomenclature of organic compounds – IUPAC systems.
Structure and shape of organic molecules: Hybridization – Definition, sp^3 hybridization of carbon (methane) – sp^2 hybridization in alkenes (ethene) and sp hybridization in alkynes (ethyne).
Reactive Intermediates: Carbocations, Carbanions, free radicals, carbenes and nitrenes (Structure and stability).

UNIT-II 7 Hrs
REACTION MECHANISM AND ISOMERISM
Cleavage of Bonds: Homolysis and Heterolysis.
Types of reagents: Electrophilic and Nucleophilic reagents – Definition and examples.
Types of organic reactions (one example for each reaction; mechanism not required) – Energy profile of organic reactions.

UNIT-III 8 Hrs
ALKANES AND CYCLOALKANES
Alkanes: Preparation (Catalytic hydrogenation, from alkyl halide, By Wurtz reaction, By Corey-House synthesis), Physical and chemical properties (free radical halogenations reaction).
Cycloalkanes: Definition, nomenclature, symbols of cycloalkanes
Stability: Baeyer’s strain theory and its limitations, Sache-Mohr theory.
Conformations of cyclohexane.
UNIT-IV

STEREOCHEMISTRY

Conformations of ethane and butane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds. Threo and erythro; D and L; cis – trans nomenclature; CIP Rules: R/ S (for only one chiral carbon atoms) and E / Z Nomenclature (for ethene).

UNIT-V

PURIFICATION TECHNIQUES


Text books


Reference books


Course designers

1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi
Course: B.Sc Chemistry (Core 2)  
Int. Marks: 25  
Class: I Year  
Ext. Marks: 75  
Semester: I  
Max. Marks: 100  
Sub. Code: MC 12  
Hours/Week: 3  
Credit: 3  
Title of the Paper: Fundamental Concepts in Inorganic and Physical Chemistry

Course Outcomes:  
On the successful completion of the course, students will be able to  
- Understand the basic structure of atoms and periodicity of elements.  
- Know the various processes involved in extraction of metals from its ore.  
- Understand the physical behaviour of gases and liquids.

Unit I: Atomic Structure  
(9 hrs)  

Unit II: Periodicity and Periodic properties  
(9 hrs)  
Periodic law and Cause of periodicity. Division of elements in to s, p, d and f blocks.  

Unit III: Metallurgical Processes  
(9 hrs)  
Definition for minerals and ores - ore dressing – gravity separation - froth flotation- magnetic separation - chemical separation- calcination and roasting- Thermodynamics of reduction processes-Ellinghem diagram.  

Unit IV: States of Matter (Gas and Liquid)  
(9 hrs)  
Gaseous State: Postulates and derivation of the kinetic gas equation - Kinds of velocities - mean, RMS, most probable velocities (definition only) – Collision frequency – mean free path - Deviation of real gas from ideal behaviour- Derivation of van der Waal’s equation.  
Liquid State: Physical properties of liquids – Vapour pressure – surface tension – coefficient of viscosity – Effect of temperature and pressure on viscosity – concentration terms – molarity (M), Normality (N), molality (m), formality, mole fraction, percentage concentration.
Unit V: Colligative Properties of Dilute Solution (9 hrs)

**Colligative Properties**: Relative lowering of vapour pressure – elevation of boiling point – depression in freezing point – osmotic pressure – Applications in calculating molar masses of normal solutes in solution. **Dilute Solution**: Lowering of vapour pressure – Raoult’s and Henry’s Law and their applications.

**Text Books**:  

**Reference Books**:  

**Course designers**:  
1. Dr. D.S. Bhuvaneshwari  
2. Dr. T. Arumuganathan  
3. Dr. K. Selvakumar
Analysis of Organic compounds

1. Aromatic Organic Compounds like mono and dicarboxylic acids.
2. Aromatic primary and secondary amines.
3. Aromatic amides.
4. Aromatic aldehyde and ketones.
5. Phenols and naphthols.
6. Chloro and nitro aromatic compounds.
7. Aliphatic diamides.

Course designers
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi
Course: B.Sc Chemistry (Core 3)  
Int. Marks: 25

Class: I Year  
Ext. Marks: 75

Semester: II  
Max. Marks: 100

Sub. Code: MC21  
Hours/Week: 3

Title of the Paper: **Inorganic Chemistry – I**  
Credit: 3

Course Outcomes:

On the successful completion of the course, students will be able to

- Identify the various types of bonds.
- Understand the concept of hybridisation.
- Know the characteristics of s-block, boron and carbon group elements.

**Unit I: Chemical Bonding**  
(9 hrs)

Chemical bond - definition, types of chemical bonds.

Ionic or electrovalent bond - Definition, Illustration of the formation of ionic bond (Examples: NaCl, MgO, CaF₂, Al₂O₃ only), Condition for the formation of ionic compounds, Born Haber cycle.

Covalent bond: Definition, types of covalent bond (single, double and triple), Illustration of the formation of covalent bond (Example: HF, H₂O, NH₃, O₂, N₂ only), factors favouring the formation of covalent compounds.

Coordinate bond: Definition, Illustration of the formation of coordinate bond (Example: H₂O₂, SO₂, CO, NH₄⁺, Al₂Cl₆ only), comparison between ionic, covalent and coordinate bond.

Hydrogen bond: Definition, properties, types and significance of hydrogen bonding.

**Unit II : Hybridization and Shape of Covalent Molecules**  
(9 hrs)

Hybridization –concept-VB theory-sp,sp²,sp³spd,sp³d². VSEPR theory-Geometry of SnCl₂ NH₃,H₂O. ClF₃,IF₅. Formation of molecular orbitals from atomic orbitals.

Molecular Orbital Theory- Homonuclear (H₂, Li₂, N₂, O₂) and Heteronuclear (CO and NO) diatomic molecules.

**Unit III:-Block Elements**  
(9 hrs)

General characteristics - anomalous behaviour of lithium and beryllium - diagonal relationships of lithium with magnesium and beryllium with aluminium.

Preparation, properties and uses of lithium hydride, sodium peroxide, potassium iodide, BeO, BeCl₂, calcium carbide, CaCl₂, super phosphate of lime, Plaster of Paris and lithopone- **Biological importance.**
Unit IV: p- Block Elements (Boron group)  

Unit V : p- Block Elements (Carbon group)  
Group 14 (carbon group): catenation and heterocatenation, allotropy of carbon-Structure of diamond, graphite and fullerenes; Metal carbides, Applications of carbides in industry.

Properties and structure of Silicates (ortho-, pyro-, cyclic-, chain-, sheet-, three dimensional silicates)- oxides and chlorides of carbon(CO, CO₂, COCl₂, CCl₄), SiCl₄, bonding in (SiH₃)₃N, Pigments of Lead.

Text Books:  

Reference Books:  

Course designers  
1. Dr. A. Suganthi  
2. Dr. A. Elangovan  
3. Dr. D.S. Bhuvaneswari  
4. Dr. K. Selvakumar
Course: B.Sc Chemistry (Core 4)  
Class: I Year  
Semester: II  
Sub. Code: MC 22  
Title of the paper: Physical Chemistry – I

Course Outcomes:
On the successful completion of the course, students will be able to
- Understand the basic concepts of Nuclear and polymer chemistry in detail
- Realize the function and types of catalyst
- Analyze physical properties of molecules like distribution, polarization, magnetism etc.

UNIT I  
NUCLEAR CHEMISTRY: Composition of the nucleus - Nuclear forces, Mass defect - ‘Binding energy – Binding energy per nucleon (Problems related to this) Nuclear stability and Binding energy.


UNIT II  
DISTRIBUTION LAW  
Nernst Distribution law - thermodynamic derivation – limitations, association of solute in one of the solvent, dissociation of solute in one of the solvent, solute enters into chemical combination with one of the solvent - Applications of Nernst distribution law

UNIT III  
CATALYSIS: Definition- different types of catalysts – homogenous and heterogeneous catalysis, acid-base catalysis, enzyme catalysis- Michaelis-Menton mechanism, auto catalysis- catalytic poisoning- promoters.

UNIT IV  
MOLECULAR PROPERTIES AND STRUCTURE  
Electrical properties of molecules - polarization of a molecule in an electric field, Derivation of Clausius - Mosotti equation, Dipole moments and molecular structure, Magnetic properties of molecules - Magnetic permeability - Magnetic susceptibility - Measurement of magnetic susceptibility, Diamagnetism, Paramagnetism, Ferro magnetism and Anti-Ferromagnetism.
UNIT V
POLYMER CHEMISTRY:
Classification of polymers – Functionality – Tacticity, addition and condensation polymerization, Thermoplastic resin and thermosetting resin, number average and weight average molecular weights, Moulding of polymers – injection and compression.

Text Books

Reference Books

Course Designer:
1. Dr. R. Sayee Kannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan
Course Outcomes:

On the successful completion of the course, students will be able to
1. Analyse simple salts containing one acid and one basic radical.

Analysis of simple salts

Acid radicals:
Simple: Nitrate, Sulphate, Bromide, Iodide and Carbonate
Interfering: Phosphate, Oxalate, Borate, tartarate and fluoride

Basic Radicals:
Lead, Copper, Cadmium, Iron, Nickel, Zinc, Calcium, Barium, Strantium, Magnesium, Ammonium.

Internal Marks = 40
External marks = 60
Total Marks = 100

Internal Marks Distribution:

Acid radical = 15
Basic radical = 15
Procedure = 05
Record = 05

Total = 40

Course Designers
1. Dr. A. Elangovan
2. Dr.D.S.Bhuvaneshwari
Course : B.Sc. Chemistry Int. Marks : 15
Class : I Ext. Marks : 35
Semester : II Max. Marks : 50
Sub.Code : MCAEC21 Hours/Week : 2
Title of the Paper: **Personality Development** Credits : 2

**Course Outcomes**
On the successful completion of the course, students will be able to

- understand the cause of a problem and way to solve it
- be acquainted with different and difficult situations

**Unit I**
Life skill strategies- Effective communication, Creative thinking, Decision making, Goal setting, Problem solving, Resume writing.

**Unit II**
Attitude, Interpersonal Skills, self awareness, SWOT, Emotional Intelligence, Leadership development- Team building, Time, Stress and Conflict Management.

**Text books**
1. N.Chockan 2011 Learn to understand others, Prodigy books, Chennai

**Reference books**
2. Sean Convey 1998. The 7 habits of highly effective teens. Fireside New York, USA.

Course designer
Dr. Rm. Murugappan
Course Outcomes:
On the successful completion of the course, students will be able to
- Study the characteristics of nitrogen and oxygen group elements
- Learn the concepts and strengths of acids and bases
- Be Aware of Lab safety and to learn sources and eradication of errors.

Unit I: p-Block elements (Nitrogen group) (9 hrs)
Group 15 (nitrogen group): General Characteristics - difference between nitrogen and the rest of the family members. Preparation, properties, structure and uses of hydrazine, hydrazoic acid hydroxyl amine. Preparation and structure of ammonia, dinitrogen trioxide, dinitrogen pentoxide, nitrogen dioxide, nitrous oxide, nitric acid, phosphinic acid, phosphonic acid, hypo phosphorus acid, ortho, pyro and meta phosphoric acid – oxides and sulphides of phosphorus - Allotropy of phosphorus, Arsenic, Antimony and Bismuth. Preparation and uses of sodium bismuthate, As$_2$O$_3$, Scheele’s green, tartaremetric. Preparation and uses of Urea, triple superphosphate, potassium nitrate.

Unit II: p-Block elements (Oxygen group) (9 hrs)

Unit III: Halogens (9 hrs)
Group 17 (halogens): General characteristics, comparison of oxidizing action of halogens. Nomenclature and structure of oxy acids of halogens. Acid strength of HX - Preparation, properties and structure of Interhalogen and Psuedohalogens compounds: xenon hexafluoride, xenon oxyfluoride and xenon trioxide, CIF, ICI; ClF$_3$, BrF$_3$; ClF$_5$, BrF$_5$, IF$_5$, IF$_7$, HClO$_4$, I$_2$O$_5$, Fluorocarbons- structure and properties. Isolation of noble gases from the atmosphere - Uses of noble gases.

Unit IV: Acids and Bases (9 hrs)
Unit V: Laboratory Safety and Error Analysis

(9 hrs)

i. Laboratory Safety
Storage and handling of corrosive, toxic and poisonous chemicals—simple first aid procedure for acid and alkali in eye, acid and alkali burns, heat burns and cut by glasses.

ii. Error Analysis
Accuracy, precision, classification of errors, minimization of errors, significant figures, mean and standard deviation—method of least squares—student Q test.

Text Books:


Reference Books:


Course designers
1. Dr. A. Suganthis
2. Dr. A. Elangovan
3. Dr. D.S. Bhuvaneswari
4. Dr. K. Selvakumar
### Course Details

<table>
<thead>
<tr>
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<th>Int. Marks</th>
<th>Class</th>
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<td>25</td>
<td>II Year</td>
<td>75</td>
<td>III</td>
<td>100</td>
<td>MC32</td>
<td>3</td>
<td>Organic Chemistry--I</td>
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### COURSE OUTCOMES

On the successful completion of the course, students will be able to:

- Understand the chemistry of unsaturated hydrocarbons, alkyl halides, alcohols, ethers, thioethers, epoxides, aldehydes & ketones.
- Remember the naming reactions, and concepts of addition and elimination reactions.
- Analyze the chemical reactions.

### UNIT-I

**9 hrs**

**UNSATURATED HYDROCARBONS**

- **Alkenes**: Methods of preparation (Catalytic hydrogenation, Birch reduction, Saytzeffs and Hofmann’s rule) – addition reactions: Markonikov and anti-Markonikov mechanism of addition to conjugated dienes.
- **Alkynes**: Preparation and Acidity of alkynes – chemical reaction (Nucleophilic and electrophilic addition reactions).

### UNIT-II

**9 hrs**

**ALKYL HALIDES**

Haloalkanes: Introduction – Methods of Preparation (from alkanes, alkenes, alcohols, Finkelstein reaction). Chemical properties: Substitution reactions (SN1, SN2 and SNi mechanism) – Elimination reactions (E1 and E2 mechanism).

Unsaturated alkyl halides: Vinyl and allyl chlorides

### UNIT-III

**9 hrs**

**ALCOHOLS**

Monohydric alcohols: Classification (1°, 2° and 3°) – Ethanol: preparation (from alkenes, alkanes, Grignard reagent) – Physical properties, acidic nature of alcohols, chemical reactions and uses.

Dihydric alcohol: Ethylene glycol: Preparation, chemical properties and uses.

Trihydric alcohol: Glycerol: Preparation, chemical properties and uses.

### UNIT-IV

**9 hrs**

**ETHERS, THIOETHER AND EPOXIDES**


Epoxides: Synthesis – reactions – acid and base-catalyzed ring opening of epoxides – (Symmetrical epoxides only).

### UNIT-V

**9 hrs**

**ALDEHYDES AND KETONES**

General methods of preparation of carbonyl compounds (by oxidation reactions, By heating calcium salts of carboxylic acids) – Reactivity of carbonyl compounds: Nucleophilic addition reactions (Reaction with HCN, Wittigs reactivity, Reformsky reaction, Baeyer-Villiger rearrangement, Reactions with NH3 and their derivatives) – Oxidation reactions, Reduction
reactions (Meerwein-Ponndorf-Verley reduction, Wolf-Kishner reduction, Clemmensen reduction), Aldol Condensation reactions – Cannizaro reaction – Distinguishing aldehyde and ketones – Chemistry of acrolein and crotonaldehyde.

Text Book


Reference Books


Course designers

1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi
Course: B.Sc. Chemistry (Core Lab-III)  
Class: II B.Sc Chemistry  
Semester: III  
Sub. Code: MCL31  
Title of the Paper: Inorganic Volumetric Analysis  

**Course Outcomes:**
On the successful completion of the course, students will be able to
1. Estimate the amount of metal ion present in the given solution
2. Prepare the inorganic complexes.

**VOLUMETRIC ANALYSIS**

**A. ACIDIMETRY - ALKALIMETRY**
1. Na$_2$CO$_3$ (Std)-HCl - Na$_2$CO$_3$
2. Na$_2$CO$_3$ (Std)-HCl - NaOH
3. NaOH-Oxalic acid - (Std)-NaOH

**B. PERMANGANIMETRY**
1. KMnO$_4$- Fe$^{2+}$- KMnO$_4$
2. Oxalic acid - KMnO$_4$- Oxalic acid
3. KMnO$_4$- Oxalic acid - KMnO$_4$

**C. DICROMETRY**
1. Fe$^{2+}$-K$_2$Cr$_2$O$_7$-FAS
2. K$_2$Cr$_2$O$_7$ - Fe$^{2+}$- K$_2$Cr$_2$O$_7$

**D. IODOMETRY**
1. K$_2$Cr$_2$O$_7$-Thio- K$_2$Cr$_2$O$_7$
2. CuSO$_4$- Thio- K$_2$Cr$_2$O$_7$

*(Any Eight estimations from the above mentioned volumetric estimations)*

**Course Designers**
1. Dr.A. Elangovan
2. Dr.D.S.Bhuvaneshwari
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : B.Sc./B.A (Non Major elective -I) Int. Marks : 15
Class : II B.A/B.Sc Ext. Marks : 35
Semester : III Max. Marks : 50
Sub. Code : MCNME31 Hours/Week : 2
Title of the Paper : Chemistry in Day-To-Day Life Credit : 2

Course Outcomes:
On the successful completion of the course, students will be able to
• Remember the various ingredients present in the consumer products.
• Prepare all these products on their own.

Unit I: Cosmetics
Dental Preparations: Tooth pastes- ingredients, their characteristics and functions.
Mouth washes (Composition only). Soap- Hard soap, Soft soap- types. Face powder
(Composition only), Deodorants and antiperspirants-Distinction between astringents and
deodorants, deodorant powders (Composition only), Hair care preparations: shampoo
different types and formulations, hair conditioners and setting lotions. Hair colourants: Hair
lighteners and bleaches, Temporary colourant, Semi-permanent colourants, permanent
colourants – vegetable dyes. Moisturizing creams, Perfumes, Lip sticks, shaving creams, after
shave preparations.

Unit II: Consumer Products
Composition and Uses of Safety Matches, Agarbattis, Naphthalene Balls, Wax
Candles, shoe polish, Gum, Ink, Chalk crayons.

Text Books:
   Simons, J.V. Chemistry and the beauty business.

Reference Books:
1. R.V. Shreve, Industrial Chemical Process, Tata McGraw Hill publishing company,
   2005, Mumbai.
   Meerut.

Course Designer
Dr. D. Bhuvaneshwari
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : B.Sc. Chemistry (Core 7)                   Int. Marks : 25
Class   : II Year                              Ext. Marks : 75
Semester : IV                                Max. Marks : 100
Sub. Code : MC41                               Hours/Week : 3
Title of the Paper : Organic Chemistry – II     Credit : 3

COURSE OUTCOMES
On the successful completion of the course, students will be able to
- Understand the chemistry of aliphatic carboxylic acid and their derivatives, hydroxyl acids, aliphatic nitrogen compounds,
- Apply the organometallic reagents in organic functional group conversion.
- Remember the chemistry of carbohydrates.

UNIT – I
CARBOXYLIC ACID AND THEIR DERIVATIVES
9 hrs
Unsaturated monocarboxylic acids: Preparation and chemical reactions of acrylic and crotonic acids.

UNIT – II
ALDEHYDIC AND KETONIC ACIDS
9 hrs
Preparation and properties of glyoxalic acids, pyruvic and laevulic acid – Preparation and synthetic importance of acetoacetic ester.
Dicarboxylic acids: Preparation and properties of Oxalic acid, malonic acid, succinic acid, glutaric acids – reactions of reactive methylene group.
Unsaturated dicarboxylic acid: Prparation and properties of fumaric and maleic acid

UNIT – III
ALIPHATIC NITROGEN COMPOUNDS
9 hrs
Nitroalkanes: Preparation, properties, and structure of nitroalkanes – chemical reactions of nitroalkanes.
Alkyl cyanides and isocyanides: Preparation and chemical reactions – Distinction between ethylecyanide and ethylisocyanides.
Aliphatic amines: Classification – Nomenclature - General methods of preparation, primary amine preparation (Lossen rearrangement, Hofmann degradation of amides, Curtius reaction) – Properties and reaction - separation of mixture of amines (Hofmann’s method) – Basicity of amines - distinction between primary, secondary and tertiary amine.
Aliphatic diazo compounds: Preparation and properties of diazomethane.
UNIT-IV

ORGANOMETALLIC REAGENTS
9 hrs

Organo magnesium halides: preparation, reactions and synthetic uses of Grignard reagents and its limitations.

Organolithiums: General methods of preparation, reactions, and synthetic applications.

Lithium Dialkylcuprates (Gilman reagent): Preparation and synthetic uses.

Tetra ethyl lead (TEL): preparation, reactions and synthetic uses.

UNIT-V

CARBOHYDRATES
9 hrs


Text Book:


References:


Course designers

1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi
Course : B.Sc Chemistry (Core 8)  
Int. Marks : 25

Class : II year  
Ext. Marks : 75

Semester : IV  
Max. Mars : 100

Sub. Code : MC 42  
Hours/Week : 3

Title of the paper : Physical Chemistry - II  
Credit : 3

Course Outcomes:
On the successful completion of the course, students will be
- Expected to learn the three laws of the thermodynamics and their application
- Understand the basic principles of chemical equilibrium
- Aware of the heat changes accompanying in chemical reactions

UNIT – I  
(9 hrs)
FIRST LAW OF THERMODYNAMICS
Importance of thermodynamics- limitations of thermodynamics-concepts of a system and surrounding, state variable- extensive and intensive properties, state function and their differential (exact and Inexact), different types of processes- Isothermal, Adiabatic, Isobaric, isochoric, reversible, irreversible and cyclic.
Statement, Mathematical expression-enthalpy and energy of a system-Heat capacity at constant P & V-Correlation between Cp and Cv - Joule Thomson effect – inversion temperature.

UNIT – II  
(9 hrs)
SECOND LAW OF THERMODYNAMICS
Need for second law- Different forms of second law, Carnot cycle-efficiency of Carnot engine and entropy a state function, Entropy changes in reversible and irreversible processes, calculation of entropy change of an ideal gas with change in P,V &T-Entropy of mixing, Physical significance of entropy- work function and free energy, variation of free energy change with temperature and pressure- Maxwell's relationships, The Gibbs-Helmholtz equation- Clausius Clapeyron equation- Application of Clausius- Clapeyron equation.

UNIT – III  
(9 hrs)
THIRD LAW OF THERMODYNAMICS
Nernst heat theorem-Statement of third law of thermodynamics, determination of Absolute entropy of solid, liquids & gases, experimental verification of third law, entropy changes in chemical reaction- residual entropy- exceptions to third law-definition of zeroth law of thermodynamics.

UNIT – IV  
(9 hrs)
THERMOCHEMISTRY

UNIT – V  
(9 hrs)
CHEMICAL EQUILIBRIUM
The law of mass action- Thermodynamic treatment of law of mass action, Relationship between $K_p$ and $K_c$, Application of Law of mass action to Homogeneous system- dissociation of PCl$_5$ and N$_2$O$_4$, application of Law of mass action to Heterogeneous system-Calcium carbonate - LeChatlier principle - LeChatlier principle and physical equilibria.
TEXT BOOKS

REFERENCE BOOKS:

Course Designers
1. Dr. R. Sayee Kannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan
Course : B.Sc. Chemistry (core Lab-IV)  
Class : II Year  
Semester : IV  
Sub. Code : MCL-41  
Int. Marks : 40  
Ext. Marks : 60  
Max. Marks : 100  
Hours/Week : 4  
Credit : 2

Title of the Paper : Estimation and Preparation of Organic Compounds

ORGANIC ESTIMATIONS

1. Estimation of Phenol  
2. Estimation of Aniline  
3. Estimation of Glycine  
4. Estimation of Ascorbic acid (Vitamin C)  
5. Estimation of Saponification value of an Oil  
6. Determination of Iodine value

ORGANIC PREPARATIONS

Preparation of the following Organic Compounds:

1. Benzoic acid from Methyl benzoate  
2. Salicylic acid from Methy or ethyl salicylate  
3. Osazone from Glucose  
4. Benzoic acid from Benzaldehyde

(Any three estimations from each of the above mentioned volumetric estimations and also any three preparations)

Course Designers
1. Dr. P. Tharmaraj  
2. Dr. P. Prakash
COURSE OUTCOMES
On the successful completion of the course, students will be able to

- Understand the nature of soil and the fertilizers.
- Gain knowledge on pesticides.

UNIT 1: SOIL AND FERTILIZERS CHEMISTRY


UNIT II: PESTICIDES


Text books:

Reference books

Course Designers
Dr. A. Suganthi
Dr. R.Mahalakshmy
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : B.Sc.Chemistry (SEC-I)  
Class : II BSc Chemistry  
Semester : IV  
Sub. Code : MCSEC41  
Title of the Paper : Dairy Chemistry (option B)

Int. Marks : 15  
Ext. Marks : 35  
Max. Marks : 100  
Hours/Week : 2  
Credit : 2

COURSE OUTCOMES
On the successful completion of the course, students will be able to

• Learn the composition and processing of milk.
• Understand the chemistry of milk products.

UNIT-I: COMPOSITION AND PROCESSING OF MILK

Milk-definition-general composition of milk-constituents of milk-lipids, proteins, carbohydrates, vitamins and minerals-physical properties of milk-colour-odour-acidity-specific gravity-viscosity and conductivity - factors affecting the composition of milk-adulterants, preservative and neutralizer-
Microbiology of milk-destruction of micro-organisms in milk-physico-chemical changes taking place in milk due to processing-boiling pasteurization-types of pasteurization-Bottle, batch and HTST (High Temperature Short Time)-Vacuum pasteurization-Ultra High Temperature Pasteurization.

UNIT – II MAJOR MILK PRODUCTS
Special milk- definition, composition and nutritive value of flavoured milk-vitaminised milk-tonned milk-imitation milk-vegetable toned milk - condensed milk.

Reference book:

Text book:

Course designer:
Dr. A. Suganthi
### COURSE OUTCOMES

On the successful completion of the course, students will be able to

- Analyse the adulterants in food stuffs.
- Find a suitable method to detect the crime.

#### UNIT I: FOOD ADULTERATION (15 hrs)

Contamination of wheat, rice, dhal, milk, butter, etc. With clay, sand, stone, water and toxic chemicals (e.g. Kasseri dhal with mentanil yellow).

Food poisons: natural poisons (alkaloids, nephrotoxins), pesticides (DDT, BHC, Follidol), Chemical poisons (KCN). First aid and Antidotes for poisoned persons.

Heavy metal (Hg, Pb,Cd) Contamination of Sea food. Use of neutron activation analysis in detecting poisoning (e.g.,As in human hair).

#### UNIT II: FORGERY AND COUNTERFEITING (15 hrs)


### Textbooks


### Reference Book


### Course Designers

1. Dr. A. Suganthi
2. Dr. R. Mahalakshmy
Course: B.Sc Chemistry (Core 9)  
Class: III Year  
Semester: V  
Sub. Code: MC51  
Title of the Paper: Inorganic Chemistry - III

Int. Marks: 25  
Ext. Marks: 75  
Max. Marks: 100  
Hours/Week: 6(5L:1T:0P)  
Total hours: 90(75L+15T)  
Credits: 6

Course Outcomes:
On the successful completion of the course, students will be able

- To study the arrangement of atom in solid state and its application elaborately.
- To understand the concept of organometalics and their uses in transition metal catalysts.

Unit-I: SOLID STATE- I  
(15L Hrs + 3T Hrs)


Unit-II: SOLID STATE- II  
(15L Hrs + 3T Hrs)


Unit -III: d-BLOCK ELEMENTS  
(15L Hrs + 3T Hrs)

General characteristics- electronic configuration, metallic character, ionization energy, variable valency, reducing property, colour, magnetic property, non-stoichiometric compounds, catalytic properties and tendency to form complexes. Metallurgy of Au, Ni and Cr. Preparation, properties and uses of potassium permanganate, V$_2$O$_5$, Ni (DMG)$_2$, CrO$_3$, potassium dichromate, potassium ferrocyanide-Nessler’s reagent. Anamalous behaviour of mercury. Alloys of copper and Nickel.

Unit -IV:  
(15L Hrs + 3T Hrs)

A. BIO–INORGANIC CHEMISTRY

Essential and Trace elements in biological systems (Mg, Al, Si, P, Ca, V, Cr, Mn, Fe, Zn) – Structure and functions of Haemoglobin and Chlorophyll.

B. TRANSITION METAL COMPOUNDS AS CATALYSTS

Wilkinson catalyst (hydrogenation of olefins) – Zeigler-natta catalyst (propylene polymerization) – organo palladium catalyst – Walker’s process (oxidation of olefins) – Mechanism of these processes.

C. ORGANOMETALLIC COMPOUNDS

Definition-Types- Alkene complexes—Zeise’s Salt-Structural Features of Zeise’s Salt-Iron- Butadiene Complex-Nomenclature of organometallic compounds, 16- and 18-
electron rule, Ferrocene- structure and Bonding. Mansanto process-Hydroformylation-Mechanism of these processes.

**UNIT -V: f- BLOCK ELEMENTS** (15L Hrs + 3T Hrs)


**Text Books:**

**Referance Books**

**Course designers**
1. Dr. A. Suganthi
2. Dr. A. Elangovan
3. Dr. D.S. Bhuvaneswari
4. Dr. K. Selvakumar
COURSE OUTCOMES
On the successful completion of the course, students will be able to

- Understand the concept of aromaticity and chemical properties of aromatic carbonyl compounds, sulphonic acid and nitrogen containing compounds
- Apply the concepts of organic spectroscopic techniques to analyse the given organic molecules.

UNIT-I
AROMATIC COMPOUNDS AND AROMATIC SUBSTITUTION
Poly Nuclear Hydrocarbons: Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene and Anthracene

UNIT – II
AROMATIC ALDEHYDES AND KETONES
Aldehydes: General methods of preparation, and properties of aromatic aldehydes – benzaldehyde – Mechanism of benzoin condensation – perkin reaction, claisen reaction, Knoevenagel reaction and cannizaro reaction.
Unsaturated aldehyde – cinnamaldehyde
Ketones: Preparation and properties of acetophenone, benzophenone – Houben Hoesch synthesis.
Rearrangement: Mechanism of the following rearrangements: Pinacol – Pinacolone, Hoffmann, Benzilic acid, Claisen, and Fries rearrangement

UNIT – III
Aromatic Sulphonic Acids: Methods of sulphonation – preparation and reaction of benzene sulphonic acid, sulphanilic acid – saccharin, and chloramine – T.
Dicarboxylic acid: phthalic acid and terephalic acid.
UNIT – IV

AROMATIC COMPOUNDS CONTAINING NITROGEN
Nitro benzene – reduction products of nitrobenzene – T.N.T – picric acid - difference between nitro toluenes and phenyl nitromethane.
Diazonium compounds: Diazotization – mechanism - benzenediazoniumchloride – structure and reactions - synthetic applications – Mechanism of diazo coupling reaction.

UNIT – V

ORGANIC SPECTROSCOPY

Text Book

Reference books:

Course designers
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi
THIAGARAJAR COLLEGE, MADURAI- 9  
(Re-Accredited with ‘A’ Grade by NAAC)  
DEPARTMENT OF CHEMISTRY  
(For those who join in 2017 and after)

Course : B.Sc. Chemistry (Core 11)  Int. Marks : 25  
Class : III year  Ext. Marks : 75  
Semester : V  Max. Mars : 100  
Sub. Code : MC 53  Hours/Week : 5  
Title of the paper : Physical Chemistry – III  Credit : 5

Course Outcomes:  
On the successful completion of the course, students will be able to  
- Understand basics of nanoscience and its technological applications  
- Deal with the concepts of phase rule and chemical kinetics  
- Learn about quantum theory and its applications

UNIT – I  
NANO TECHNOLOGY  
(15 hrs)  
Definition of nanoscience, top down and bottom up approach, Sol-gel method, electron microscopes – Scanning electron microscope (SEM) - transmission electron microscope (TEM), application of nano materials – insulation materials, machine tools, phosphors, batteries and solar energy.

UNIT-II  
PHASE RULE  
(15 hrs)  
Statement and thermodynamic derivations, application of phase rule – one component system (Water and Sulphur only) – Two component systems – simple eutectic (Lead – Silver only) – Compound formation – congruent melting point (Zn – Mg only) – Incongruent melting point (Na – K only)

UNIT – III  
CHEMICAL KINETICS  
(15 hrs)  
Rate constant, order and molecularity – Integrated rate expression - I order, II order (reactants same and different) and zero order reaction – derivation, Half life period - zero, I, II order reactions, methods of determining order of the reaction-use of differential rate expression-use of integral rate expression-half-life method- isolation method, Arrhenius equation – significance of energy of activation.

UNIT – IV  
ATOMIC STRUCTURE AND WAVE MECHANICS  
(15 hrs)  
Black body radiation- Quantum theory of radiation -Planck’s theory ( no derivation required) , Bohr’s theory of hydrogen atom – spectrum of hydrogen atom, Derivation of Ritz combination principle, Photoelectric effect-Einstein photoelectric equation, Compton effect, de Broglie’s wave equation, Heisenberg’s uncertainty principle, Hund’s rule and Pauli’s exclusion principle.
UNIT – V
QUANTUM CHEMISTRY
(15 hrs)
Postulates of quantum mechanics, derivation of Schrödinger wave equation, wave function and its significance, probability of finding electrons, operators - differential and integral operators only, application of Schrödinger wave equation - particle in one dimensional box.

Text Books


Reference Books


Course Designers

1. Dr. R. Sayee Kannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : B.Sc. Chemistry (Core Lab-V)                  Int.Marks : 40
Class   : III Year                                   Ext. Marks : 60
Semester: V                                         Max. Marks : 100
Sub. Code: MCL51                                    Hours/Week : 4
Title of the Paper : Inorganic Estimations and Preparations Credit : 2

I. Gravimetric Analysis: (Any TWO)
a) Estimation of lead as lead chromate  
b) Estimation of Nickel as Ni-DMG  
c) Estimation of Magnesium as Magnesium oxinate

III. Preparation: (Any FOUR)
a) Potassium cupricsulphate  
b) Potassium trioxalatoaluminate  
c) Hexathioureaplumbusnitrate  
d) Tetrammine copper(II)sulphate  
e) Ferrous/Ferric oxalate

III. Colorimetry: (Any ONE)
a) Estimation of Iron (III) 
b) Estimation of Copper (II)

IV. Chromatography (Demo only NOT for the Exam)
a) Paper Chromatography: Chromatographic separation of a mixture of Co, Mn, Ni and Zn  
b) Column Chromatography: Chromatographic separation of potassium permanganate and dichromate.

V. UV-visible spectrophotometer (Demo only NOT for the Exam)
Estimation of concentration of an inorganic compound using UV-visible spectrophotometer.

Course Designers
1. Dr. A. Suganthi
2. Dr. D.S. Bhuvaneshwari
Course : B.Sc.Chemistry (Core elective 1)  Int. Marks : 25
Class : III year  Ext. Marks : 75
Semester : V  Max. Marks : 100
Sub. Code : MCME51(G)  Hours/Week : 5
Title of the Paper : Group theory and Spectroscopy (Option A)  Credit : 5

Course Outcomes:
On the successful completion of the course, students will be able to
- Understand the fundamentals and application of group theory in chemistry
- Learn about theory and applications of Microwave, IR and Raman spectroscopy
- Deal with the theory and application of resonance spectroscopy such as NMR and ESR

UNIT – I
GROUP THEORY-1  15 hrs
(i) Introduction - Symmetry elements and symmetry operations - Definition of mathematical group – four cardinal properties of a group – closure, associative, identity and inverse rule – cyclic group – Abelian group (H₂O only) and non-abelian group (NH₃ only) – Group multiplication table- C₂v and C₃v; subgroup – similarity transformation – class of group – Point group – Assignment of point group of simple molecules – H₂O, NH₃, HCl and H₂.
(i) Matrix-introduction - matrix representation of the symmetry operations – idendity (E), Proper axis of rotation (Cₙ), Vertical reflection (σᵥ), Improper axis of rotation (Sₙ) and Inverse (i); Representation definition – reducible and irreducible representation of a group.

UNIT-II
MOLECULAR SPECTROSCOPY  15 hrs
Electromagnetic Spectrum – different regions in electromagnetic spectrum-Molecular spectra-Types of molecular spectra.

UNIT-III
INFRA-RED SPECTROSCOPY  15 hrs
IR spectra - range - theory of IR spectroscopy- selection rule-Instrumentation - diatomic molecule as a harmonic oscillator - Diatomic molecule as anharmonic oscillator - Analysis of IR spectra on the basis of modes of vibrations of CO₂, H₂O - Finger print region and Characteristic frequencies – Overtones- Finger print region.
UNIT-IV
RAMAN SPECTROSCOPY 15 hrs

UNIT-V
RESONANCE SPECTROSCOPY 15 hrs
ESR: ESR introduction – factors affecting the g value- difference between ESR and NMR- basic instrumentation-Hyperfine interactions –Applications of ESR-hydrogen radical and methyl radical.

Text Books:
1. 1. Puri B. R., Sharma L.R. 2003, Physical chemistry, 33rd edition, Vishal Puplications, New Delhi,
   India.

Reference Books:

Course designer:
1. Dr. A. Suganthi
2. Dr. T. Arumuganathan
COURSE OUTCOMES

On the successful completion of the course, students will be able to

- Understand the generation of energy from various types of fuels.
- Know the usage of chemicals in improvement of agricultural crops
- Employ method for purification of water for industry and home
- Identify Pollution occurring from various sources and resulting toxic effects

UNIT-1: Industrial fuels


Liquid fuels: Refining of crude petroleum and uses of fractions. Hydrodesulphurisation. Cracking: thermal and catalytic (fixed bed and fluidised bed catalysis). Octane number. Production and uses of tetraethyl lead, ETBE and MTBE.

Gaseous fuels: Natural gas and gobar gas: production, composition and uses, Gobar electric cell.

UNIT-2: Chemistry and agriculture

Fertilizers: NPK, representation, superphosphate, triple superphosphate, uses of mixed fertilizers. Micronutrients and their role, biofertilizers, plant growth hormones.

Pesticides: Classification of pesticides with examples. Insecticides; stomach poisons, contact insecticides, fumigants. Manufacture and uses of insecticides. DDT, BHC (gammaxane: Conformation of gamma isomer) pyrethrin. Mention of aldrin, dieldrin, endrin and pentachlorophenel (and its Na salts) and Biopesticides: Herbicides: Manufacture of 2,4-D and 2,4,5-T Fungicides: Preparation of Bordeaux mixture. Mention of lime-sulphur, creosote oil and formula.

UNIT-3: Water treatment

Introduction to sources of water. Hardness of water—temporary or carbonate hardness, permanent hardness or non-carbonate hardness. Units of hardness, disadvantages of hard water—In domestic, in industry and in steam generation in boilers. Effect of iron and manganese in water. Estimation of hardness—EDTA method—Estimation of total hardness—O. Hehner’s method or alkali titration method.


UNIT-4: Pollution and chemical toxicology

Pollution: Air pollution—Acid rain. Green house effect (global warming), ozone layer depletion—photochemical oxidants. Control of air pollution. Water pollution—organic pollutants, Chemical oxygen demand (COD), Biological oxygen demand (BOD), total organic carbon. International standards for water and air quality and regulations


UNIT-5: Small scale units

Safety matches, agarbatties, naphthalene balls, wax candle, shoe polish, gum paste, writing/fountain pen ink, chalk/crayons, plaster of paris, silicon carbide crucibles, how to remove stains.

Text book:

Reference book:

Course designer:
1. Dr. A. Suganthi
2. Dr. R. Mahalakshmy
Course : B.Sc.Chemistry (Non major elective)  
Class : II B. A/B.Sc  
Semester : V  
Sub. Code : MCNME51  
Title of the Paper : Processing of Consumer Products (Lab)  

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to
1. Prepare the consumer products which are useful in day to day life.

**Training in the laboratory preparation of the following products:**
(i) Tooth powder  
(ii) Detergent powder  
(iii) Cleaning powder  
(iv) Phenoyl  
(v) Shampoo  
(vi) Pain Balm  
(vii) Face powder  
(viii) Candle  
(ix) Chalk  
(x) Soap oil

**Text Books:**
1. Poucher, W.A. Perfumes, Cosmetics and soaps, Vol. III, Modern Cosmetics;  

**Reference Books:**

**Course Designer:**
Dr. D. S. Bhuvaneshwari
Course: B.Sc Chemistry (Core 12)  Int. Marks : 25
Class: III Year  Ext. Marks : 75
Semester: VI  Max. Marks : 100
Sub. Code: MC61  Hours/Week : 6(5L:1T:0P)

Title of the Paper: Inorganic Chemistry and Computer Applications  Credit : 6

Course outcomes

On the successful completion of the course, students will be able to

- Understand the basic concepts of analytical Chemistry, inorganic polymers and computer applications.
- To know the basic components and function of various analytical instruments.
- Students gain hand on training of instruments and experience in writing C programming of their application in physical chemistry practical's.

Unit I: ANALYTICAL CHEMISTRY -I  (15L Hrs + 3T Hrs)

i. Redox titrations, redox potentials, theory of redox indicators- principles involved in iodometric and iodimetric titrations- Complexometric titrations involving EDTA - indicators for Complexometric titrations.


Unit II: ANALYTICAL CHEMISTRY-II  (15L Hrs + 3T Hrs)

i. Principle, instrumentation and aplication of Cyclic voltammetry, amphrometric titration, Electrogravimetric methods (with out potantial control) and Coulumetric methods.

ii. Principles and instrumentation TGA and DTA- glass transition temperature of polymer- applications of calcium oxalate monohydrate, Copper sulphate pentahydrate and mixture of polymers.

Unit-III: INORGANIC POLYMERS  (15L Hrs + 3T Hrs)

Unit-IV: INTRODUCTION OF COMPUTERS (15L Hrs + 3T Hrs)
Importance of Computers-history and development-hardware and software-structure of a computer - operating systems - DOS and UNIX – Low level and High level languages- Interpreter and compiler-Types of Computers - various input and output devices.

Unit-V: PROGRAMMING IN `C’ LANGUAGE (15L Hrs + 3T Hrs)
i. Advantages - types-style of the language - Structure of C-program- keywords - variables –constants-data types-operators-arithmetic expressions--input and output functions- Running of C program -control-statements-Looping statements- arrays.
ii. Application Of C Program In Chemistry-Formula Translations
Calculation of RMS and average velocities of O₂ - Mean activity coefficient of an electrolyte - Calculation of pH of the given solution - Use of braces in if-else ladder to obtain the lines of Lyman series-Applying C-programming to simple physical chemistry practicals like Rast method and Ester hydrolysis - Calculation of Normality, Molarity and molality of the given solution - Conversion of Celsius to Kelvin temperature and vice versa.

Text Books:
1. Sharma, B. K. 2000. Instrumental Methods of Chemical Analysis, 5th edn. Goel publication,
   New Delhi.
   Company Ltd., New Delhi.

Reference Books:

Course designers
1. Dr. A. Suganthi
2. Dr. A. Elangovan
3. Dr. D.S. Bhuveswari
4. Dr. K. Selvakumar
Course : B.Sc. Chemistry (Core 13) 
Class : III Year 
Semester : VI 
Sub. Code : MC62 
Title of the Paper : Organic Chemistry – IV 

COURSE OUTCOMES
On the successful completion of the course, students will be able to

- Understand the chemistry of heterocyclic compounds, dyes and natural products.
- Write the mechanism of photochemical reactions.
- Learn amino acids, peptides, proteins and enzymes.
- Apply green chemistry principles.

UNIT – I
HETERO CYCLIC COMPOUNDS AND DY ES

Introduction to heterocyclic compounds, Nomenclature – preparation and reactions of furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline and indole.

Introduction to dyes – colour and constitution - Classification based on structure and application – preparation and applications of the following dyes – methylorange, congored, malachite green, flourescein, phenolphthalene and indigo.

UNIT – II
CHEMISTRY OF NATURAL PRODUCTS

Alkaloids
Introduction - general characteristics - classification – Hofmann Exhaustive methylation - structure and synthesis of the following alkaloids – piperine, nicotine, and atropine.

Terpenoids
Introduction and classification - isoprene rule – gem dialkyl rule - structure, synthesis and stereochemistry of the following terpenoids – citral, menthol and camphor.

UNIT – III
PHOTO CHEMISTRY

UNIT – IV
(15L Hrs + 3T Hrs)
AMINO ACIDS, PEPTIDES, PROTEINS AND ENZYMES:

UNIT – V
(15L Hrs + 3T Hrs)
GREEN CHEMISTRY
Definition – Basic principles- Solid state and solvent free organic reactions (using supported reagents)- Microwave radiation- Characteristics of microwave heating- Difference between microwave heating and conventional heating.
Microwave assisted reactions in aqueous media, organic solvents, Supercritical CO2 and ionic liquids.

Text Books:

Reference books

Course designer
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi
Course : B.Sc Chemistry (Core 14)  Int. Marks : 25
Class : III year  Ext. Marks : 75
Semester : VI  Max. Mars : 100
Sub. Code : MC 63  Hours/Week: 6 (5L + 1T+0P)
Title of the paper : Physical Chemistry – IV  Credit : 6

Course Outcomes:
On the successful completion of the course, students will be able to
- Understand the principle of electrochemistry
- Learn about various photochemical processes, surface chemistry and their kinetics
- Deal with the preparation, properties and applications of colloids.

UNIT – I
ELECTRO CHEMISTRY – I  (15L+ 3T + 0P- hrs)
(i) Conductance:  Electrical conductance in solution – Ohm’s law and Faraday’s law, specific and molar conductance, variation of conductance with dilution – Oswald’s dilution law, Kohlrausch’s law and its application, conductometric titrations (Strong acid and strong base, weak acid and weak base)
(ii) Ionic equilibria: Ionic product of water, Ionization constant of weak acids and bases, pH, pOH and pKa, buffer solutions – Henderson-Haselbach equation, common ion effect (definition only).

UNIT – II
ELECTROCHEMISTRY – II  (15L+3T +0P - hrs)
Electrochemical cells – Galvanic cells and Emf, electrode reaction and electrode potential – thermodynamics of cells -concentration cells, measurement of Emf (Poggendrof’s method) and it’s applications, Nernst’s equation - standard electrode potential –representation of cells- Electrochemical ells, dry cell – Leglanche’s cell, lead storage battery, potentiometric titration (FAS Vs K₂Cr₂O₇ only), fuel cells – hydrogen-oxygen fuel cell.

UNIT – III PHOTOCHEMISTRY  (15L+3T +0P - hrs)
UNIT – IV  COLLOIDS  
(15L+3T +0P hrs)
Definition-Difference between true solution, colloidal solution and suspension – classification of colloids, difference between lyophilic and lyophobic colloids, preparation and properties of colloids-electrical double layer- zeta potential – coagulation, Hardy Schulze law, Hofmeister series protective effects – protective colloids - gold number – gels, thixotrophy, syneresis and imbibition – applications of colloids (purification of drinking water, pollution control, sewage disposal, medicine and detergent)

UNIT – V  SURFACE CHEMISTRY  
(15L+3T +0P - hrs)
Definition-Adsorption, adsorbent, adsorbate, occlusion - types of adsorption- -Differences between physisorption and chemisorption-Langmuir's and Freundlich adsorption isotherms, positive and negative adsorption, application of adsorption (gas masks, chromatography, preserving vacuum, cleaning of sugar, paint industry and catalysis).

Text Books

Reference Books

Course designers
1. Dr. P. Sayee Kannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan
### Course Outcomes

On the successful completion of the course, students will be able to

1. Understand the concepts of Physical chemistry experiments.
2. Do the physical chemistry experiments.

### EXPERIMENTS

1. Potentiometric Titrations (Redox titration).
2. Conductometric Titrations (Strong acid Vs Strong base).
4. Simple Eutectic system (Phase diagram).
5. Compound formation (Phase diagram).
6. Ester hydrolysis using acid HCl or H₂SO₄
7. Critical Solution Temperature (CST) of Phenol-water system and effect of impurity on CST.

### Course designers

1. Dr. P. Prakash
2. Dr. R. Mahalakshmy
3. Dr. T. Arumuganathan
COURSE OUTCOMES
On the successful completion of the course, students will be able to

- Understand the basic concepts, theories, mechanism and application of Coordination chemistry.
- Gain knowledge on metal carbonyls.

UNIT – I: Introduction to Coordination Chemistry (15 hrs)

UNIT – II: Theories of Coordination Chemistry (15 hrs)
Theories – Valence bond theory - application to octahedral and square planar complexes – crystal field theory – magnetic properties of metal complexes – factors influencing the magnitude of crystal field splitting – colour of transition metal complexes Jahn Teller distortion – Electronic spectra – Orgel diagram – d1 and d9 systems – MO theory applied to sigma bonding only.

UNIT – III: Reaction mechanism of Coordination Complexes (15 hrs)
Reactions of metal complexes. Labile and Inert complexes VBT, Taube’s explanation of lability and inertness – ligand substitution reactions applied to Octahedral complexes SN1, SN2 reactions. Electron transfer reactions, inner sphere and outer sphere mechanism.

UNIT – IV: Metal Carbonyls (15 hrs)
UNIT – V: Application of coordination compounds


Text books:

Reference books:

Course Designer:
1. Dr. A. Suganthisi
2. Dr. P. Tharmaraj
COURSE OUTCOMES
On the successful completion of the course, students will be able to

- Understand the role of metal ions in biological system
- Understand the theory of enzyme catalysis
- Gain knowledge on metals in medicine

UNIT I: ROLE OF METALS IN BIOLOGY (15 hrs)

UNIT II: BIOCHEMISTRY FUNDAMENTALS (15 hrs)
Proteins – Amino Acid Building Blocks – Protein Structure – Protein Sequencing and Proteomics – Protein Function, Enzymes, Classification of enzymes – Enzyme Kinetics – Enzyme Inhibition

Unit III: IRON-CONTAINING OXYGEN CARRIERS (15 hrs)

UNIT IV: COPPER ENZYMES AND NITROGENASE (15 hrs)

UNIT V: METALS IN MEDICINE (15 hrs)
Inorganic Medicinal Chemistry - Metal Toxicity and Homeostasis – Anti-cancer agents: Cisplatin and related compounds - Chelation therapy – Cancer treatment – Anti-arthritis drugs – Gadolinium MRI Imaging Agents.
Text Books


Reference books


Course Designers

1. Dr. R. Mahalakshmy
2. Dr. A. Tamil Selvi
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : B.Sc Chemistry (SEC)  
Int. Marks : 15
Class : III year  
Ext. Marks : 35
Semester : VI  
Max. Marks : 50
Sub. Code : MCSEC61  
Hours/Week : 2
Title of the Paper : Water analysis –Lab (Option A)  
Credit : 2

Course Outcomes:
On the successful completion of the course, students will be able to
• Estimate hardness producing ions present in water.
• Determine BOD and COD.

Experiments
1. Estimation of temporary and permanent hardness.
2. Estimation of calcium and magnesium hardness.
3. Estimation of chloride by Mohr’s method.
4. Estimation of sulphate.
5. Spectro photometric estimation of fluoride.
7. Estimation of TDS.
8. Determination of Biological Oxygen Demand (BOD).

Course designer
Dr. P. Prakash
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : B.Sc Chemistry (SEC)     Int. Marks : 15
Class : III year                   Ext. Marks : 35
Semester : VI                      Max. Marks : 50
Sub. Code : MCSEC61                Hours/Week : 2
Title of the Paper : Food Chemistry (Option B) Credit : 2

COURSE OUTCOMES
On the successful completion of the course, students will be able to
• Gain basic knowledge in Food and milk chemistry.
• Get practical knowledge in food analysis.

UNIT 1: Introduction (10 hours)

UNIT 2: Nutrition and Balanced Diet (10 hours)

Text books:

Reference Book

Course Designer:
Dr. A. Suganthi
Course : B.Sc. Chemistry (SEC)  Int. Marks : 15
Class : III year  Ext. Marks : 35
Semester : VI  Max. Marks : 50
Sub. Code : MCSEC61  Hours/Week : 2
Title of the Paper : Polymer Chemistry (option-C)  Credit : 2

COURSE OUTCOMES
On the successful completion of the course, students will be able to
- Understand the chemistry of polymers.
- Write the preparation, properties and uses of commercial polymers.

UNIT-I
INTRODUCTION TO POLYMERS  (15 hrs)

UNIT-II
CHEMISTRY OF COMMERCIAL POLYMERS  (15 hrs)
General methods of preparation, properties and uses of the following polymers: Polyethylene (LDPE & HDPE), PVC, Polystyrene, PAN, Teflon, Polyurethanes, phenol-formaldehydes-composites- ABS.

Text Book:

Reference Book:

Course Designer
Dr. R. Sayeekannan
GENERIC ELECTIVES
Course: B.Sc. MB, Physics, Botany, Mathematics (Generic elective) Int. Marks: 25
Class: I & II year
Ext. Marks: 75
Semester: I & III
Max. Marks: 100
Sub. Code: AC11/AP31
Hours/Week: 4
Title of the Paper: General Chemistry - I
Credits: 4

Course Outcomes:
On the successful completion of the course, students will be able to

- to study the structure of atom, importance of hydrogen and its isotopes and purification of water.
- get an idea about the chemistry in industry and agriculture.

Unit-I: STRUCTURE OF ATOM

12 Hrs
Rutherford model of the atom- defects of Rutherford model - Discovery of neutron, Bohr model of an atom (postulates only)- merits and demerits- de Broglie’s concept of duality - quantum numbers- shapes of s, p, d atomic orbitals. Arrangement of electrons in atoms- Hund’s rule – Pauli exclusion principle- Heisenberg’s uncertainty principle.

Unit-II: WATER

12 Hrs

Unit-III: CARBOHYDRATE

12 Hrs
Classification- preparation and properties and uses of sucrose- muta rotation- conversion of aldopentose to aldohexone and vice versa. Conversion of glucose to fructose vice versa.

Unit-IV: INDUSTRIAL FUELS

12 Hrs
Unit-V: CHEMISTRY AND AGRICULTURE 12 Hrs

Fertilizers: Preparation and uses of urea, super phosphate, triple super phosphate and potassium nitrate. Pesticides: Classification of pesticides with examples-Insecticides: stomach poisons, contact insecticides and uses of insecticides- DDT, BHC (gammexane: conformation of gamma isomer)- Herbicides- 2,4-D and 2,4,5-T- Fungicides definition and uses.

Text Books


Reference Books


Course designers

1. Dr. A. R. Ramesh
2. Dr. D.S.Bhuvaneshwari
3. Dr. K.S. Selvakumar
Course: B.Sc. MB, Physics, Botany, Mathematics ( Generic elective) Int. Marks : 25
Class : I & II year Ext. Marks : 75
Semester : II & IV Max. Marks : 100
Sub. Code : AC21/ AP41 Hours/Week : 4
Title of the Paper : General Chemistry - II Credits : 4

Course Outcomes:
On the successful completion of the course, students will be able
- To understand the basic concept of conductance in solution, type of catalysts and application of nuclear chemistry.
- To get an idea about aminoacids and uses of vitamin and nano and green chemistry reactions.

Unit- I: ELECTROCHEMISTRY

Unit- II: CATALYSIS
Definition- different types of catalysts – homogenous and heterogeneous catalysis- acid-base catalysis- enzyme catalysis-mechanism. Mechanism of heterogeneous catalytic reactions - auto catalysis- catalytic poisoning- promoters.

Unit- III: NUCLEAR CHEMISTRY

Unit- IV: AMINOACIDS & VITAMINES
Unit- V: NANO AND GREEN CHEMISTRY

12 Hrs

Definition of nanoscience-preparation methods- top down approach – bottom up approach-
sol-gel synthesis- application- Green chemistry-basic postulates of green chemistry- Green
solvents- microwave reaction principle- advantage of microwave synthesis.

Text Books:


Reference Books

   Publication, New Delhi.
   Nagin
   Chand & co.
   Ltd.,

Course designers

1. Dr. A. R. Ramesh
2. Dr. D.S.Bhuvaneshwari
3. Dr. K.S. Selvakumar
Course Outcomes:
On the successful completion of the course, students will be able to
1. Understand the concept of volumetric titration.
2. Do titrations of acidimetry - alkalimetry, permanganometry, dichrometry and iodometry.

I ACIDIMETRY - ALKALIMETRY
1 \( \text{Na}_2\text{CO}_3 \) (Std)-HCl - \( \text{Na}_2\text{CO}_3 \)
2 \( \text{Na}_2\text{CO}_3 \) (Std)-HCl - NaOH
3 HCl- \( \text{Na}_2\text{CO}_3 \) (Std)-HCl
4 NaOH-Oxalic acid - (Std)-NaOH

II PERMANGANOMETRY
1 \( \text{Fe}^{2+} \)- \( \text{KMnO}_4 \)-FAS
2 \( \text{KMnO}_4 \)- \( \text{Fe}^{2+} \)- \( \text{KMnO}_4 \)
3 Oxalic acid - \( \text{KMnO}_4 \)-Oxalic acid
4 \( \text{KMnO}_4 \)-Oxalic acid - \( \text{KMnO}_4 \)

III DICHROMETRY
1 \( \text{Fe}^{2+} \)-K\( \text{Cr}_2\text{O}_7 \)-FAS
2 K\( \text{Cr}_2\text{O}_7 \)- \( \text{Fe}^{2+} \)- K\( \text{Cr}_2\text{O}_7 \)

IV IODOMETRY
1 K\( \text{Cr}_2\text{O}_7 \)-Thio- K\( \text{Cr}_2\text{O}_7 \)
2 \( \text{KMnO}_4 \)-Thio- K\( \text{Cr}_2\text{O}_7 \)
3 CuSO\(_4\)-Thio- K\( \text{Cr}_2\text{O}_7 \)
4 CuSO\(_4\)-Thio- \( \text{KMnO}_4 \)

Course Designers
1. Dr. A.R. Ramesh
2. Dr. K.Selvakumar
M.Sc., Chemistry (Aided)
## THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)
MASTER OF CHEMISTRY
Semester – I

<table>
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<th>Course</th>
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<th>Max Marks SE</th>
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**Total Hrs:** 450 **Max Marks SE:** 300

**Total Hrs:** 30 **Max Marks SE:** 480 **Total:** 700
### Semester – III

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- For core practical credits will be given at the end of II semester (Year wise practical)
A) CONSOLIDATION OF CONTACT HOURS AND CREDITS: PG

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B) Curriculum Credits

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THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course       : M.Sc. Chemistry (Core 1)     Int. Marks  : 25
Class        : I Year                      Ext. Marks  : 75
Semester     : I                           Max. Marks : 100
Sub. Code    : 1PC1                        Hours/Week : 5
Title of the Paper : Organic Chemistry – I  Credits : 5

COURSE OUTCOMES
On the successful completion of the course, students will be able to

• 1. Understand the concept of aromaticity.
• 2. Gain the knowledge about structure and stability of reaction intermediates.
• 3. Understand the reaction mechanism, isomerism and stereochemistry of organic molecules.

UNIT-I Delocalized chemical bonding, Aromaticity and Reaction intermediate  (15 hrs)
Electron displacement – Steric effect – Tautomerism
Concept of aromaticity – Benzenoid and non-benzenoid compounds – Huckel’s rule - Non aromatic and anti aromaticity - Alternant and non alternant hydrocarbons - aromaticity of cyclopentadienyl anion and Tropylium cation – Azulenes and annulenes.

UNIT - II Reaction mechanism-I (Basics)  (15 hrs)

UNIT - III Reaction mechanism-II (Substitution Reactions)  (18 Hrs)
Aliphatic Nucleophilic Substitution Reactions - Mechanism – $S_N1$ and $S_N2$, mixed $S_N1& S_N2$, $S_{\text{N}1}$, SET, Neighboring group participation by $\sigma$ and $\pi$ bonds – Reactivity at an allylic, aliphatic trigonal and vinyllic carbon – Effect of substrate structure, attacking nucleophile, leaving group and reaction medium on reactivity – Ambident nuleophiles.
Aromatic Nucleophilic Substitution Reactions – Unimolecular, Bimolecular and Benzyne mechanism – Effect of substrate, leaving group and attacking nucleophile.
Electrophilic substitution reactions:
Aliphatic: Bimolecular mechanism SE2 and SE1 – Aromatic: Arenium ion mechanism – Orientation and reactivity: Ortho and Para ratio, partial rate factor
UNIT-IV Reaction Mechanism III (Elimination reactions) (12 hrs)
E₁, E₂ and E₁CB mechanism- Competition between substitution and elimination – orientation of double bonds (Bredt’s rule and Hofmann and saytzeff rules) – Effect of substrate structure, attacking nucleophile, leaving group and nature of reaction medium on reactivity – Mechanism and orientation in pyrolytic eliminations - Cope and Chugaev reaction (cis-elimination)

UNIT-V Reaction Mechanism IV (Addition to carbon-Carbon multiplebonds) (15 hrs)
Electrophilic, Nucleophilic & free radical addition – Mechanism, Orientation and reactivity and reactions - addition to conjugated systems- addition to α,β-unsaturated carbonyl and nitrile systems- Michael addition – addition of Grignard reagents-Diels Alder reaction- Enamine reaction - Mechanism of Reformatsky reaction- Darzen reaction- Mannich reaction - Wittig reaction - Stobbe and Dieckman condensation.

Text books:
5. G.M. Badger, 2001 Aromatic character and Aromaticity, Cambridge, USA.

Reference Books:

Course designer
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi
Course: M.Sc Chemistry (Core 2)  
Int. Marks: 25

Class: I Year  
Ext. Marks: 75

Semester: I  
Max. Marks: 100

Sub. Code: 1PC2  
Hours/Week: 5

Title of the Paper: Inorganic Chemistry- I  
Credits: 5

COURSE OUTCOMES
On the successful completion of the course, students will be able to
- Understand the concepts of bonding and electronic structure of atom.
- Write the concept of acid base systems and non aqueous solvents.
- Understand nuclear Chemistry.

UNIT – I: ELECTRONIC STRUCTURE OF ATOM  
(15 Hrs)
Modern views on atomic structure: Wave mechanical description of electron and orbitals, radial density functions and orbital energies, angular functions and orbital shapes-term symbol.
Modern periodic table: Periodic properties-Ionisation potential, Ionic radii and covalent radii, Electron affinity, Electronegativity and their trend in the periodic table- Comparison of transition metals of 3d, 4d and 5d series.

UNIT – II: NATURE OF THE CHEMICAL BOND  
(15 Hrs)

UNIT – III: BONDING APPLICATION  
(15 Hrs)
Application of VB and MO theories to the structure of homonuclear (H2, B2, C2, N2 and O2) and heteronuclear (CO, NO, HCl, HF) diatomic and selective polyatomic molecules (CO3^2-, NO2, BeH2, CO2) comparison of VB and MO theories. Bond properties, bond order, bond energy, bond length and bond polarity. Partial ionic character of covalent bonds-Fajan’s Rule –Effects of polarization. VSEPR theory and its applications to H2O, NH3, ICl2, IF3, IF7, ClO4^- ions. VSEPR applied to Xenon compounds like Xenon halides and xenon oxides.

UNIT – IV: ACID-BASE SYSTEMS AND NON-AQUEOUS SOLVENTS.  
(15 Hrs)
UNIT – V: NUCLEAR CHEMISTRY  
15Hrs


TEXT BOOKS:

REFERENCE BOOKS:

Course designer
1 Dr.A.Suganthi
2 Dr.A. Elangovan
3 Dr.D.S. Bhuvaneshwari
4 Dr.K.Selvakumar
Thiagarajar College, Madurai -09 (Academic Council, June 2017)

Course : M.Sc Chemistry (Core 3)
Int. Marks : 25

Class : I Year
Ext. Marks : 75

Semester : I
Max. Marks : 100

Sub. Code : 1PC3
Hours/Week : 5

Title of the Paper : Physical Chemistry - I
Credits : 5

Course Outcome:
On successful completion of the course students will be able to
1. Understand the properties of gases, liquid crystals, theory of thermodynamic equilibrium and non-equilibrium.
2. Aware of concepts of quantum chemistry and their applications.
3. Develop their knowledge in physical features of biochemistry.

UNIT-I
PROPERTIES OF GASES AND LIQUID CRYSTAL (15 HRS)
Equations of states - molecular speeds- Maxwell distribution of molecular velocities - one, two and three dimensions; Energy distribution-Maxwell – Boltzmann distribution law- Rotation, vibrations and translational degree of freedom- principle of equipartition of energy and heat capacity; Molecular collisions- collision diameter, cross-section, number, frequency, mean free path (definition only); Transport phenomena in gases - Viscosity of gases – viscosity in terms of momentum transfer, thermal conductivity, and diffusion.

Liquid crystals- Nematic (p-methoxycinnamic acid), cholesteric (cholestryl benzoate), smectic (ethyl-p-azoxybenzoate)- theory and its application in liquid crystals display.

UNIT-II
THERMODYNAMICS – EQUILIBRIUM AND NON-EQUILIBRIUM (15 HRS)
A general review of enthalpy, entropy and free energy concepts: Nernst heat theorem- Genesis of third law and its limitations - derivation of third law and their application to real gases- calculation of (δH/dP)T, (δE/dV)T and μj.T for gases-
Thermodynamics of open systems - partial molar properties- internal energy, molar enthalpy, molar entropy, molar volume, free energy (chemical potential) – determination of partial molar properties; Chemical potential- relationship between partial molal quantities - Gibbs -Duhem equation- Duhem Margules equation; thermodynamic properties of real gases- Fugacity concept- Determination of Fugacity of real gases.
Electrolytes and Non-Electrolytes- Equilibrium thermodynamics- Gibbs phase rule and its application to three component systems- quantitative treatment of Le Chatlier principle- equilibria respond to pressure and temperature; Non Equilibrum Thermodynamics -Basic concepts - Principle of microscopic reversibility and the Onsager reciprocal relations.
UNIT –III
QUANTUM CHEMISTRY-I (15 HRS)
Black Body radiation- Heisenberg’s uncertainty principle- de Broglie wave particle duality-
Experimental verification of matter waves- Compton effect- The Schrodinger equation and
the postulates of quantum mechanics- operators –linear and non-linear operators-
commutative and non-commutative operators- Hermitian operators- Eigen function, Eigen
values and degeneracy- Orthogonality and Normalization of wave functions- Derivation of
Schrodinger's wave equation.

UNIT- IV
QUANTUM CHEMISTRY-II (15 HRS)
Application of quantum mechanics to simple system-Application of SWE to free particle
moving in one dimension- particle moving in a one dimension box - particle moving in 3D
cubical and rectangular box- Quantum Mechanical tunneling - particle in a ring- rigid rotor-
Simple Harmonic oscillator - hydrogen atom- angular momentum spin momentum- ladder
operator.

UNIT-V
PHYSICO-CHEMICAL PRINCIPLES AND BIOLOGICAL REACTIONS (15 HRS)
(i) Studies on biochemical equilibria: Buffer system of intracellular fluids – H₂CO₃ / HCO₃⁻
HPO₄²⁻ / H₂PO₄⁻ - Application of Henderson-Hasselbach equation; Ion channels –
membrane and static potentials - Role of Na⁺ / K⁺ ions in neural communications –Na⁺ / K⁺
ion pump; allosterism and oxygen saturation curves for hemeoglobin and myoglobin –
derivation of Hill equation (ii) Medicinal Chemistry – QSAR; Partition parameters – Partition Coefficients (P)
– hydrophobicity or lipophilicity constant (π); Electronic Parameters – Hammett constant (σ);
Steric parameters – Taft Steric parameterer (Es); Hansch equation; Craig Plot – Topliss
Scheme; ΔG criteria for biological reactions – ATP and ADP conversion.

Text Books:
   York.
   UK.
   Press, UK.
   Publishing company, UK.
9. Publishing Co Ltd., New Delhi, India.
Kogakusha Ltd., New York.
(ISBN:8122424082/9788122424089)

Reference Books:

Course Designed by
1. Dr. R. Sayeekannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan


THIAGARAJAR COLLEGE, MADURAI- 9  
(Re-Accredited with ‘A’ Grade by NAAC) 
DEPARTMENT OF CHEMISTRY 
(For those who join in 2017 and after)

Course: M.Sc. Chemistry (Core 4)  
Int. Marks : 25

Class: I year  
Ext. Marks : 75

Semester: II  
Max. Marks : 100

Sub. Code: 2PC1  
Hours/Week : 4

Title of the Paper: Organic Chemistry – II  
Credits : 4

COURSE OUTCOMES
On the successful completion of the course, students will be able to
- Understand the principles and application of UV-Vis, IR, NMR and Mass spectroscopy.
- Apply the spectroscopy concept in analyzing and determining the structure of organic compounds.
- Gain insight on conformational characteristic of organic acyclic and cyclic compounds
- Identify the effect of conformational flexibility on reactivity.

Unit-I UV and IR Spectroscopy  
(12 Hrs)

Ultraviolet spectroscopy – basic principle – instrumentation – the absorption laws, types of electronic transitions – Effect of solvent and hydrogen bonding on \( \lambda_{\text{max}} \) values - Woodward rules to calculate \( \lambda_{\text{max}} \) values of conjugated dienes, conjugated polyenes, and carbonyl compounds

Infrared spectroscopy – basic principle – Molecular Vibrations – instrumentation – characteristic IR absorption of different functional groups – factors influencing the vibrational frequencies

Unit-II \(^1\text{H} \) NMR and \(^{13}\text{C} \) NMR spectroscopy  
(12 Hrs)

\(^1\text{H} \) NMR spectroscopy: Basic principles – number of signals – chemical shift – factors influencing chemical shift – spin-spin coupling – coupling constant and factors influencing coupling constant. Simplification of complex spectra – shift reagents, deuterium substitution and spin decoupling.

\(^{13}\text{C} \) NMR spectroscopy: Basic principle – comparison with \(^1\text{H} \) NMR – noise decoupling – off resonance decoupling – factors affecting the C-13 chemical shifts.


UNIT-III: Mass Spectroscopy, ORD and CD  
(12 hrs)

(Nitrogen rule) – Determination of structures of organic molecules. Introduction to ESI, MALDI and FAB mass spectrometer.

Optical rotatory dispersion (ORD) and Circular Dichroism (CD): Circularly polarized light – Circular birefringence and CD – plain curves and their applications – Cotton effects curves – structural applications – axial haloketone rule, octant rule and their applications. Solving problems based on UV, IR, NMR and Mass data.

UNIT IV - Organic Stereochemistry

**Optical isomerism**

Symmetry elements – the concept of chirality – chirality about a center – specification by Cahn-Ingold-Prelog notations – compounds with more than one chiral center – erythro, threo and meso nomenclature – concept of prochirality – homotopic, enantiotopic and diastereotopic ligands and faces – Asymmetric synthesis – Cram’s rule and Prelog’s rule. Optical activity in allenes and spiranes – StereoChemistry of nitrogen compounds.

**Geometrical isomerism**

E and Z notation – Determination of configuration of geometrical isomers by simple techniques like hydroxylation, hydroboration and methods based on physical properties – Stereoisomerism in cyclic compounds – 3, 4 and 5 membered ring systems.

UNIT V – Conformational Analysis


**Text Books:**

**Reference Books:**
2. V.M.Potapov,1999. Stereochemistry, MIR Publisher, Moscow.

**Course designer**
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi
THIAGARAJAR COLLEGE, MADURAI- 9  
(Re-Accredited with ‘A’ Grade by NAAC)  
DEPARTMENT OF CHEMISTRY  
(For those who join in 2017 and after)

<table>
<thead>
<tr>
<th>Course</th>
<th>M.Sc Chemistry (Core 5)</th>
<th>Int. Marks</th>
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<tr>
<td>Class</td>
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<td>Hours/Week</td>
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<td>Title of the Paper</td>
<td>Inorganic Chemistry- II</td>
<td>Credits</td>
<td>4</td>
</tr>
</tbody>
</table>

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

- study the solid state chemistry of inorganic compounds.
- understand analytical Chemistry.
- know the techniques like Colorimetry, Fluorimetry, AAS, TGA, DTA, Chromatography and cyclic voltammetry.

**UNIT I SUPRAMOLECULAR CHEMISTRY**  
(12 Hrs)
Definition, Nature of supramolecular interactions- Non-Covalent interactions, Host - guest interaction, complexing involving crowns and cryptands-cyclodextrine - Inclusion compounds-Clatharates-intercalation compounds -Molecular recognition, Types of recognition, Self-assembly. General properties of Supramolecular complexes- Molecular Library- Transition metal mediated supramolecules-Directional bond approach- Molecular triangles (Pd and Pt)- Molecular squares (Pd, Pt and Re)- Molecular rectangles-(Pd, Pt, Cu and Re) Molecular Cages (Pd, Pt and Re) and their applications.

**UNIT II SOLID-STATE CHEMISTRY**  
(12 Hrs)

**UNIT-III Inorganic Rings, Cages, Clusters and Polymers- I**  
(12 Hrs)
UNIT- IV Inorganic Rings, Cages, Clusters and Polymers- II (12 Hrs)

UNIT-V ANALYTICAL CHEMISTRY-I (12 Hrs)
Principles and practice of complexometric estimations/- Spectro analytical methods:- Principles and applications of colorimetry and spectro photometry, fluorimetry, nephelometry and turbidimetry-emission and atomic absorption spectroscopy (AAS) and atomic fluorescence spectroscopy.

ANALYTICAL CHEMISTRY-II
Principles, Instrumentation and applications of Cyclic Voltametry, Thermogravimetry, Differential thermal analysis and differential scanning colorimetry, Chromatography: GC, HPLC and Ion Exchange Chromatographic techniques.

Text book:
Reference books:


Course designer

1. Dr. A. Suganthi
2. Dr. A. Elangovan
3. Dr. D. S. Bhuvaneshwari
4. Dr. K. Selvakumar
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Sc Chemistry (Core 6)  Int. Marks : 25
Class : I Year  Ext. Marks : 75
Semester : II  Max. Marks : 100
Sub. Code : 2PC3  Hours/Week : 4
Title of the Paper : Physical Chemistry- II  Credits : 4

Course outcomes:
On successful completion of the course students will be able to
• Learn about theories and applications of electrochemistry
• Understand the need and applications of statistical thermodynamics
• Gain knowledge in advanced quantum chemistry

UNIT-I
ELECTROCHEMISTRY-I
(12 Hrs)

UNIT-II
ELECTROCHEMISTRY-II
(12 Hrs)

UNIT-III
STATISTICAL THERMODYNAMICS-I
(12 Hrs)
Need for statistical mechanics or thermodynamics-Ensemble- types of ensemble – micro canonical - canonical and grand canonical ensemble; Phase space- microstates- probability and distribution- Maxwell Boltzmann classical distribution law- derivation in term of degeneracy; Partition function (Q) – relation between partition function and the following thermodynamic functions – internal energy (E), Helmholtz free energy (A), Pressure (P), Enthalpy (H), Gibbs free energy (G), chemical potential (µ), heat capacity (Cᵥ) and entropy (S); Derivation of Sackur-Tetrode equation-thermodynamic properties of monoatomic gases.
UNIT-IV  (12 Hrs)
STATISTICAL THERMODYNAMICS-II

UNIT –V  (12 Hrs)
Approximation methods, application of SWE to many electron systems.

Text Books:
2. Crow Dr., 1988, Principles and Applications of Electrochemistry, Chapman Hall, UK.

Reference Books:

Course Designed by
1. Dr. R. Sayee Kannan,
2. Dr. A. R. Ramesh,
3. Dr. T. Arumuganathan,
THIAGARAJAR COLLEGE, MADURAI- 9  
(Re-Accredited with ‘A’ Grade by NAAC)  
DEPARTMENT OF CHEMISTRY  
(For those who join in 2017 and after)

Course                  : M.Sc.(Core elective 1)                  
Class                   : I M.Sc Chemistry                        
Semester                : II                                      
Sub. Code               : 2PCE1(C)                                
Int. Marks              : 75                                      
Ext. Marks              : 25                                      
Max. Marks              : 100                                     
Hours/Week              : 5                                       
Credits                 : 5                                       
Title of the Paper      : C-Programming: Fundamentals And Applications in Chemistry (Option A)

COURSE OUTCOMES
On the successful completion of the course, students will be able to
1. To have an Overview of C-Programme.
2. To comprehend the basic ideas of Operators, Data input and Output.
3. To know about Decision Making, Arrays, and Functions and to understand Applications of C in Chemistry

UNIT-I  Introduction and overview of C
Introduction – Importance of C-structure of C-programs- Simple programs-style of the language.  
Characters–Keywords, Variables and parameters-Data types-Constants-Declaration of and assignments of values to variables.  
Operators-Arithmetic, Relational, Logical, assignment, Increment and Decrement, Conditional and bitwise operators-Special operators.  

UNIT-II  Data input and Output
Character input- The getchar function – Character output- The putchar function – Entering input data- the Scanf function-Writing output data- The printf function- Formatted input and output data-the gets and puts functions-preparing and running a complete program.

UNIT-III  Decision making and Looping
Arrays: One dimensional array –Two dimensional arrays –Initializing two dimensional arrays- Multidimensional arrays.  
User defined functions: Need for user–defined functions – A multifunction program – The form of C functions -Return values and their types- Calling a function –Category of function-No arguments and no return values –Nesting functions- Recursions- The scope and life time of variables in function.

UNIT-IV Applications of C in Chemistry-I
Explanation of the formulae, equations and programs to solve the following problems in chemistry:  
2. Calculation of pH.
3. Determination on First Order rate constant for the given reaction
4. Evaluation of lattice energy using
   i). Born- Haber Cycle
   ii). Born –Lande equation
5. Computing ionic radii- Lande’s method and Paulings method
6. Calculation of Normality, Molarity and Molality of a given solution
7. Converting Kelvin to Celsius temperature and vice versa.
8. Determination of enthalpy of a given solution
9. Evaluation of Cell constant

UNIT-V: Applications of C in Chemistry-II  (T: 5 HRS + P: 10 HRS)

Explanation of the formulae, equations and programs to solve the following problems in chemistry:

Organic Chemistry:
1. Use of Recursive functions to calculate the number of $\pi$ Resonance structures for an organic conjugated system using
   \[ \text{res - str} = \frac{n!}{((n/2)! * ((n/2) + 1)!)} \]
2. Empirical formula of Hydrocarbons and other Organic compounds.

Inorganic Chemistry:
1. Array manipulation to balance the chemical equations.
2. Half life and average life periods of radioactive nuclei.
3. Binding energy of nucleus.
4. Program to get output as First ten elements of Periodic Table with their Name, Symbol, Atomic number and Atomic Weight.

Physical Chemistry:
1. Calculation of RMS, average and MPV of gases.
2. Solving Quadratic equation to evaluate the Equilibrium constant for the reaction
   \[ \text{H}_2 + \text{I}_2 \rightarrow 2\text{HI} \]
3. Illustrate use of Loop to calculate the NMR frequency for a nucleus with Spin $\frac{1}{2}$
4. Mean activity coefficient of an Electrolyte (KCl)

TEXT BOOK

REFERENCES:

Course designer
1. Dr. A. Elangovan
2. Dr. R. Mahalakshmy
3. Dr. A. Tamilselvi
THIAGARAJAR COLLEGE, MADURAI- 9  
(Re-Accredited with ‘A’ Grade by NAAC)  
DEPARTMENT OF CHEMISTRY  
(For those who join in 2017 and after)  

Course : M.Sc (Core elective 1)  
Class : I MSc Chemistry  
Semester : II  
Sub. Code : 2PCE1(M)  

Title of the Paper : Medicinal Chemistry (Option B)  

COURSE OUTCOMES  
On the successful completion of the course, students will be able to  
1. Understand the concept of pharmacokinetics, pharmacodynamics drug discovery by design.  
2. Synthesis different types of drugs.  

Unit – I : Introduction to Drug Design  
15 hrs  
a) ADME Properties  
The pharmacokinetics phase-Adsorption-Distribution, Metabolism-Elimination-Bioavailability of drug, pharmacokinetics models, Intravascular and Extravascular administration. The use of pharmacokinetics in Drug design.  
b) Pharmacodynamics - Stereoelectronic structure.  

Unit - II Drug Discovery by Design  
15 hrs  
a) Stereochemistry and Drug Design  
Structurally rigid Groups –procaine, Acetylcholine. Conformation-Syn and Anti Acetylcholine, Phenyl ethanoate methiodides. Configuration-Variations in the biological activities of stereoisomers  
b) Structural –Activity –Relationship (SAR)  
Changing the size and shape. Changing the degree of unsaturation. Introduction or removal of ring system. Introduction of new substituents-methyl group, Halogens, hydroxyl groups, Basic groups, carboxylic and sulphonic acid groups. Changing the existing substituents of lead-isosteres, bioisosteres.  

Unit III a) Quantitative-structural Activity-Relationship (QSAR)  
15 hrs  
b) Combinatorial Chemistry  
Basic concepts-The design of combinatorial syntheses. The general technique used in combinatorial synthesis i) Solid support method-parallel synthesis –Furka’s mix and split techniques-sequential chemical tagging methods-Still’s binary code Tag systemcomputerised tagging. ii) Combinatorial synthesis in solution iii) Screening and deconvolution
Unit – IV

a) Antineoplastic Agents: 15 hrs
Introduction, cancer chemotherapy, special problems, role of alkylating agents and antimitabolites in treatment of cancer

b) Psychoactive drugs – The chemotherapy of Mind:
Introduction, neurotransmitters, CNS depressants, general anaesthetics, mode of action of hypnotics, sedatives, neurochemistry of mental diseases

c) Cardiovascular Drugs and Local Antiinfective Drugs:
Introduction, Cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output.

Unit V Synthesis of Drugs 15 hrs

a) Synthesis of Antineoplastic agents
Mechlorethamine, Cyclophosphamide uracil, mustards and 6-mercaptopurine

b) Synthesis of cardiovascular drugs
Amyl-nitrate, sorbitrate, Verapamil.

c) Synthesis of Phychoactive drugs
Synthesis of Diazepam, Chlorazepam, oxazepam, Alprazolam, Phenyltocin or Diphenylhydantoin, Barbitol, Phenobarbital.

Text Books:
2. Robert F. Dorge 2003 Wilson and Gisvold’s Text Book of Organic Medicinal and Pharmaceutical Chemistry,

Reference Books:

Course Designer
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
Course: M.Sc.(Core 1 Lab)  Int. Marks : 40
Class: I Year  Ext. Marks : 60
Semester: II  Max. Marks : 100
Sub. Code: 2PCL1  Hours/Week : 5
Title of the Paper: Organic Chemistry Lab 1  Credits : 5

Organic qualitative analysis

Course Outcomes
On the successful completion of the course, students will be able to
1. get practical skills in analyzing a mixture of two organic substances
2. do preparation of organic compounds.

Analysis
Analysis of Organic mixtures: Two component Systems  (Maximum of SIX Mixtures)

Preparation of organic compounds
1. Dibenzal acetone
2. Dimethyl pyrazole
3. DiphenylChalcone
4. P.Nitroacetanilide
5. Salicylaldoxime

Course Designers
1. Dr. P. Tharmaraj
2. Dr. A. Tamilselvi
Course: M.Sc. Chemistry (Core 2 Lab)  Int. Marks: 40
Class: I Year  Ext. Marks: 60
Semester: II  Max. Marks: 100
Sub. Code: 2PCL2  Hours/Week: 4
Title of the Paper: Inorganic Chemistry Lab 1  Credits: 4

Course objective:
To impart skills in both qualitative and quantitative inorganic analysis

I. COMPLEXOMETRIC TITRATIONS WITH EDTA

1. Estimation of ZINC

2. Estimation of MAGNESIUM

3. Estimation of COPPER

4. Estimation of NICKEL

   a) By Direct Method
   b) By Indirect Method

II. SEMI MICRO ANALYSIS

Semi micro analysis of samples containing two Familiar Cations and two Less Familiar Cations. – Maximum of Five samples.

Course Designers
1. Dr. A. Elangovan
2. Dr. T. Arumuganathan
**Course Objective:**

On successful completion of the course students will be able to

1. Develop practical skills in conductometric and potentiometric titration experiments.
2. Understand experimental knowledge on kinetics and surface chemistry
3. Learn about the estimation of metal ions by using spectrophotometer

<table>
<thead>
<tr>
<th>S. No.</th>
<th>EXPERIMENT</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Kinetics of Acid hydrolysis of an ester</td>
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<tr>
<td>2</td>
<td>Estimation of strong acid conductometrically</td>
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<tr>
<td>3</td>
<td>Estimation of mixture of acids conductometrically</td>
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<tr>
<td>4</td>
<td>Estimation of NH₄Cl by Conductometrically</td>
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<tr>
<td>5</td>
<td>Estimation of CH₃COONa by conductometrically</td>
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<tr>
<td>6</td>
<td>Estimation of BaCl₂ by conductometrically</td>
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<tr>
<td>7</td>
<td>Estimation of Fe(II) using K₂Cr₂O₇ by Potentiometry</td>
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<tr>
<td>8</td>
<td>Estimation of Fe(II) using CAS by Potentiometry</td>
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<tr>
<td>9</td>
<td>Estimation of KI with KMnO₄ by Potentiometry</td>
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<tr>
<td>10</td>
<td>Estimation of Copper (II) by Spectrocolorimetry</td>
</tr>
<tr>
<td>11</td>
<td>Determination of the Adsorption Parameters of Oxalic acid on Charcoal</td>
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<tr>
<td>12</td>
<td>Adsorption of acetic acid on to activated charcoal</td>
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<tr>
<td>13</td>
<td>Estimation of thiocyanate using iron (III) by spectrocolorimetry</td>
</tr>
<tr>
<td>14</td>
<td>Determination of Iron ion content by photometric method based on complex formation</td>
</tr>
</tbody>
</table>

**Course Designer**

1. Dr. R. Sayeekannan
2. Dr. A. R. Ramesh
Course : M.Sc. Chemistry(Core 7) Int. Marks : 25
Class : II Year Ext. Marks : 75
Semester : III Max. Marks : 100
Sub. Code : 3PC1 Hours/Week : 5
Title of the Paper : Organic chemistry – III Credits : 5

COURSE OUTCOMES
On the successful completion of course students will be able to

- Apply various reagents in organic synthesis.
- Write advanced synthetic routes for an ideal organic synthesis.
- Write the mechanism of pericyclic and photochemical reactions.
- Understand the mechanism of molecular rearrangement reaction.

Unit-I: Reagents in Organic Synthesis (15 Hrs)

Unit-II Advanced Organic Synthesis I (Retro-synthesis) (15 hrs)
Disconnection Approach: Importance of organic synthesis-Planning synthesis – Synthons and types – synthetic equivalents – latent functionality Guideliness for best disconnection approach, Reactions involving functional group interconversions – Reterosynthetic analysis – concept of umpolung – two group C-X disconnections and synthetic strategies 1,2-, 1,3-, 1,4-, 1,5- and 1,6- difunctionalised disconnection. Stereoselective and stereospecific reactions-Chemoselectivity–Stereoactivity- Regioactivity.

Unit-III Advanced Organic Synthesis II (Asymmetric synthesis) (15hrs)


Unit-IV Photochemistry and Pericyclic reactions (15 hrs)
General principles – orbital symmetry considerations related to photochemical reactions, thermal versus photochemical reactions – principles of energy transfer – photochemical reactions of ketones – Norrish type I and type II reactions – Paterno Buchi reaction – Dienone
photochemistry – photo reduction, photochemical oxidation, Barton reaction – photochemistry of alkenes and dienes.


**Unit-V Molecular rearrangements** (15 hrs)
Acid catalyzed rearrangement – Arndt-Eistert synthesis – carbon to nitrogen migration – Hofmann rearrangement, Curtius rearrangement, Lossen rearrangement, Schmidt and Beckmann rearrangement

**Text book:**

**Reference Books:**

**Course designer**
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A.Tamilselvi
### Course Outcomes:
On the successful completion of course students will be able to

- understand coordination Chemistry, lanthanides and actinides chemistry.
- write the basic concept, theories, mechanism and spectra of coordination compounds.
- An emphasize is given on Separation techniques of lanthanides and synthesis of actinides.
- gain knowledge about the synthesis, properties, characterization and the applications of nano materials.

### UNIT I  COORDINATION CHEMISTRY-1  
15 Hrs
Nomenclature of coordination complexes-Stereochemistry of coordination compounds: Geometrical isomerism- optical isomerism of complexes having C.N.4,6-stability constants of complexes-stepwise and overall stability constant- their determination-Jobs’ continuous variation method-Chelate effect


### UNIT-II  COORDINATION CHEMISTRY-II  
15 Hrs
(INORGANIC REACTION MECHANISMS)
Substitution reactions- lability-inertness- square planar substitution reactions- Factors affecting reactivity of square planar complexes- Trans effect- Theories of Trans effect- Stereochemistry of substitution in octahedral complexes.(SN¹, SN², SNiCB)- Reactions of coordinated ligands- Acid hydrolysis- anation reactions and base hydrolysis.

Mechanism of electron transfer reactions- Outer sphere, inner sphere electron transfer reactions- Marcus Theory and its applications. Synthesis of coordination compounds using electron transfer and substitution reaction.

### UNIT- III  CHEMISTRY OF NANOSCIENCE AND TECHNOLOGY  
15 Hrs
Introduction- Types of nano materials-Nanoparticles, nanotubes-Carbon nanotubes: SWCNT and MWCNT, nanowires, nanoribbons, nanorods, nano composites.

UNIT – IV PHYSICAL METHODS IN INORGANIC CHEMISTRY-I 15 Hrs


IR and Raman spectra: Applications of IR and Raman. Selection rules to structure determination – IR spectral studies of carbonyl compounds.

Nuclear magnetic resonance : Application of chemical shift and spin coupling to structure determination using multiple NMR (H,P,F) chemical exchange, dynamic processes in inorganic and organometallic compounds- Fluxional NMR of metal carbonyls and allyl complexes – paramagnetic NMR and contact and pseudo contact shifts.

NQR- Basic theory, principles and applications.

UNIT-V LANTHANIDES AND ACTINIDES 15Hrs

a) Lanthanides:-

Occurrence- differences between 4f and 5f orbitals-Separation techniques (Fractional crystallisation, precipitation, ion-exchange, solvent-extraction and thermal decomposition- Selective reduction and oxidation)- Electronic configuration- Oxidation states, Lanthanide contraction- Spectral and Magnetic properties- Ln chelates-organometallic compounds of Ln. Uses of lanthanides (shift reagents, Pu bomb) and their compounds- aqueous chemistry of uranyl compounds- position in the periodic table.

b) Actinides:-

Synthesis of elements- Extraction of Th and U and Pu- electronic configuration and oxidation states, spectral and magnetic properties- position in the periodic table.

TEXT BOOKS:

4. House, I Edn.,
6. New Delhi, .
REFERENCES:

6. Gary L. Miessler and Donald A. Tarr, 2004 Inorganic Chemistry, Pearson Education,
8. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard
10. Press India (P). Ltd. New Delhi 1st Edn.,.
12. Big Idea, Pearson Education Inc., US and UK,

Course Designer
1. Dr. A. Suganthi
2. Dr. A. Elangovan
3. Dr. D.S. Bhuvaneshwari
4. Dr. K. Selvakumar
Course: M.Sc Chemistry (Core 9)  Int. Marks: 25
Class: II Year  Ext. Marks: 75
Semester: III  Max. Marks: 100
Sub. Code: 3PC3  Hours/Week: 5
Title of the Paper: PHYSICAL CHEMISTRY-III  Credits: 5

Course outcomes:
On successful completion of the course students will be able to

- Learn about the fundamentals of symmetry and applications of group theory.
- Understand in detail about IR, Raman and microwave spectroscopy
- Study the concepts of PES, ESR, Mossbauer, NQR spectroscopy and their applications.

UNIT – I

GROUP THEORY – I (Basics of Group Theory)  15 Hrs
(i) Introduction - Symmetry elements and symmetry operations - Definition of mathematical group – four cardinal properties of a group – closure, associative, idendity and inverse rule – cyclic group – Abelian group (H2O only) and non-abelian group (NH3 only) – Group multiplication table- C2V and C3V; subgroup – similarity transformation – class of group – Point group – Assignment of point group of simple molecules;
(ii) Matrix-introduction - matrix representation of the symmetry operations – idendity (E), Proper axis of rotation (Cn), Vertical reflection (σv), Improper axis of rotation (Sn) and Inverse (i); (iii) Representation definition – reducible and irreducible representation of a group –block factorization. The great orthogonality theorem (GOT) – rules for writing (properties of) irreducible representations – Projection operator (definition only) – character table definition – construction of character table C2V and C3V.

UNIT – II

GROUP THEORY – II (Applications of Group Theory)  15 Hrs
Prediction of symmetry of atomic orbitals - linear vector, rotation vector – symmetries of tensor like properties (α & g); Prediction of orbitals and hybridization in BF3 and CH4 molecules; Normal mode analysis – H2O and NH3; Direct product representation and its applications – identification of IR and Raman active vibration of H2O and N2F2 – selection rules to predict allowed and forbidden electronic transition in UV-Visible spectra for example formaldehyde (HCHO); HMO energy calculation for ethylene and butadiene.

UNIT – III SPECTROSCOPY - I  15 Hrs

UNIT – IV SPECTROSCOPY – II  15 Hrs
Electronic spectra of diatomic molecules – molecular quantum numbers – dissociation energy calculations – Birge-sponer extrapolation technique – pre-dissociation spectra – charge
transfer spectra – Fortrat diagram – electronic spectra of molecules – absorbance – oscillator strength;
Photoelectron spectroscopy – basic principles, spectrum, X-ray PES, (ESCA) – vibrational structure – koopman’s theorem – PES of argon, oxygen and nitrogen.

UNIT – V
SPECTROSCOPY - III  15 Hrs
ESR spectroscopy – principle, g-factor, experimental method, spectrum, fine and hyperfine structures and applications (H-atom, CH₃ radical, p-1,4 benzosemiquinone radical anion, naphthalene anion, Tempol)
NQR spectroscopy – quadrupole movement, coupling constant, quadrupole transition-electric field gradient and molecular structure (7N¹⁴, 5B¹¹, 17Cl³⁶)
Mossbauer spectroscopy – recoilless emission and resonance absorption, experimental method, isomeric shift and electric quadrupole splitting in Fe⁵⁷.

TEXT BOOKS: (UNIT I & II)
2. Ramakrishnan, V., Gopinathan M.S., 1988, Group theory in chemistry, Vishal publication, New delhi, India.

REFERENCE BOOKS:

Course Designers

1. Dr. R. Sayeekannan,
2. Dr. A. R. Ramesh,
3. Dr. T. Arumuganathan,
THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course: M.Sc.(Core elective 2)  Int. Marks : 75
Class: II MSc Chemistry  Ext. Marks : 25
Semester: III  Max. Marks : 100
Sub. Code: 3PCE1(C)  Hours/Week : 5
Title of the Paper: Computer Applications in Chemistry (Option A)  Credits : 5

COURSE OUTCOMES
On the successful completion of the course, students will be able to

• Understand the concepts in internet and E-mail.
• Have an understanding on HTML and JAVA APPLET and also to emphazise on their applications in chemistry.
• Get hands-on experience on chemistry-related software and their applications

UNIT-I: INTERNET AND E-MAIL  T: 10 + P: 5 Hrs

UNIT- II: HTML  T: 8 + P: 7 Hrs
HTML - Need- Structure of HTML Document- HTML Tags- Horizontal line Tags- Background and Text color Tags- Font Tags- MARQUEES Tags- Adding pictures - Ordered and Unordered Lists- Creating Links- Construction of Periodic Table with required data for first ten elements- Frames – Developing and hosting of Web Pages for a given molecule / chemical.
JAVA APPLETS: - Simple and Java applets with graphics- Applications of applet to draw 2D and 3D view of molecules.

UNIT-III: APPLICATIONS OF CHEMDRAW AND CHEM 3D SOFTWARE IN CHEMISTRY  T: 8 + P: 7 Hrs
UNIT-IV: APPLICATIONS OF SHELX PROGRAM IN CHEMISTRY

T: 5 + P: 10 Hrs


UNIT-V: APPLICATIONS OF RASMOL and MATLAB IN CHEMISTRY-III

8 + P: 7 Hrs

RASMOL: - Introduction- User commands- Identification of disulfide-bridges and visualization of : -hydrophobic and polar residues, the distribution of polar and non polar amino acids, side chain of carboxylate and amine , the different structural motives like α-helix, β-sheet and β - turn, the amino acids bound to Zn, active site of carboxypeptidase A, the environment of the active center.

MATLAB: - Introduction-advantages- getting started- windows for workspace, command interpretation, command history and current history- Addition- Use of sine and Cosine of angles(pi)- variable ‘ans’- order of operations- significant decimals- Representation of matrix- getting transpose of a matrix- display of images- saving images-solving linear equations(case m=n only).

Text Books:
   Publishing Company Ltd., New Delhi, 2nd Edn., 15th Reprint
3. C. Xavier, 2000 World wide web design with HTML, , Tata McGraw-Hill
   Publishing Company Ltd., New Delhi, 2nd Reprint.

Reference Books:
   Publishing Company Ltd., New Delhi.
3. Alexis Leon and Mathews Leon, 2000 Internet for Everyone, Leon TECH World, 
   Publishers & Distributors Ltd..
   Ltd., NewDelhi, 11th Reprint.
   Company Ltd., New Delhi, 4th Edn.
   Indian Edn..
   Company Ltd., New Delhi, 2nd Edn.
10. Shelx, Rasmol and MATLAB- Manuals.
REFERENCES in the NET

Course designers
1. Dr. A. Elangovan
2. Dr. R. Mahalakshmy
3. Dr. A. Tamilselvi
Course: M.Sc.(Core elective 2)  
Class: II M.Sc Chemistry  
Semester: III  
Sub. Code: 3PCE1(A)  
Title of the Paper: Advanced Organic Synthesis  
(Credit: 5)

COURSE OUTCOMES
On the successful completion of the course, students will be able to

- gain knowledge in Stereoselective and retrosynthetic analysis
- understand about the guest-host interaction.
- gain scientific and technical knowledge in Green chemistry and biotransformation

UNIT-I REETEROSESYNTHETIC ANALYSIS (15 Hrs)
Synthetic Strategy of the following target molecules: longifolene-juvabione-jasmone- 5-hexenoic acid-trans-9-methyl I-decalone- bicyclo (4,1,0) heptan-2 one- α-onocerin-isonootketone.

UNIT-II BIOGENESIS OF ALKALOIDS,TERPENOIDS & FLAVONES (15 Hrs)

Terpenoids: Geranyl diphosphate-Geraniol-Farnesol–Camphor-limonene-citronellol-caryophyllene(Corey methods) – santonin

UNIT-III BIOSYNTHESIS OF FATTY ACIDS (15 Hrs)

UNIT-IV: DYES (15 Hrs)

UNIT – V : BIOTRANSFORMATION (15 Hrs)
Text Books:

References:
5. Chemistry of Carbocyclic Compounds-Azhuwalla
6. Pharmaceutical, Medicinal and Natural Product Chemistry-P. S. Kalsi & Sangeetha Jagtap-Narosa Publishing House
8. Synthetic Dyes-Gurudeep Chatwal

Course Designers
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
COURSE OUTCOMES

On the successful completion of the course, students will be able to

- Kindle the synthetic aptitude on the heterocycles and chemistry of steroids and vitamins.
- Understand the chemistry of heterocycles as alkaloids and terpenoids in natural products.
- Understand the Protein and Green Chemistry.

Unit - I CHEMISTRY OF HETEROCYCLIC COMPOUNDS


Introduction to anthocyanins and flavonoids

Unit - II CHEMISTRY OF TERPENOIDS AND ALKALOIDS

Chemistry of terpenoids: General methods of determining structure of terpenoids – α-pinene, Zingiberene, and Abietic acid.


Unit- III CHEMISTRY OF STEROIDS AND VITAMINS

Chemistry of steroids: Introduction – Structural elucidation of Cholesterol – Androsterone and Testosterone (male sex hormones) – Oesterone, progesterone (Female sex hormone).

Classification of Vitamins: Nomenclature of Vitamins – Structure and Biological functions of vitamins: Vitamin A (Retinol), Vitamin B2 (Riboflavin), Vitamin B6 (Pyridoxine), Vitamin B12, Vitamin C, D and E (Structure elucidation and synthesis not required).

Unit IV CHEMISTRY OF PEPTIDES AND NUCLEIC ACID

(a) Polypeptides – Classification - the peptide linkage - Structure of amino acids – 1⁰, 2⁰, 3⁰ and quaternary structure) – Solid phase peptide synthesis (Merifield) – use of protecting groups and reagents – Structural elucidation of glutathione, thyroxin and oxytocin.

(b) Nucleosides, Nucleotides and Nucleic acids – structure and synthesis of nucleosides and nucleotides – Elementary treatment on the structure of DNA and RNA.
Unit – V GREEN CHEMISTRY (15 hrs)

Text Books:

Reference Books


Course designer
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Sc Chemistry (Core 11)  Int. Marks : 25
Class : II Year  Ext. Marks : 75
Semester : IV  Max. Marks : 100
Sub. Code : 4PC2  Hours/Week : 5
Title of the Paper : Inorganic Chemistry- IV  Credits : 4

COURSE OUTCOMES
On the successful completion of the course, students will be able to
• gain knowledge on organo metallic chemistry and transition metal catalysts.
• understand bioinorganic chemistry.
• get an idea about inorganic photochemistry.
• understand the concept of PES, EPR, Mossbauer spectroscopic techniques.

UNIT – I  ORGANOMETALLIC CHEMISTRY – I  15 Hrs

UNIT – II  ORGANOMETALLIC CHEMISTRY – II  15 Hrs

UNIT –III  BIO-INORGANIC CHEMISTRY  15Hrs

UNIT-IV  PHYSICAL METHODES IN INORGANIC CHEMISTRY-II  15Hrs
Electron paramagnetic resonance spectroscopy: Applications of hyperfine splitting and g factor to structural elucidation- Zero field splitting-Krammer’s Degeneracy- EPR spectra of Cu (II) and Mn (II) in various site symmetry- covalency of metal-ligand bonding

Mossbauer spectroscopy: Basic principles- Doppler effect- Isomer shift- Electron nuclear hyperfine interactions- Quadrupole and magnetic interactions in the study of structure and bonding in Iron and Tin complexes and in Biological systems.

UNIT –V INORGANIC PHOTOCHEMISTRY 15 Hrs

Excited states of coordination complexes – properties of excited states charge transfer and energy transfer – photochemical pathways.

Photo redox reactions of Co(III) and Cr(III) complexes – photosubstitution reactions – photoaquation, photoanation and photorearrangements - Role of TiO₂ in solar energy conversion – Photoredox chemistry of Ruthenium bipyridyl and Ruthenium(III) poly pyridyl compounds- energy conversion and photochemical decomposition of water using Ru complexes- storage of solar energy.

TEXT BOOKS: -

REFERENCE BOOKS: -

Course designers
1. Dr. A. Suganthi
2. Dr. A. Elangovan
3. Dr. D. S. Bhuvaneshwari
4. Dr. K. Selvakumar
Course: M.Sc Chemistry (Core 12)  Int. Marks : 25
Class: II Year  Ext. Marks : 75
Semester: IV  Max. Marks : 100
Sub. Code: 4PC3  Hours/Week : 4
Title of the Paper: Physical Chemistry-IV  Credits : 4

Course Outcomes:
On successful completion of the course students will be able to
- Impart knowledge on various kinetic theories and reaction rate
- Understand the physical concepts of photochemistry and surface chemistry
- Gain knowledge on basics and applications on polymer chemistry

UNIT-I  (12 hrs)
CHEMICAL KINETICS-I
Simple Collision theory- modification - Absolute reaction rate theory (ARRT) - Statistical and thermodynamics formulation - Comparison of ARRT with collision theory- Significance of entropy of activation- Relation between $\Delta H$ and $E_a$ - Transmission co-efficient - ARRT of termolecular reactions – Unimolecular reactions - Lindemann, Hinshelwood, RRKM and Slater treatments. –solution kinetics – ARRT of reaction in solution – Influence of ionic strength on the rates of ionic reactions (salt effects).

UNIT-II  (12 hrs)
CHEMICAL KINETICS-II

UNIT-III  (12 hrs)
PHOTOCHEMISTRY
Physical properties of the electronically excited molecules – radiationless transitions – Jablonski diagram-Internal conversion and intersystem crossing – Stern-Volmer equation and its application – radiative transition – fluorescence, phosphorescence and other deactivation processes; Effect of temperature on emission process – photosensitization and Chemiluminescence; Experimental techniques in photochemistry, chemical actinometers. photochemical Kinetics of $H_2$-$X_2$ reactions – Photolysis of acetaldehyde Photodimerisation of anthracene – Photoequation of $[Cr(NH_3)_5NCS]^2+$ and photo isomerisation of Cis-bis glycinate Pt(II); Applications of photochemistry – Solar energy conversion and storage – photo synthesis- excited state acidic property and energy transfer.

UNIT-IV  (12 hrs)
SURFACE CHEMISTRY
Physisorption and Chemisorption – adsorption isotherm – derivation of Langmuir and Freundlich, derivation of B.E.T equation of multilayer adsorption – application of BET equation to surface area determination, derivation of Gibbs adsorption isotherm. Heterogeneous catalysis and their kinetics – chemical reactions on solid surfaces -

UNIT-V
POLYMER CHEMISTRY
(12 hrs)

Industry important polymers – Preparation, Properties and uses of (LDPE & HDPE), Polystyrene, polyester, acrylo polymer, Teflon, Phenolic resins, amino resins and epoxy resins, Polyvinyl acetate-composites of Resins-ABS-Conducting Polymers-Polyacetylene, Polyaniline, Inorganic polymer-Silicone and Biopolymers-cellulose.

Text Books:

Reference Books:

Course Designers
1. Dr. R. Sayee Kannan,
2. Dr. A. R. Ramesh,
3. Dr. T. Arumuganathan,
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Sc.Chemistry (Core 7 lab)  
Class : II Year  
Semester : IV  
Sub. Code : 4PCL1  
Title of the Paper : Organic Chemistry Lab 2

Int.Marks : 40  
Ext. Marks : 60  
Max. Marks : 100  
Hours/Week : 5

Credits : 5

Course Outcomes:
On successful completion of the course students will be able to
  • Prepare organic compounds in two steps.
  • Do quantitative estimation of organic compounds.

DO Double Stage Preparation
1. p-Nitroaniline
2. p-Bromoaniline
3. 1,3,5-Tribromobenzene
4. Benzanilide
5. m-Nitrobenzoic acid
6. p-Iodonitrobenzene (III stage)
7. 2,5-dihydroxy acetophenone

(any five preparations only)

ESTIMATION
1. Estimation of glucose – Lane and Eynon method
2. Estimation of glucose-Betrand method
3. Estimation of ethyl methyl ketone
4. Estimation of acetone
5. Estimation of glycine

Course Designers
1. Dr. P. Prakash
2. Dr. R. Mahalakshmy
Course: M.Sc. Chemistry (Core 8 Lab)  Int. Marks: 40
Class: II Year  Ext. Marks: 60
Semester: IV  Max. Marks: 100
Sub. Code: 4PCL2  Hours/Week: 5
Title of the Paper: Inorganic Chemistry Lab 2  Credits: 5

Inorganic Estimations and Preparations

I. Gravimetric Analysis:
   a) Estimation of lead as lead chromate
   b) Estimation of Nickel as Ni-DMG
   c) Estimation of Magnesium as Magnesium oxinate

III. Preparation: (Any FOUR)
   a) Potassium cupric sulphate
   b) Potassium trioxalatoaluminate
   c) Hexathioureaplumbus nitrate
   d) Tetrammine copper(II)sulphate
   e) Ferrous/Ferric oxalate

III. Colorimetry:
   a) Estimation of Iron (III)
   b) Estimation of Copper (II)

IV. Chromatography (Demo only NOT for the Exam)
   a) Paper Chromatography: Chromatographic separation of a mixture of Co, Mn, Ni and Zn
   b) Column Chromatography: Chromatographic separation of potassium permanganate and dichromate.

V. UV-visible spectrophotometer (Demo only NOT for the Exam)
   Determination stability constant for a complex.

Total Marks = 100 (Internal 40 + External 60)

Course Designers
1. Dr. A. Suganthi
2. Dr. D. S. Bhuvaneshwari
Course : M.Sc. Chemistry
Class : II Year
Semester : IV
Sub. Code : PJ
Title of the Paper : Project

Int. Marks : 40
Ext. Marks : 60
Max. Marks : 100
Hours/Week : 6

Credits : 3

Course Outcomes

On successful completion of the course students will be able to

1. Get skills on developing new materials through new synthetic routes and

2. Characterize the material using different techniques.

2. Learn research methodologies along with literature survey.

Marks
External Examiner : Viva : 20
External Examiner : Evaluation of Project : 40
Internal Examiner : Evaluation of Project : 40

100

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M.Sc., Chemistry (Special)
Self finance
### THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

**MASTER OF CHEMISTRY**
**Semester – I**

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- For core practical credits will be given at the end of even semester (Year wise practical)
### A) CONSOLIDATION OF CONTACT HOURS AND CREDITS: PG

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### B) Curriculum Credits

- **Core**: $(16+12+12+12) = 52$ Credits
- **Core Lab**: $(12+13) = 25$ Credits
- **Core electives**: $5+5 = 10$ Credits
- **Project**: $= 03$ Credits
- **Total**: $= 90$ Credits
COURSE OUTCOMES

On the successful completion of the course, students will be able to

- Understand the concept of aromaticity.
- Gain the knowledge about structure and stability of reaction intermediates.
- Understand the reaction mechanism, isomerism and stereochemistry of organic molecules.

UNIT-I Delocalized chemical bonding, Aromaticity and Reaction intermediate (12 hrs)

Electron displacement – Steric effect – Tautomerism
Concept of aromaticity – Benzenoid and non-benzenoid compounds – Huckel’s rule - Non aromatic and anti aromaticity - Alternant and non alternant hydrocarbons - aromaticity of cyclopentadienyl anion and Tropylium cation – Azulenes and annulenes.

UNIT - II Reaction mechanism-I (Basics) (12 hrs)


UNIT - III Reaction mechanism-II (Substitution Reactions) (12 Hrs)

Aliphatic Nucleophilic Substitution Reactions - Mechanism – S_N1 and S_N2, mixed S_N1& S_N2, S_Ni, SET, Neighboring group participation by σ and π bonds – Reactivity at an allylic, aliphatic trigonal and vinylic carbon – Effect of substrate structure, attacking nucleophile, leaving group and reaction medium on reactivity – Ambident nuleophiles.
Aromatic Nucleophilic Substitution Reactions – Unimolecular, Bimolecular and Benzyne mechanism – Effect of substrate, leaving group and attacking nucleophile.
Electrophilic substitution reactions:
Aliphatic: Bimolecular mechanism SE2 and SE1 – Aromatic: Arenium ion mechanism – Orientation and reactivity: Ortho and Para ratio, partial rate factor
UNIT-IV Reaction Mechanism III (Elimination reactions) (12 hrs)
E₁, E₂ and E₃CB mechanism- Competition between substitution and elimination – orientation of double bonds (Bredt’s rule and Hofmann and saytzeff rules) – Effect of substrate structure, attacking nucleophile, leaving group and nature of reaction medium on reactivity – Mechanism and orientation in pyrolytic eliminations - Cope and Chugaev reaction (cis-elimination)

UNIT-V Reaction Mechanism IV (Addition to carbon-Carbon multiplebonds) (12 hrs)
Electrophilic, Nucleophilic & free radical addition – Mechanism, Orientation and reactivity and reactions - addition to conjugated systems- addition to α,β-unsaturated carbonyl and nitrile systems- Michael addition – addition of Grignard reagents-Diels Alder reaction- Enamine reaction - Mechanism of Reformatsky reaction- Darzen reaction- Mannich reaction - Wittig reaction - Stobbe and Dieckman condensation.

Text books:

Reference Books:
2 E.S. Gould,1960 Mechanism and structure in Organic Chemistry, Holtoo INC.

Course designer
1 Dr. P. Tharmaraj
2 Dr. P. Prakash
3 Dr. R. Mahalakshmy
4 Dr. A. Tamil Selvi
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Sc Chemistry(Spl) (Core 2)  Int. Marks : 25
Class : I Year  Ext. Marks : 75
Semester : I  Max. Marks : 100
Sub. Code : S1PC2  Hours/Week : 4
Title of the Paper : Inorganic Chemistry- I  Credits : 4

COURSE OUTCOMES
On the successful completion of the course, students will be able to
- Understand the concepts of bonding and electronic structure of atom.
- Write the concept of acid base systems and non aqueous solvents.
- Understand nuclear Chemistry.

UNIT – I: ELECTRONIC STRUCTURE OF ATOM  12 Hrs
Modern views on atomic structure: Wave mechanical description of electron and orbitals, radial density functions and orbital energies, angular functions and orbital shapes-term symbol.
Modern periodic table: Periodic properties-Ionisation potential, Ionic radii and covalent radii, Electron affinity, Electronegativity and their trend in the periodic table- Comparison of transition metals of 3d, 4d and 5d series.

UNIT – II: NATURE OF THE CHEMICAL BOND  12Hrs

UNIT – III: BONDING APPLICATION  12 Hrs
Application of VB and MO theories to the structure of homonuclear (H₂, B₂, C₂, N₂ and O₂) and heteronuclear (CO, NO, HCl, HF) diatomic and selective polyatomic molecules (CO₂²⁻, NO₂, BeH₂, CO₂) comparison of VB and MO theories. Bond properties, bond order, bond energy, bond length and bond polarity. Partial ionic character of covalent bonds-Fajan’s Rule –Effects of polarization. VSEPR theory and its applications to H₂O, NH₃, IC₁₂⁻, IF₅ IF₇, ClO₄⁻ ions. VSEPR applied to Xenon compounds like Xenon halides and xenon oxides.

UNIT – IV: ACID-BASE SYSTEMS AND NON-AQUEOUS SOLVENTS.  12Hrs
UNIT – V: NUCLEAR CHEMISTRY 12 Hrs

TEXT BOOKS:

REFERENCE BOOKS:

Course Designer
1. Dr. A. Suganthi
2. Dr. A. Elangovan
3. Dr. D.S. Bhuvaneswari
4. Dr. K. Selvakumar
Course: M.Sc Chemistry (Spl) (Core 3)  
Int. Marks: 25

Class: I Year  
Ext. Marks: 75

Semester: I  
Max. Marks: 100

Sub. Code: S1PC3  
Hours/Week: 4

Title of the Paper: Physical Chemistry - I  
Credits: 4

Course Outcome:
On successful completion of the course students will be able to
- Understand the properties of gases, liquid crystals, theory of thermodynamic equilibrium and non-equilibrium.
- Aware of concepts of quantum chemistry and their applications
- Develop their knowledge in physical features of biochemistry

UNIT-I
PROPERTIES OF GASES AND LIQUID CRYSTAL  (12 HRS)
Equations of states - molecular speeds- Maxwell distribution of molecular velocities - one, two and three dimensions; Energy distribution-Maxwell – Boltzmann distribution law- Rotation, vibrations and translational degree of freedom- principle of equipartition of energy and heat capacity; Molecular collisions- collision diameter, cross-section, number, frequency, mean free path (definition only); Transport phenomena in gases - Viscosity of gases – viscosity in terms of momentum transfer, thermal conductivity, and diffusion.

Liquid crystals- Nematic (p-methoxycinnamic acid), cholesteric (cholestryl benzoate), smectic (ethyl-p-azoxybenzoate)- theory and its application in liquid crystals display.

UNIT-II
THERMODYNAMICS – EQUILIBRIUM AND NON-EQUILIBRIUM  (12 HRS)
A general review of enthalpy, entropy and free energy concepts: Nernst heat theorem-Genesis of third law and its limitations - derivation of third law and their application to real gases- calculation of (δH/dP)T, (δE/dV)T and μj.T for gases-
Thermodynamics of open systems - partial molar properties- internal energy, molar enthalpy, molar entropy, molar volume, free energy (chemical potential) – determination of partial molar properties; Chemical potential- relationship between partial molal quantities - Gibbs - Duhem equation- Duhem Margules equation; thermodynamic properties of real gases- Fugacity concept- Determination of Fugacity of real gases.
Electrolytes and Non-Electrolytes- Equilibrium thermodynamics- Gibbs phase rule and its application to three component systems- quantitative treatment of Le Chatlier principle-equilibria respond to pressure and temperature; Non Equilibrium Thermodynamics -Basic concepts - Principle of microscopic reversibility and the Onsager reciprocal relations.
UNIT –III
QUANTUM CHEMISTRY-I  (12 HRS)
Black Body radiation- Heisenberg’s uncertainty principle- de Broglie wave particle duality- Experimental verification of matter waves- Compton effect- The Schrodinger equation and the postulates of quantum mechanics- operators –linear and non-linear operators-commutative and non-commutative operators- Hermitian operators- Eigen function, Eigen values and degeneracy- Orthogonality and Normalization of wave functions- Derivation of Schrodinger’s wave equation.

UNIT- IV
QUANTUM CHEMISTRY-II  (12 HRS)
Application of quantum mechanics to simple system-Application of SWE to free particle moving in one dimension- particle moving in a one dimension box - particle moving in 3D cubical and rectangular box- Quantum Mechanical tunneling - particle in a ring- rigid rotor- Simple Harmonic oscillator - hydrogen atom- angular momentum spin momentum- ladder operator.

UNIT-V
PHYSICO-CHEMICAL PRINCIPLES AND BIOLOGICAL REACTIONS  (12 HRS)
(i) Studies on biochemical equilibria: Buffer system of intracellular fluids – H₂CO₃ / HCO₃⁻ HPO₄²⁻ / H₂PO₄⁻ - Application of Henderson-Hasselbach equation; Ion channels – membrane and static potentials - Role of Na⁺ / K⁺ ions in neural communications –Na⁺ / K⁺ ion pump; allostery and oxygen saturation curves for hemeoglobin and myoglobin – derivation of Hill equation
(ii) Medicinal Chemistry – QSAR; Partition parameters – Partition Coefficients (P) – hydrophobicity or lipophilicity constant (π); Electronic Parameters – Hammett constant (σ); Steric parameters – Taft Steric parameterer (Eσ); Hansch equation; Craig Plot – Topliss Scheme; ΔG criteria for biological reactions – ATP and ADP conversion.

Text Books:

   (ISBN: 9122424082/9788122424089)

**Reference Books:**

**Course Designers**
1. Dr. R. Sayeekannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Sc. Chemistry (Spl) (Core Spl.Lab)  Int. Marks : 40
Class : I year  Ext. Marks : 60
Semester : II  Max. Marks : 100
Sub. Code : S1PCL4  Hours/Week : 4
Title of the Paper: Separation Technique and Quantitative Analysis  Credits : 4

COURSE OUTCOMES
On the successful completion of the course, students will be able to
Gain knowledge of separation technique
Extract the component from the natural source.

I. SEPARATION TECHNIQUE
(i) Chromatographic Separation of Carbohydrates.
(ii) Separation of amino acids by TLC.
(iii) Separation of amino acids by paper chromatography
(iv) Separation of organic compounds by Column chromatography

II. EXTRACTION
(i) Isolation of lactose from milk.
(ii) Isolation of Citric acid from lemon

III. ESTIMATIONS
(i) Iodine value on an Oil using Hanus method.
(ii) Saponification value of an oil.
(iii) Estimation of Ascorbic acid.
(iv) Reichert-Meissel value of an oil.

Course Designers
1. Dr. P. Tharmaraj
2. Dr. S. Pitchaimuthu
THIAGARAJAR COLLEGE, MADURAI- 9  
(Re-Accredited with ‘A’ Grade by NAAC)  
DEPARTMENT OF CHEMISTRY  
(For those who join in 2017 and after)

Course : M.Sc. Chemistry (Spl) (Core 4)  
Class : I year  
Semester : II  
Sub. Code : S2PC1  
Title of the Paper : Organic Chemistry – II

**Course Outcomes**

- On the successful completion of the course, students will be able to
- Understand the principles and application of UV-Vis, IR, NMR and Mass spectrometry.
- Apply the spectroscopy concept in analyzing and determining the structure of organic compounds.
- Gain insight on conformational characteristic of organic acyclic and cyclic compounds
- Identify the effect of conformational flexibility on reactivity.

**Unit-I UV and IR Spectroscopy**  
(12 Hrs)

Ultraviolet spectroscopy – basic principle – instrumentation – the absorption laws, types of electronic transitions – Effect of solvent and hydrogen bonding on \( \lambda_{\text{max}} \) values - Woodward rules to calculate \( \lambda_{\text{max}} \) values of conjugated dienes, conjugated polyenes, and carbonyl compounds

Infrared spectroscopy – basic principle – Molecular Vibrations – instrumentation – characteristic IR absorption of different functional groups – factors influencing the vibrational frequencies

**Unit-II \(^1\text{H} \) NMR and \(^{13}\text{C} \) NMR spectroscopy**  
(12 Hrs)

\(^1\text{H} \) NMR spectroscopy: Basic principles – number of signals – chemical shift – factors influencing chemical shift – spin-spin coupling – coupling constant and factors influencing coupling constant. Simplification of complex spectra – shift reagents, deuterium substitution and spin decoupling.

\(^{13}\text{C} \) NMR spectroscopy: Basic principle – comparison with \(^1\text{H} \) NMR – noise decoupling – off resonance decoupling – factors affecting the C-13 chemical shifts.


**UNIT-III: Mass Spectroscopy, ORD and CD**  
(12 hrs)

Basic instrumentation of Mass spectrometer - types of ions – molecular, isotopic, metastable and fragmentation ions – Tests for molecular ion peak – General fragmentation modes- Retro Diels - Alder reactions – Mc Lafferty rearrangement – Fragmentation pattern of

Optical rotatory dispersion (ORD) and Circular Dichroism (CD): Circularly polarized light – Circular birefringence and CD – plain curves and their applications – Cotton effects curves – structural applications – axial haloketone rule, octant rule and their applications.

Solving problems based on UV, IR, NMR and Mass data.

UNIT IV - Organic Stereochemistry (12 hrs)

Optical isomerism

Symmetry elements – the concept of chirality – chirality about a center – specification by Cahn-Ingold-Prelog notations – compounds with more than one chiral center – erythro, threo and meso nomenclature – concept of prochirality – homotopic, enantiotopic and diastereotopic ligands and faces – Asymmetric synthesis – Cram’s rule and Prelog’s rule.

Optical activity in allenes and spiranes – StereoChemistry of nitrogen compounds.

Geometrical isomerism

E and Z notation – Determination of configuration of geometrical isomers by simple techniques like hydroxylation, hydroboration and methods based on physical properties – Stereoisomerism in cyclic compounds – 3, 4 and 5 membered ring systems.

UNIT V – Conformational Analysis (12 hrs)


Text Books:

Reference Books:

Course designer
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi
THIAGARAJAR COLLEGE, MADURAI- 9  
(Re-Accredited with ‘A’ Grade by NAAC)  
DEPARTMENT OF CHEMISTRY  
(For those who join in 2017 and after)  

Course: M.Sc Chemistry (Spl) (Core 5)  
Class: I Year  
Semester: II  
Sub. Code: S2PC2  
Title of the Paper: Inorganic Chemistry- II  

Course Outcomes  
On the successful completion of the course, students will be able to:  
- Study the solid state chemistry of inorganic compounds.  
- Understand analytical Chemistry.  
- Know the techniques like Colorimetry, Fluorimetry, AAS, TGA, DTA, Chromatography and cyclic voltammetry.  

 UNIT I  SUPRAMOLECULAR CHEMISTRY  
(12 Hrs)  
Definition, Nature of supramolecular interactions- Non-Covalent interactions, Host-guest interaction, complexing involving crowns and cryptands-cyclodextrine - Inclusion compounds-Clatharates-intercalation compounds-Molecular recognition, Types of recognition, Self-assembly. General properties of Supramolecular complexes- Molecular Library- Transition metal mediated supramolecules-Directional bond approach- Molecular triangles (Pd and Pt)- Molecular squares (Pd, Pt and Re)- Molecular rectangles-(Pd, Pt, Cu and Re) Molecular Cages (Pd, Pt and Re) and their applications.

 UNIT II  SOLID-STATE CHEMISTRY  
(12 Hrs)  

 UNIT-III Inorganic Rings, Cages, Clusters and Polymers- I  
(12 Hrs)  
Electron deficient compounds: Borane and carboranes- Synthesis, structure and bonding (VBT and MO approach) –topological treatment-wades rule –styx numbers-structural studies by NMR-metallocarboranes-other heteroatom boron derivatives, borates-boroxines-B-P and B-As heterocycles. Synthesis, structure and bonding in Binary sulphur nitrils, S-N cations and anions, cyclic S-N compounds, S-N halogen compounds-bonds and electron counting in

UNIT- IV Inorganic Rings, Cages, Clusters and Polymers- II (12 Hrs)

UNIT-V ANALYTICAL CHEMISTRY-1 (12 Hrs)
Principles and practice of complexometric estimations/- Spectro analytical methods:-Principles and applications of colorimetry and spectro photometry, fluorimetry, nephelometry and turbidimetry-emission and atomic absorption spectroscopy (AAS) and atomic fluorescence spectroscopy.

ANALYTICAL CHEMISTRY-II
Principles, Instrumentation and applications of Cyclic Voltametry, Thermogravimetry, Differential thermal analysis and differential scanning colorimetry, Chromatography: GC, HPLC and Ion Exchange Chromatographic techniques.

Text book:

REFERENCE BOOKS:


Course designers
1 Dr. A. Suganthi
2 Dr. A. Elangovan
3 Dr. D. S. Bhuvaneshwari
4 Dr. K. Selvakumar
Course : M.Sc Chemistry (Spl)(Core 6) Int. Marks : 25
Class : I Year Ext. Marks : 75
Semester : II Max. Marks : 100
Sub. Code : S2PC3 Hours/Week : 4
Title of the Paper : Physical Chemistry - II Credits : 4

Course outcomes:
On successful completion of the course students will be able to
- Learn about theories and applications of electrochemistry
- Understand the need and applications of statistical thermodynamics
- Gain knowledge in advanced quantum chemistry

UNIT-I
(12 Hrs)
ELECTROCHEMISTRY-I

UNIT-II
(12 Hrs)
ELECTROCHEMISTRY-II

UNIT-III
(12 Hrs)
STATISTICAL THERMODYNAMICS-I
Need for statistical mechanics or thermodynamics-Ensemble- types of ensemble – micro canonical - canonical and grand canonical ensemble; Phase space- microstates- probability and distribution- Maxwell Boltzmann classical distribution law- derivation in term of degeneracy; Partition function (Q) – relation between partition function and the following thermodynamic functions – internal energy (E), Helmholtz free energy (A), Pressure (P), Enthalpy (H), Gibbs free energy (G), chemical potential (µi), heat capacity (Cv) and entropy (S); Derivation of Sackur-Tetrode equation-thermodynamic properties of monoatomic gases.
UNIT-IV

STATISTICAL THERMODYNAMICS-II

(12 Hrs)


UNIT –V

(12 Hrs)

Approximation methods, application of SWE to many electron systems.


Text Books:
2. Crow Dr., 1988, Principles and Applications of Electrochemistry, Chapman Hall, UK.

Reference Books:

Course Designed by

1. Dr. R. Sayee Kannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan
Course: M.Sc.Chemistry (Spl)(Core elective 1)  Int. Marks : 75
Class: I MSc Chemistry  Ext. Marks : 25
Semester: II  Max. Marks : 100
Sub. Code: S2PCE1 (C)  Hours/Week : 4
Credits : 5

Title of the Paper: C-Programming: Fundamentals and Applications in Chemistry (Option A)

COURSE OUTCOMES
On the successful completion of the course, students will be able to
- To have an Overview of C-Programme.
- To comprehend the basic ideas of Operators, Data input and Output.
- To know about Decision Making, Arrays, and Functions and to understand Applications of C in Chemistry

UNIT-I Introduction and overview of C (12 HRS)
Introduction – Importance of C-structure of C-programs- Simple programs-style of the language.
Characters–Keywords, Variables and parameters-Data types-Constants-Declaration of and assignments of values to variables.
Operators-Arithmetic, Relational, Logical, assignment, Increment and Decrement, Conditional and bitwise operators-Special operators.

UNIT-II Data input and Output (T: 6 HRS + P: 6 HRS)
Character input- The getchar function – Character output- The putchar function – Entering input data- the Scanf function-Writing output data-The printf function- Formatted input and output data-the gets and puts functions-preparing and running a complete program.

UNIT-III (T: 8 HRS + P: 4 HRS)
Arrays: One dimensional array –Two dimensional arrays –Initializing two dimensional arrays- Multidimensional arrays.
User defined functions: Need for user–defined functions – A multifunction program – The form of C functions -Return values and their types- Calling a function –Category of function- No arguments and no return values –Nesting functions- Recursions- The scope and life time of variables in function.
UNIT-IV  Applications of C in Chemistry-I  

(T: 4 HRS + P: 8 HRS)

Explanation of the formulae, equations and programs to solve the following problems in chemistry:

14. Calculation of pH.
15. Determination on First Order rate constant for the given reaction
16. Evaluation of lattice energy using
   i). Born- Haber Cycle
   ii). Born –Lande equation
17. Computing ionic radii- Lande’s method and Paulings method
18. Calculation of Normality, Molarity and Molality of a given solution
19. Converting Kelvin to Celsius temperature and vice versa.
20. Determination of enthalpy of a given solution
21. Evaluation of Cell constant
22. Calculation of energy of Hydrogen atom spectral lines.

UNIT-V: Applications of C in Chemistry-II  

(T: 4 HRS + P: 8 HRS)

Explanation of the formulae, equations and programs to solve the following problems in chemistry:

**Organic Chemistry:**

3. Use of Recursive functions to calculate the number of $\pi$ Resonance structures for an organic conjugated system using
   $$\text{res} - \text{str} = n! / ((n/2)! * ((n/2) + 1)!$$
4. Empirical formula of Hydrocarbons and other Organic compounds.

**Inorganic Chemistry:**

1. Array manipulation to balance the chemical equations.
2. Half life and average life periods of radioactive nuclei.
3. Binding energy of nucleus.
4. Program to get output as First ten elements of Periodic Table with their Name, Symbol, Atomic number and Atomic Weight.

**Physical chemistry:**

1. Calculation of RMS, average and MPV of gases.
2. Solving Quadratic equation to evaluate the Equilibrium constant for the reaction
   $$\text{H}_2 + \text{I}_2 \rightarrow 2\text{HI}$$
3. Illustrate use of Loop to calculate the NMR frequency for a nucleus with Spin $\frac{1}{2}$
4. Mean activity coefficient of an Electrolyte (KCl)

**TEXT BOOK**


**REFERENCES:**


**Course designer**

1. Dr. A. Elangovan
2. Dr. R. Mahalakshmy
3. Dr. A. Tamilselvi
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course: M.Sc Chemistry (Spl) (Core elective 1)  Int. Marks: 75
Class: I Year  Ext. Marks: 25
Semester: II  Max. Marks: 100
Sub. Code: S2PCE1(M)  Hours/Week: 4
Credits:5

Title of the Paper: Medicinal Chemistry (Option B)

COURSE OUTCOMES

On the successful completion of the course, students will be able to
1. Understand the concept of pharmacokinetics, pharmacodynamics drug discovery by design.
2. synthesis different types of drugs.

Unit – I :: Introduction to Drug Design:  12 hrs

a) ADME Properties
The pharmacokinetics phase-Adsorption-Distribution, Metabolism-Elimination-Bioavailability of drug. pharmacokinetics models, Intravascular and Extravascular administration. The use of pharmacokinetics in Drug design.

b) Pharmacodynamics - Stereoelectronic structure.

Unit II Drug Discovery by Design  12 hrs

a) Stereochernistry and Drug Design
Structurally rigid Groups –procaine, Acetylcholine. Conformation-Syn and Anti Acetylcholine, Phenyl ethanoate methiodides. Configuration-Variations in the biological activities of stereoisomers

b) Strutural –Activity –Relationship (SAR)
Changing the size and shape.Changing th degree of unsaturation. Introduction or removal of ring system. Introduction of new substituents-methyl group, Halogens, hydroxyl groups, Basic groups, carboxylic and sulphonic acid groups. Changing the excisting substituents of lead-isosteres,bioisoteres.

Unit III a)Quantitative-structural Activity-Relationship (QSAR)  12 hrs

b) Combinatorial Chemistry
Basic concepts-The design of combinatorial syntheses. The general technique used in combinatorial synthesis i) Solid support mthod-parrllel synthesis –Furka’s mix and split techniques-sequential chemical tagging methods-Still;s binary code Tag systemcomputerised tagging. ii) Combinateral synthesis in solution iii) Screening and deconvolution
Unit – IV  

a) Antineoplastic Agents:  
Introduction, cancer chemotherapy, special problems, role of alkylating agents and antimetabolites in treatment of cancer  

b) Psychoactive drugs – The chemotherapy of Mind:  
Introduction, neurotransmitters, CNS depressants, general anaesthetics, mode of action of hypnotics, sedatives, neurochemistry of mental diseases  

c) Cardiovascular Drugs and Local Antinfective Drugs:  
Introduction, Cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output.  

Unit V Synthesis of Drugs  

a) Synthesis of Antineoplastic agents  
Mechlorethamine, Cyclophosphamide uracil, mustards and 6-mercaptopurine  

b) Synthesis of cardiovascular drugs  
Amyl-nitrate, sorbitrate, , Verapamil.  

c) Synthesis of Phychoactive drugs  
Synthesis of Diazepam, Chlorazepam, oxazepam, Alprazolam, Phenyltocin or Diphenylhydantoin, Barbitol, Phenobarbital.  

Text Books:  
2. Robert F.Dorge, 2003 Wilson and Gisvold’s Text Book of Organic Medicinal and Pharmaceutical Chemistry,  

Reference Books:  

Course Designers  
1. Dr. P. Tharmaraj  
2. Dr. P. Prakash
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Sc.Chemistry (Spl) (Core 1 Lab )  Int. Marks : 40
Class : I Year  Ext. Marks : 60
Semester : II  Max. Marks : 100
Sub. Code : S2PCL1  Hours/Week : 5
Title of the Paper : Organic Chemistry Lab 1  Credits : 5

Course Outcomes

On the successful completion of the course, students will be able to
1. get practical skills in analyzing a mixture of two organic substances
2. do preparation of organic compounds.

Analysis
Analysis of Organic mixtures: Two component Systems  (Maximum of SIX Mixtures)

Preparation of organic compounds
1. Dibenzal acetone
2. Dimethyl pyrazole
3. DiphenylChalcone
4. P.Nitroacetanilide
5. Salicylaldoxime

Course Designers
1. Dr. P. Tharmaraj
2. Dr. A. Tamilselvi
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Sc. Chemistry (Spl) (Core 2 Lab) Int. Marks : 40
Class : I Year Ext. Marks : 60
Semester : II Max. Marks : 100
Sub. Code : S2PCL2 Hours/Week : 4
Title of the Paper : Inorganic Chemistry Lab 1 Credits : 4

Course outcomes:
To impart skills in both qualitative and quantitative inorganic analysis

I. COMPLEXOMETRIC TITRATIONS WITH EDTA

1. Estimation of ZINC
2. Estimation of MAGNESIUM
3. Estimation of COPPER
4. Estimation of NICKEL
   a) By Direct Method
   b) By Indirect Method

II. SEMI MICRO ANALYSIS

Semi micro analysis of samples containing two Familiar Cations and two Less Familiar Cations. – Maximum of Five samples.

Course Designers
1. Dr. A. Elangovan
   Dr. T. Arumuganathan
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Sc.Chemistry (Spl) (Core 3 Lab)  
Class : I Year  
Semester : I/II  
Sub. Code : S2PCL3  
Title of the Paper : Physical Chemistry Lab 1

Int.Marks : 40  
Ext. Marks : 60  
Max. Marks : 100  
Hours/Week : 5  
Credits : 4

Course Objective:

On successful completion of the course students will be able to
1. Develop practical skills in conductometric and potentiometric titration experiments.
2. Understand experimental knowledge on kinetics and surface chemistry
3. Learn about the estimation of metal ions by using spectrophotometer

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<thead>
<tr>
<th>S. No.</th>
<th>EXPERIMENT</th>
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<tbody>
<tr>
<td>1</td>
<td>Kinetics of Acid hydrolysis of an ester</td>
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<td>2</td>
<td>Estimation of strong acid conductometrically</td>
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<td>3</td>
<td>Estimation of mixture of acids conductometrically</td>
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<td>4</td>
<td>Estimation of NH$_4$Cl by Conductometrically</td>
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<td>5</td>
<td>Estimation of CH$_3$COONa by conductometrically</td>
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<td>6</td>
<td>Estimation of BaCl$_2$ by conductometrically</td>
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<tr>
<td>7</td>
<td>Estimation of Fe(II) using K$_2$Cr$_2$O$_7$ by Potentiometry</td>
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<tr>
<td>8</td>
<td>Estimation of Fe(II) using CAS by Potentiometry</td>
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<tr>
<td>9</td>
<td>Estimation of KI with KMnO$_4$ by Potentiometry</td>
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<td>10</td>
<td>Estimation of Copper (II) by Spectrocolorimetry</td>
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<td>11</td>
<td>Determination of the Adsorption Parameters of Oxalic acid on Charcoal</td>
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<td>12</td>
<td>Adsorption of acetic acid on to activated charcoal</td>
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<tr>
<td>13</td>
<td>Estimation of thiocyanate using iron (III) by spectrocolorimetry</td>
</tr>
<tr>
<td>14</td>
<td>Determination of Iron ion content by photometric method based on complex formation</td>
</tr>
</tbody>
</table>

Course Designed by
1. Dr. R. Sayeekannan
2. Dr. A. R. Ramesh
## COURSE OUTCOMES

On the successful completion of course students will be able to

- Apply various reagents in organic synthesis.
- Write advanced synthetic routes for an ideal organic synthesis.
- Write the mechanism of pericyclic and photochemical reactions.
- Understand the mechanism of molecular rearrangement reaction.

### Unit-I: Reagents in Organic Synthesis (15 Hrs)


### UNIT-II Advanced Organic Synthesis I (Retro-synthesis) (15 hrs)

Disconnection Approach: Importance of organic synthesis-Planning synthesis – Synthons and types – synthetic equivalents – latent functionality Guidelines for best disconnection approach, Reactions involving functional group interconversions – Reterosynthetic analysis – concept of umpolung – two group C-X disconnections and synthetic strategies 1,2-, 1,3-, 1,4-, 1,5- and 1,6- difunctionalised disconnection. Stereoselective and stereospecific reactions-Chemoselectivity–Stereoselectivity- Regioselectivity.

### UNIT-III Advanced Organic Synthesis II (Asymmetric synthesis) (15 hrs)


### UNIT-IV Photochemistry and Pericyclic reactions (15 hrs)

General principles – orbital symmetry considerations related to photochemical reactions, thermal versus photochemical reactions – principles of energy transfer – photochemical reactions of ketones – Norrish type I and type II reactions – Paterno Buchi reaction – Dienone
photochemistry – photo reduction, photochemical oxidation, Barton reaction – photochemistry of alkenes and dienes.


UNIT-V Molecular rearrangements (15 hrs)
Acid catalyzed rearrangement – Arndt-Eistert synthesis – carbon to nitrogen migration – Hofmann rearrangement, Curtius rearrangement, Lossen rearrangement, Schmidt and Beckmann rearrangement

Text book:

Reference Books:

Course designer
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy 4. Dr. A.Tamilselvi
Course: M.Sc Chemistry (Spl) (Core 8)  Int. Marks : 25
Class: II Year  Ext. Marks : 75
Semester: III  Max. Marks : 100
Sub. Code: S3PC2  Hours/Week : 5
Title of the Paper: Inorganic Chemistry- III  Credits : 4

Course Outcomes:
On the successful completion of course students will be able to

- understand coordination Chemistry, lanthanides and actinides chemistry.
- write the basic concept, theories , mechanism and spectra of coordination compounds.
- An emphasize is given on Separation techniques of lanthanides and synthesis of actinides.
- gain knowledge about the synthesis, properties, characterization and the applications of nano materials.

UNIT I COORDINATION CHEMISTRY-1 15 Hrs
Nomenclature of coordination complexes-Stereochemistry of coordination compounds: Geometrical isomerism- optical isomerism of complexes having C.N.4,6- stability constants of complexes-stepwise and overall stability constant- their determination- Jobs’ continuous variation method-Chelate effect

UNIT-II COORDINATION CHEMISTRY-II 15 Hrs
(INORGANIC REACTION MECHANISMS)
Substitution reactions- lability-inertness- square planar substitution reactions- Factors affecting reactivity of square planar complexes- Trans effect- Theories of Trans effect- Stereo chemistry of substitution in octahedral complexes.(SN$_1$, SN$_2$, SNI CB)- Reactions of coordinated ligands- Acid hydrolysis- anation reactions and base hydrolysis.

Mechanism of electron transfer reactions- Outer sphere, inner sphere electron transfer reactions- Marcus Theory and its applications. Synthesis of coordination compounds using electron transfer and substitution reaction.

UNIT- III CHEMISTRY OF NANOSCIENCE AND TECHNOLOGY 15 Hrs
Introduction- Types of nano materials-Nanoparticles, nanotubes-Carbon nanotubes: SWCNT and MWCNT, nanowires, nanoribbons, nanorods, nano composites.
UNIT – IV PHYSICAL METHODS IN INORGANIC CHEMISTRY-I 15 Hrs


IR and Raman spectra: Applications of IR and Raman. Selection rules to structure determination – IR spectral studies of carbonyl compounds.

Nuclear magnetic resonance : Application of chemical shift and spin coupling to structure determination using multiple NMR (H,P,F) chemical exchange, dynamic processes in inorganic and organometallic compounds- Fluxional NMR of metal carbonyls and allyl complexes – paramagnetic NMR and contact and pseudo contact shifts.

NQR- Basic theory, principles and applications.

UNIT-V LANTHANIDES AND ACTINIDES 15 Hrs

a) Lanthanides:-

Occurrence- differences between 4f and 5f orbitals-Separation techniques (Fractional crystallisation, precipitation, ion-exchange, solvent-extraction and thermal decomposition- Selective reduction and oxidation)- Electronic configuration- Oxidation states, Lanthanide contraction- Spectral and Magnetic properties- Ln chelates-organometallic compounds of Ln. Uses of lanthanides (shift reagents, Pu bomb) and their compounds- aqueous chemistry of uranyl compounds- position in the periodic table.

b) Actinides:-

Synthesis of elements- Extraction of Th and U and Pu- electronic configuration and oxidation states, spectral and magnetic properties- position in the periodic table.

TEXT BOOKS:


REFERENCES:

Course Designers
1. Dr.A.Suganthi
2. Dr.A. Elangovan
3. Dr.D.S. Bhuvaneshwari
4. Dr.K.Selvakumar
Course: M.Sc Chemistry (Spl) (Core 9)  Int. Marks : 25
Class: II Year  Ext. Marks : 75
Semester: III  Max. Marks : 100
Sub. Code: S3PC3  Hours/Week : 5
Title of the Paper: Physical Chemistry - III  Credits : 4

Course outcomes:
On successful completion of the course students will be able to
- Learn about the fundamentals of symmetry and applications of group theory.
- Understand in detail about IR, Raman and microwave spectroscopy
- Study the concepts of PES, ESR, Mossbauer, NQR spectroscopy and their applications.

UNIT – I
GROUP THEORY – I (Basics of Group Theory)  15 Hrs
(i) Introduction - Symmetry elements and symmetry operations - Definition of mathematical group – four cardinal properties of a group - closure, associative, identity and inverse rule – cyclic group – Abelian group (H2O only) and non-abelian group (NH3 only) – Group multiplication table- C2v and C3v; subgroup – similarity transformation – class of group – Point group – Assignment of point group of simple molecules;
(ii) Matrix-introduction - matrix representation of the symmetry operations – idendity (E), Proper axis of rotation (C_n), Vertical reflection (sigma_v), Improper axis of rotation (S_n) and Inverse (i); (iii) Representation definition – reducible and irreducible representation of a group –block factorization. The great orthogonality theorem (GOT) – rules for writing (properties of) irreducible representations – Projection operator (definition only) – character table definition – construction of character table C2v and C3v.

UNIT – II
GROUP THEORY – II (Applications of Group Theory)  15 Hrs
Prediction of symmetry of atomic orbitals - linear vector, rotation vector – symmetries of tensor like properties (a & g); Prediction of orbitals and hybridization in BF3 and CH4 molecules ; Normal mode analysis – H2O and NH3; Direct product representation and its applications – identification of IR and Raman active vibration of H2O and N2F2 – selection rules to predict allowed and forbidden electronic transition in UV-Visible spectra for example formaldehyde (HCHO); HMO energy calculation for ethylene and butadiene.

UNIT – III SPECTROSCOPY - I  15 Hrs
UNIT – IV SPECTROSCOPY – II 15 Hrs
Electronic spectra of diatomic molecules – molecular quantum numbers – dissociation energy calculations – Birge-sponer extrapolation technique – pre-dissociation spectra – charge transfer spectra – Fortrat diagram – electronic spectra of molecules – absorbance – oscillator strength;
Photoelectron spectroscopy – basic principles, spectrum, X-ray PES, (ESCA) – vibrational structure – koopman’s theorem – PES of argon, oxygen and nitrogen.

UNIT – V
SPECTROSCOPY - III 15 Hrs
ESR spectroscopy – principle, g-factor, experimental method, spectrum, fine and hyperfine structures and applications (H-atom, CH₃ radical, p-1,4 benzosemiquinone radical anion, naphthalene anion, Tempol)
NQR spectroscopy – quadrupole movement, coupling constant, quadrupole transition-electric field gradient and molecular structure (¹⁷N¹⁴, ³⁵B¹¹, ¹⁷Cl³⁶)
Mossbauer spectroscopy – recoilless emission and resonance absorption, experimental method, isomeric shift and electric quadrupole splitting in Fe⁵⁷.

TEXT BOOKS: (UNIT I & II)
2. Ramakrishnan, V., Gopinathan M.S., 1988, Group theory in chemistry, Vishal pub, New delhi,

REFERENCE BOOKS:

Course Designed by
1. Dr. R. Sayeekannan,
2. Dr. A. R. Ramesh,
3. Dr. T. Arumuganathan,
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course: M.Sc. Chemistry(Spl) (Core elective 2)  
Class: II Year  
Semester: III  
Sub. Code: S3PCE1(C)  
Title of the Paper: Computer Applications in Chemistry (Option A)

INT. MARKS: 75  
EXT. MARKS: 25  
MAX. MARKS: 100  
CREDITS: 5  
HOURS/WEEK: 5

COURSE OUTCOMES
On the successful completion of the course, students will be able to
- Understand the concepts in internet and E-mail.
- Have an understanding on HTML and JAVA APPLET and also to emphasize on their applications in chemistry.
- Get hands-on experience on chemistry-related software and their applications

UNIT-I: INTERNET AND E-MAIL  
T: 10 + P: 5 Hrs


UNIT- II: HTML  
T: 8 + P: 7 Hrs
HTML - Need- Structure of HTML Document- HTML Tags- Horizontal line Tags- Background and Text color Tags- Font Tags- MARQUEES Tags- Adding pictures - Ordered and Unordered Lists- Creating Links- Construction of Periodic Table with required data for first ten elements- Frames – Developing and hosting of Web Pages for a given molecule / chemical.

JAVA APPLETS: - Simple and Java applets with graphics- Applications of applet to draw 2D and 3D view of molecules.

UNIT-III: APPLICATIONS OF CHEMDRAW AND CHEM 3D SOFTWARE IN CHEMISTRY  
T: 8 + P: 7 Hrs
UNIT-IV: APPLICATIONS OF SHELX PROGRAM IN CHEMISTRY

T: 5 + P: 10 Hrs


UNIT-V: APPLICATIONS OF RASMOL and MATLAB IN CHEMISTRY-III

: 8 + P: 7 Hrs

RASMOL: - Introduction- User commands– Identification of disulfide-bridges and visualization of :hydrophobic and polar residues, the distribution of polar and non polar amino acids, side chain of carboxylate and amine , the different structural motives like α-helix, β-sheet and β - turn, the amino acids bound to Zn, active site of carboxypeptidase A, the environment of the active center.

MATLAB: - Introduction-advantages- getting started- windows for workspace, command interpretation, command history and current history- Addition- Use of sine and Cosine of angles(pi)- variable ‘ans’- order of operations- significant decimals- Representation of matrix- getting transpose of a matrix- display of images- saving images-solving linear equations\(\text{case m=n only}\).

Text Books:
   Leon TECH World, UBS Publishers & Distributors Ltd.
   Publishing Company Ltd., New Delhi, 2nd Edn., 15th Reprint
3. C. Xavier,2000 World wide web design with HTML, , Tata McGraw-Hill
   Publishing Company Ltd., New Delhi, 2nd Reprint.

Reference Books:
   Publishing Company Ltd., New Delhi.
3. Alexis Leon and Mathews Leon,2000 Internet for Everyone, Leon TECH World,
   Publishers & Distributors Ltd..
   Ltd., New Delhi, 11th Reprint.
   Company Ltd., New Delhi, 4th Edn.
   Indian Edn..
   Company Ltd., New Delhi, 2nd Edn.
10. Shelx, Rasmol and MATLAB- Manuals.
REFERENCES in the NET

Course designers
1. Dr. A. Elangovan
2. Dr. R. Mahalakshmy
3. Dr. A. Tamilselvi
### COURSE OUTCOMES

On the successful completion of the course, students will be able to
1. gain knowledge in Stereoselective and retrosynthetic analysis
2. understand about the guest-host interaction.
3. gain scientific and technical knowledge in Green chemistry and biotransformation

### UNIT-I RETROSYNTHETIC ANALYSIS

(15 Hrs)

Synthetic Strategy of the following target molecules: longifolene-juvabione-jasmone- 5-hexenoic acid-trans-9-methyl I-decalone- bicyclo (4,1,0) heptan-2 one- α-onocerin-isonootketone.

### UNIT-II BIOGENESIS OF ALKALOIDS,TERPENOIDS & FLAVONES

(15 Hrs)

Alkaloids(pyridine,phenanthrene and indole type)-nicotine-gramine-harmine-morphine-codine-terpenoids of classes with examples Lanosterol & Cholesterol from squalene-coumarins-carbohydrates-fructose-6-phosphate-xylose-5-phosphate-ribulose-5-phosphate-sucrose-amylose and amyllopectin-flavonoids-proteins

Terpenoids: Geranyl diphosphate-Geraniol-Farnesol–Camphor-limonene-citronellol-

**Text Books:**

References:
5. Chemistry of Carbocyclic Compounds-Azhuvalia
6. Pharmaceutical, Medicinal and Natural Product Chemistry-P. S. Kalsi & Sangeetha Jagtap-Narosa Publishing House
8. Synthetic Dyes-Gurudeep Chatwal

Course designer
1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamilselvi
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Sc.Chemistry (Spl) (Core 10) Int. Marks : 75
Class : II MSc Chemistry Ext. Marks : 25
Semester : IV Max. Marks : 100
Sub. Code : S4PC1 Hours/Week : 4
Title of the Paper : Organic Chemistry – IV Credits :4

COURSE OUTCOMES
On the successful completion of the course, students will be able to
• Kindle the synthetic aptitude on the heterocycles and chemistry of steroids and vitamins.
• Understand the chemistry of heterocycles as alkaloids and terpenoids in natural products.
• Understand the Protein and Green Chemistry.

Unit - I CHEMISTRY OF HETEROCYCLIC COMPOUNDS (12 hrs)

Unit - II CHEMISTRY OF TERPENOIDS AND ALKALOIDS (12 hrs)
Chemistry of terpenoids: General methods of determining structure of terpenoids – α-pinene, Zingiberene, and Abietic acid.

Unit- III CHEMISTRY OF STERIODS AND VITAMINS (12 hrs)
Chemistry of steroids : Introduction – Structural elucidation of Cholesterol – Androsterone and Testosterone (male sex hormones) – Oesterone, progesterone ( Female sex hormone).
Classification of Vitamins: Nomenclature of Vitamins – Strucure and Biological functions of vitamins: Vitamin A (Retinol), Vitamin B2 (Riboflavin), Vitamin B6 (Pyridoxine), Vitamin B12, Vitamin C, D and E (Structure elucidation and synthesis not required).

Unit IV CHEMISTRY OF PEPTIDES AND NUCLEIC ACID (12 hrs)
(c) Polypeptides – Classification - the peptide linkage - Structure of amino acids – 1\textsuperscript{0}, 2\textsuperscript{0}, 3\textsuperscript{0} and quaternary structure) – Solid phase peptide synthesis (Merifield) – use of protecting groups and reagents – Structural elucidation of glutathione, thyroxin and oxytocin.
(d) Nucleosides, Nucleotides and Nucleic acids – structure and synthesis of nucleosides and nucleotides – Elementary treatment on the structure of DNA and RNA.
Unit – V GREEN CHEMISTRY (12 hrs)

Text Books:
2. S.F. Dyke, 1965 Chemistry of Vitamins, Interscience, Toronto, USA.

Reference Books


Course designers

1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi
THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Sc Chemistry (Spl) (Core 11)  Int. Marks : 25
Class : II Year  Ext. Marks : 75
Semester : IV  Max. Marks : 100
Sub. Code : S4PC2  Hours/Week : 4
Title of the Paper : Inorganic Chemistry- IV  Credits : 4

COURSE OUTCOMES
On the successful completion of the course, students will be able to

- gain knowledge on organo metallic chemistry and transition metal catalysts.
- understand bioinorganic chemistry.
- get an idea about inorganic photochemistry.
- understand the concept of PES, EPR, Mossbauer spectroscopic techniques.

UNIT –I  ORGANOMETALLIC CHEMISTRY –I  12 Hrs


UNIT – II  ORGANOMETALLIC CHEMISTRY –II  12 Hrs

UNIT –III  BIO-INORGANIC CHEMISTRY  12Hrs


UNIT-IV  PHYSICAL METHODES IN INORGANIC CHEMISTRY- II  12Hrs

Electron paramagnetic resonance spectroscopy: Applications of hyperfine splitting and g factor to structural elucidation- Zero field splitting-Krammer's Degeneracy- EPR spectra of Cu (II) and Mn (II) in various site symmetry- covalency of metal-ligand bonding by EPR- study of dynamic processes in solids- Study of phase transition by Mn (II) – John Teller distortions in Cu (II) complexes.

Mossbauer spectroscopy: Basic principles- Doppler effect- Isomer shift- Electron nuclear hyperfine interactions- Quadrupole and magnetic interactions in the study of structure and bonding in Iron and Tin complexes and in Biological systems.

UNIT –V  INORGANIC PHOTOCHEMISTRY  12 Hrs

Excited states of coordination complexes – properties of excited states charge transfer and energy transfer – photochemical pathways.

Photoredox reactions of Co(III) and Cr(III) complexes – photosubstitution reactions – photoaquation, photoanation and photorearrangements - Role of TiO₂ in solar energy conversion – Photoredox chemistry of Ruthenium bipyridyl and Ruthenium(II) poly pyridyl compounds- energy conversion and photochemical decomposition of water using Ru complexes- storage of solar energy.

TEXT BOOKS: -
REFERENCE BOOKS:


Course Designers

1. Dr. A. Suganthi
2. Dr. A. Elangovan
3. Dr. D. S. Bhuvaneshwari
4. Dr. K. Selvakumar
## Course

**Course:** M.Sc Chemistry (Spl) (Core 12)  
**Int. Marks:** 25

**Class:** II Year  
**Ext. Marks:** 75

**Semester:** IV  
**Max. Marks:** 100

**Sub. Code:** S4PC3  
**Hours/Week:** 4

**Title of the Paper:** Physical Chemistry-IV  
**Credits:** 4

### Course Outcomes:

On successful completion of the course students will be able to

- Impart knowledge on various kinetic theories and reaction rate
- Understand the physical concepts of photochemistry and surface chemistry
- Gain knowledge on basics and applications on polymer chemistry

## UNIT-I

**CHEMICAL KINETICS-I**  
(12 hrs)

Simple Collision theory- modification - Absolute reaction rate theory (ARRT) - Statistical and thermodynamics formulation - Comparison of ARRT with collision theory- Significance of entropy of activation- Relation between \( \Delta H \) and \( E_a \) - Transmission co-efficient; ARRT of termolecular reactions – Unimolecular reactions - Lindemann, Hinshelwood, RRKM and Slater treatments. –solution kinetics – ARRT of reaction in solution – Influence of ionic strength on the rates of ionic reactions (salt effects).

## UNIT-II

**CHEMICAL KINETICS-II**  
(12 hrs)

Fast reactions-flow and relaxation techniques, Temperature Jump and pressure jump method - complex reactions – opposing, consecutive and parallel reactions; Chain reaction – kinetics and general characteristic – \( \text{H}_2 \)- \( \text{Br}_2 \) reaction, Rice – Herzfeld mechanism for decomposition of acetaldehyde & ethane – Branched chain reaction – study of \( \text{H}_2\text{-O}_2 \) explosive reaction- homogeneous catalysis – acid, base catalysis.

## UNIT-III

**PHOTOCHEMISTRY**  
(12 hrs)


photochemical Kinetics of \( \text{H}_2\text{-X}_2 \) reactions – Photolysis of acetaldehyde Photodimerisation of anthracene – Photoequation of \([\text{Cr(NH}_3)_5\text{NCS}]^{2+}\) and photo isomerisation of Cis-bis glycinate Pt(II); Applications of photochemistry – Solar energy conversion and storage – photo synthesis- excited state acidic property and energy transfer.
UNIT-IV
SURFACE CHEMISTRY
(12 hrs)

UNIT-V
POLYMER CHEMISTRY
(12 hrs)
Industrially important polymers – Preparation, Properties and uses of (LDPE & HDPE), Polystyrene, polyester, acrylo polymer, Teflon, Phenolic resins, amino resins and epoxy resins, Polyvinyl acetate-composites of Resins-ABS- Conducting Polymers-Polyacetylene, Polyamine, Inorganic polymer-Silicone and Biopolymers-cellulose.

Text Books:

Reference Books:

Course Designers
1. Dr. R. Sayee Kannan
2. Dr. A. R. Ramesh  3. Dr. T. Arumuganathan
Course Outcomes:

On successful completion of the course students will be able to

- Prepare organic compounds in two steps.
- Do quantitative estimation of organic compounds.

DOUBLE STAGE PREPARATION

1. p-Nitroaniline
2. p-Bromoaniline
3. 1,3,5-Tribromobenzene
4. Benzanilide
5. m-Nitrobenzoic acid
6. p-Iodonitrobenzene (III stage)
7. 2,5-dihydroxy acetophenone

(any five preparations only)

ESTIMATION

1. Estimation of glucose – Lane and Eynon method
2. Estimation of glucose-Betrand method
3. Estimation of ethyl methyl ketone
4. Estimation of acetone
5. Estimation of glycine

Course Designers

1. Dr. P. Prakash
2. Dr. R. Mahalakshmy
I. Gravimetric Analysis:
   a) Estimation of lead as lead chromate
   b) Estimation of Nickel as Ni-DMG
   c) Estimation of Magnesium as Magnesium oxinate

III. Preparation: (Any FOUR)
   a) Potassium cupric sulphate
   b) Potassium trioxalatoaluminate
   c) Hexathiourea-plumbus nitrate
   d) Tetrammine copper(II) sulphate
   e) Ferrous/Ferric oxalate

III. Colorimetry:
   a) Estimation of Iron (III)
   b) Estimation of Copper (II)

IV. Chromatography (Demo only NOT for the Exam)
   a) Paper Chromatography: Chromatographic separation of a mixture of Co, Mn, Ni and Zn
   b) Column Chromatography: Chromatographic separation of potassium permanganate and dichromate.

V. UV-visible spectrophotometer (Demo only NOT for the Exam)
   Determination stability constant for a complex.

Course Designers
1. Dr. A. Suganthi
2. Dr. D.S. Bhuvaneshwari
I. Characterization of the following complexes by electronic and IR spectral data.
   (i) Tetraammine Copper (II) sulphate
   (ii) Zinc-Oxine
   (iii) Nickel-DMG

II. Study the following reaction using IR and UV spectra.
   (i) benzophenone $\rightarrow$ benzophenone oxime
   (ii) acetone + benzaldehyde $\rightarrow$ dibenzalacetone
   (iii) salicylic acid $\rightarrow$ aspirin

III. Study the Adduct formation using the spectral data.
   (i) hydroquinone --- $p$-benzoquinone ---- anthracene adduct
   (ii) urea-salicylic acid

IV. Compare the spectra of the following:
   (i) $[\text{Cu(NH}_3)_4]^{2+}$ of solution and solid-vapor process
   (ii) Reaction between CuSO$_4$ and aniline under solution and solid-vapor process

Course Designers
1. Dr. A. Suganthi
2. Dr S. Pitchaimuthu
THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Sc.Chemistry (Spl)  Int.Marks : 40
Class : II Year  Ext. Marks : 60
Semester : IV  Max. Marks : 100
Sub. Code : SPJ  Hours/Week : 6
Title of the Paper : Project  Credits : 3

Course Outcomes

On successful completion of the course students will be able to

1. Get skills on developing new materials through new synthetic routes and

2. Characterize the material using different techniques.

2. Learn research methodologies along with literature survey.

Marks
External Examiner : Viva : 20
External Examiner : Evaluation of Project : 40
Internal Examiner : Evaluation of Project : 40

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100
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M. Phil., Chemistry
Objectives of the Programme:

1. To develop research aptitude.
2. To equip the students with latest concepts and techniques in chemical research.
3. To enable the students to present their research work in conferences.
4. To encourage the students to publish research papers in reputed journals.
5. To facilitate students to acquire the Ph. D degree.

Course Structure
Semester - I

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<thead>
<tr>
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<th>Code No</th>
<th>Subject</th>
<th>Hrs/Week</th>
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<th>Max Mark CA</th>
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<td>Research methodology</td>
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<td>S1MC3</td>
<td>In depth study</td>
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<td>90</td>
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Total: 18 270 300 300 600

Semester-II

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<th>Max Mark CA</th>
<th>Max Marks SE</th>
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<td>*b100</td>
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Total

*a. Viva-voce (Project guide) : 50
*b. Viva-voce (external examiner) : 50
*b. Thesis evaluation by external examiner : 100

Total : 200

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THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with ‘A’ Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)
Course : M.Phil Chemistry(Core 1)  
Int. Marks : 100

Class : I Year  
Ext. Marks : 100

Semester : I  
Max. Marks : 200

Sub. Code : S1MC1  
Hours/Week : 6

Title of the Paper : Research Methodology

Course Outcomes:
On the successful completion of the course, students will be able to

• Gain knowledge about general research methods and analytical skills required to carry out chemistry research projects with the help of latest web based chemical literature using chemical databases.

Unit I - Literature Survey:  
(18 hrs)

Searching the chemical literature, primary sources & secondary sources of literature survey – Importance of journals and patents, impact factor, h-index, i-index, ISSN, ISBN –Science Citation Index - chemistry journal index - choosing a problem - Computers in literature search using Internet websites- ACS-pubs, Royal Society, Springer link, science direct, Wiley - Interscience, search engines-Google, Yahoo, Alta Vista, etc., and Chemical Abstract Online.

Unit II - Computers in Chemistry:  
(18 hrs)

Desk-top chemical software: Chemoffice: Chemdraw, Chem 3D & Chem finder, Linear regression, Multi regression. MS Excel: Graph drawing and calculations -Origin.

Rasmol: Visualization of Protein molecules – highlighting amino acids, helices, beta sheets, non-hydrogen, hydrogen and sulphur bonds, identification of metal atoms and active sites.

Kinemages: Construction and visualization of one’s own protein molecules

SHELX: Structure solving and refinement using Shelxs and Shelxl.

Molecular modeling:

Coordinate systems - Cartesian and internal coordinate systems-wire frame, ball and stick, space filling and surface models - potential energy surfaces – force fields in molecular mechanics and potential energy calculation. Optimization of small molecules using Gaussian software.

Unit III- Instrumental Methods of Chemical Analysis:  
(18 hrs)


Principle, instrumentation and applications- HPLC, GC-MS and cyclic voltammetry-Spectrofluorimetry.

Unit IV- Laboratory techniques:  
(18 hrs)

Safety in chemical lab - explosion and fire hazards - hazards due to toxic chemicals - electrical safety - UV radiation - first aids for various kinds of accidents including toxic chemicals - preparation and purification of reagents - precipitation- filtration - evaporation- preparation of deionised water - choice of solvents and liquids - purification - distillation - steam and fractional distillation - solvents and reagents.
Unit V - Effective thesis writing: (18 hrs)


References:
Course: M.Phil Chemistry (Core 2)  
Class: I Year  
Semester: I  
Sub. Code: S1MC2  
Title of the Paper: Course Work

Course Outcomes:  
On the successful completion of the course, students will be able to

- do Organic synthesis.  
- understand the concept and applications of various spectral techniques.  
- derive advanced knowledge on Polymer Chemistry.  
- set themselves exposed to Nano / Green Chemistry  
- have an understanding of Bio-inorganic Chemistry.

UNIT I: Advanced Organic synthesis:  
Importance of organic synthesis - Key intermediates – Synthon, Retron-synthetic equivalent- starting materials - Retro synthetic analysis- Guideline for best disconnection-synthesis involving functional group interconversion -chemo selectivity, regioselectivity, stereo selectivity- two group C-X disconnection and synthetic strategies 1,2-1,3-1,4-1,5-1,6 difunctionalised disconnection- use of inclusion compounds such as cyclodextrin, calixarene- carbon-carbon bond forming reaction-suzuki coupling, Heck reaction, sharpless epoxidation.

UNIT II: Nano / Green Chemistry:  
Need for Green Chemistry - Solvent free reactions - Microwave assisted synthesis - Role of ionic liquids in green chemistry - Cleaner technology with super critical fluids - Catalytic approach to green chemistry (use of Zeolites, clays, mesoporous materials).

UNIT III: Bio-Inorganic Chemistry:  
Metalloproteins: Transport and storage protein: e.g Fe-S protein, Blue-copper protein, Ferritin, Transferritin, Hemocyanin and Heme erythrin. Metalloenzymes: Hydrolases (e.g. Carboxy peptidases and amino peptidases), Oxido reductases (e.g. Superoxide dismutase), Isomerases and Synthetases – (e.g. Vit B_{12}) - Nickel containing enzymes - Structure of DNA - types of Nucleic acid interactions - Coordination, intercalation and hydrogen bonding - Interactions of metal ion with Nucleic acid, Redox Chemistry, Hydrolytic Chemistry.

UNIT IV: Polymer Chemistry:  
Polymer-Introduction-Classification-Tacticity-Polymerization- Addition, Co-polymerisation and condensation – Mechanism of polymerization – Free radical mechanism, Ionic mechanism, Zeigler-Nata polymerization- Stucture-Property relationships in polymer-Classification of plastics- Thermosetting and Thermoplastic resins- Additives-Compounding of plastic-Fabrication-Compression moulding, Injection moulding, Extrusion moulding and Blow moulding - Molecular weight determination-Light scattering, viscosity, osmometry methods- Number average and Average number weight polymer.  
Preparation, properties and uses of some important polymeric resins-PE (LDPE and HDPE), Phenol-formaldehyde resins, Silicon resins- composite-ABS, Cellulose-Bio-degradable polymer.
UNIT V - Spectroscopy:

NMR Spectroscopy - Proton and $^{13}$C- fluxional NMR, 2-dimensional NMR - uses of Shift reagents.


Analysis and Interpretation of Spectra of simple Aliphatic and Aromatic compounds using IR, UV, NMR, MASS, XRD techniques.

References:


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DEPARTMENT OF CHEMISTRY
(For those who join in 2017 and after)

Course : M.Phil (core 3)  Int. Marks : 100
Class : I Year  Ext. Marks : 100
Semester : I  Max. Marks : 200
Sub. Code : S1MC3  Hours/Week : 6
Title of the Paper : In-Depth study

Course Outcomes:
On the successful completion of the course, students will be able to

This paper is based on the project work proposed by the guide for each student. Guide shall give 10-research articles related to the project work from reputed international and other journals. For internal evaluation, a written test will be conducted for 2-hours and will be evaluated by the guide. The students are expected to give a seminar and assignment. The summative examination question papers will be set by the guide and one examiner will evaluate all the answer scripts.

Internal = 100 (Internal test: 60; Seminar:25; Assignment: 15)
External = 100

Total = 200
Course : M.Phil Chemistry  
Class : I Year  
Semester : II  
Sub. Code : SMPJ  
Title of the Paper : Project

Dissertation work is a Two Semesters Sequential Course:

Course Outcomes:
On the successful completion of the course, students will be able to
1. Carry out the project selected in the first semester supplemented by experimental investigations.

Progress Report:
The first progress report should be presented to the Department before the 60th working day of the second semester.

Preview of dissertation:
The student will present the preview of the dissertation by the 75th working day of the semester to the Department.

Submission of dissertation:
The student has to submit four typed copies of dissertation by the 85th working day of the second semester to the department. A copy of this dissertation will be sent to the external examiner for review.

Evaluation of dissertation:
The Head of the PG department will be the chairman and the convener of the research committee. Internal valuation will be done by the guide. A public viva-voce examination will be conducted by a panel of examiners consisting of an external examiner who valued the dissertation and the guide.

Marks:
Thesis evaluation by external examiner : 100
Viva-voce (Project guide) : 50
Viva-voce (external examiner) : 50

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200
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