**SENGAMALATHAYAAREDUCATIONALTRUSTWOMEN'SCOLLEGE**

**(AUTONOMOUS)**

**(Accredited by NAAC; An ISO 9001:2015 Certified Institution)**

SUNDARAKKOTTAI, MANNARGUDI–614016.

**TAMILNADU, INDIA.**

# M.Sc., CHEMISTRY COURSE STRUCTURE WITH SYLLABUS UNDERCBCS

(*For the candidates admitted in the academic year 2022-2023)*

**DEPARTMENT OF CHEMISTRY**

**Program Outcomes for M. Sc Degree.,**

| PO No. | Programme Outcomes<br>(*Upon completion of the M.Sc. Degree Programme, the postgraduate will be able to )* |
|---|---|
| **PO-1** | **Disciplinary Knowledge:** demonstrate in-depth knowledge and understanding of theories, policies, and practices in one or more disciplines that form a part of a Post Graduate program of study in Master of Science. |
| **PO-2** | **Critical Thinking and Problem Solving**: apply analytic thought to a body of knowledge, analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence, identify relevant assumptions or implications, formulate coherent arguments, critically evaluate practices, policies and theories by following scientific approach to knowledge development: solve problems and extrapolate the same to real life situation |
| **PO-3** | **Information/digital literacy and Communication Skills**: use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources, and use appropriate software for analysis of data: communicate thoughts and ideas analytically and effectively in writing and orally using appropriate media, and present complex information in a clear and concise manner to different groups. |
| **PO-4** | **Research-related skills*:*** conduct independent inquiry in a chosen scientific discipline, demonstrate sense of inquiry and capability for asking relevant/appropriate questions, problematizing, synthesizing and articulating; recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; plan, execute and report the results of an experiment or investigation. |
| **PO-5** | **Scientific reasoning and Reflective Thinking:** analyze, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective; critically and sensibly evaluate life experiences, with self-awareness and reflexivity of both self and society. |
| **PO-6** | **Multidisciplinary Approach, Innovation and Entrepreneurship:** propose novel ideas of interdisciplinary approach in providing better solutions and new ideas for the sustainable developments; identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society. |
| **PO-7** | **Moral and ethical awareness/reasoning:** embrace moral/ethical values in conducting one‟s life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work, demonstrate the ability to identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopt objective, unbiased and truthful actions in all aspects of work. |
| **PO-8** | **Self-directed Learning**: work independently, identify appropriate resources required for a project, and manage a project till completion. |
| **PO-9** | **Lifelong Learning:** engage in continuous learning for professional growth and development, acquire knowledge and skills, adapt to changing environment and adapt to changing trades and demands of work place through knowledge/skill development/reskilling. |
| **PO-10** | **Multicultural Competence, Social Interaction and Effective Citizenship:** understand the values and beliefs of multiple cultures, global perspectives, engage and interact respectfully with diverse groups and elicit views of others, mediate disagreements and help reach conclusions in group settings, and demonstrate empathetic social concern and equity centred national development. |

## Program Specific Outcomes for M. Sc Degree.,

| PSO No. | Programme Specific Outcomes<br>Students will be able to |
|---|---|
| **PSO-1** | Understand the basic concepts, fundamental principles, and the scientific theories related to various chemical phenomena, their relevancies in the day-to-day life and applications. |
| **PO-2** | Explain the physical aspects of atomic structure, dual behavior, reaction pathways with respect to time, various energy transformations, molecular assembly in nano level, significance of electrochemistry, molecular segregation using their symmetry |
| **PO-3** | Appraise different branches of Chemistry like Analytical, Food Chemistry, Medicinal, Solid-Statechemistry, environmental, polymer and pharmaceutical chemistry andl apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries. |
| **PO-4** | Interpret the principles of Chemical Thermodynamics, Kinetics, Electrochemistry, Atomic Structure, Photo Chemistry, Group theory, Quantum Chemistry, Surface Chemistry, Spectroscopy and Skill in Industrial Chemistry. |
| **PO-5** | Assess the importance of various elements present in the periodic table, coordination chemistry and structure of molecules, properties of compounds, and structural determination of complexes using theories and instruments. |
| **PO-6** | Understands the background of organic reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and molecular rearrangements. |
| **PO-7** | Perform experiments in the area of organic analysis, estimation, separation, derivative process, inorganic semi micro analysis, preparation, conductometric and potentiometric analysis |

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**TAMILNADU, INDIA.**

## M.Sc., CHEMISTRY COURSE STRUCTURE UNDER CBCS

**Eligibility:** Candidates who have passed Bachelor level Examination in Chemistry

**LEARNINIG OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)**

**(Applicable to the candidates admitted form the academic year 2022-23 onwards)**

| Sem | Types of the Courses | Course Code | Title of the Course | Ins. Hrs | Credit | Exams Hrs | Marks | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Int | Ext. | |
| I | Core Course I (CC) | 22PCH101 | Inorganic Chemistry-I | 6 | 5 | 3 | 25 | 75 | 100 |
| | Core Course II (CC) | 22PCH102 | Organic Chemistry-I | 6 | 5 | 3 | 25 | 75 | 100 |
| | Core Course III (CC) | 22PCH103 | Physical Chemistry-I | 6 | 5 | 3 | 25 | 75 | 100 |
| | Core Practical I (P) | 22PCH104P | Inorganic Chemistry Practical | 6 | 3 | 6 | 40 | 60 | 100 |
| | Elective Course I (EC) (At least Two Choices) | 22PCHE1A /22PCHE1B | A) Analytical Chemistry/ B) Supramolecular Chemistry | 6 | 4 | 3 | 25 | 75 | 100 |
| | Value Added Course I (VAC) | | | - | 2* | 3 | 25 | 75 | 100* |
| | **Total** | | | **30** | **22** | **-** | | | **500** |
| II | Core Course IV (CC) | 22PCH205 | Inorganic Chemistry –II | 5 | 5 | 3 | 25 | 75 | 100 |
| | Core Course V (CC) | 22PCH206 | Organic Chemistry –II | 5 | 5 | 3 | 25 | 75 | 100 |
| | Core Course VI (CC) | 22PCH207 | Physical Chemistry –II | 6 | 5 | 3 | 25 | 75 | 100 |
| | Core Practical II (CP) | 22PCH208P | Organic Chemistry Practical | 6 | 3 | 6 | 40 | 60 | 100 |
| | Elective Course II (EC) (At least Two Choices) | 22PCHE2A /22PCHE2B | A. Solid State Chemistry/ B. Inorganic Photo Chemistry | 5 | 4 | 3 | 25 | 75 | 100 |
| | Extra Disciplinary Course- | | | 3 | 2 | 3 | 25 | 75 | 100 |
| | **Total** | | | **30** | **24** | **-** | | | **600** |
| III | Core Course VII (CC) | | Coordination Chemistry | 5 | 5 | 3 | 25 | 75 | 100 |
| | Core Course VIII (CC) | | Physical Chemistry –II | 6 | 5 | 3 | 25 | 75 | 100 |
| | Core Course IX (CC) | | Scientific Research Methodology | 5 | 5 | 3 | 25 | 75 | 100 |
| | Core Practical III (CP) | | Physical Chemistry Practical | 6 | 3 | 6 | 40 | 60 | 100 |
| | Elective Course III (EC) (At least Two Choices) | | A) Chemistry of Nano Science and Nanotechnology / B) Green Chemistry | 5 | 4 | 3 | 25 | 75 | 100 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Extra Disciplinary Course- | | | 3 | 2 | 3 | 25 | 75 | 100 |
| | **Total** | | | **30** | **24** | **-** | **-** | **-** | **600** |
| IV | Core Course X (CC) | | Organic Chemistry-III | 6 | 5 | 3 | 25 | 75 | 100 |
| | Core Course XI (CC) | | Spectral Techniques in Inorganic Compounds | 6 | 5 | 3 | 25 | 75 | 100 |
| | Entrepreneurship / Industry Based Course | | Industrial Chemistry | 6 | 5 | 3 | 25 | 75 | 100 |
| | Project | | Dissertation = 80 Marks<br>Viva = 20 Marks | 12 | 5 | - | 20 | 80 | 100 |
| | Value Added Course II (VAC) | | | - | 2* | 3 | 25 | 75 | 100* |
| | **Total** | | | **30** | **20** | **-** | **-** | **-** | **400** |
| **Grand Total** | | | | **120** | **90** | **-** | **-** | **-** | **2100** |

**Summary of Curriculum Structure of PG Programmes (Science)**

| Sl. No. | Types of the Courses | No. of Courses | No. of Credits | Marks |
|---|---|---|---|---|
| 1 | Core Courses | 11 | 55 | 1100 |
| 2 | Core Practical | 3 | 9 | 300 |
| 3 | Elective Courses | 3 | 12 | 300 |
| 4 | Entrepreneurship/ Industry Based Course | 1 | 5 | 100 |
| 5 | Project | 1 | 5 | 100 |
| 6 | Extra Disciplinary Elective Courses | 2 | 4 | 200 |
| | Total | 21 | 90 | 2100 |
| | Value Added Courses * | 2* | 4* | 200* |

***The value-added courses credit will not be included in the total CGPA.**
**These courses are extra-credit courses.**
**Instruction hours for these courses is 30 hours.**

| **Note:** | | | | |
|---|---|---|---|---|
| 1. Theory | Internal | 25 marks | External | 75 marks |
| 2. Practical | | 40 marks | | 60 marks |
| 3. Separate passing minimum is prescribed for Internal and External | | | | |

(a) The passing minimum for CIA shall be 40% out of 25 marks (ie.10marks)
(b) The passing minimum for University Examinations shall be 40% out of 75marks (ie.30marks)
(c) The passing minimum not less than 50% in the aggregate.

## ELECTIVE COURSES OFFERED BY THE DEPARTMENT

| S. No. | Nature of the Course | Course Code | Elective Courses (EC) (Anyone from the list) |
|---|---|---|---|
| 1. | Elective Course (EC) – I | 22PCHE1A / 22PCHE1B | A) Analytical Chemistry/ B) Supramolecular Chemistry |
| 2. | Elective Course (EC) – I | 22PCHE2A / 22PCHE2B | (A)Solid State Chemistry/ (B). Inorganic Photo Chemistry |
| 3. | Elective Course (EC) –II | | A) Chemistry of Nano Science and Nanotechnology / B) Green Chemistry |

## EXTRA DISCIPLINARY COURSES OFFERED BY THE DEPARTMENT

| S. No. | Nature of the Course | Course Code | Extra Disciplinary Courses (EDC) (Anyone from the list) |
|---|---|---|---|
| 1. | Extra Disciplinary Course (EDC) – I | 22PCHED1A / 22PCHED1B | A.) Food Chemistry/ B) Medicinal Chemistry |
| 2. | Extra Disciplinary Course (EDC) – II | | A) Chemistry in Everyday life / B) Agricultural Chemistry |

## VALUE ADDED COURSES OFFERED BY THE DEPARTMENT

| S. No. | Nature of the Course | Course Code | Value Added Courses (VAC) |
|---|---|---|---|
| 1. | Value Added Course- I | | Environmental Chemistry |
| 2. | Value Added Course- II | | Sustainable Water Resources Management |

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**TAMILNADU, INDIA.**

## DEPARTMENT OF CHEMISTRY

M.Sc., CHEMISTRY

***(For the candidates admitted from the academic year 2022 – 2023 onwards)***

## Question Paper Pattern - (Theory)

**Max time: 3 Hours** **Max Marks: 75**

**Section –A (10X2 =20)**

**Answer all the Questions**

**Answer in One or Two Sentences Each**

1. } Unit I
2. }
3. } Unit II
4. }
5. } Unit III
6. }
7. } Unit IV
8. }
9. } Unit V
10. }

**Section – B (5 x 5 = 25)**

**Answer all the questions**

**Each answer should not exceed 500 words**

11. a (or) } Unit I
12. b }

12 . a (or) } Unit II
b }

13. a (or) } Unit III
b. }

14. a (or) } Unit IV
b }

15. a (or) } Unit V
b }

**Section – C (3 x 10 = 30)**

**Answer any THREE questions in 1200 words**

16. Unit I
17. Unit II
18. Unit III
19. Unit IV
20. Unit V

# SEMESTER I

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**DEPARTMENT OF CHEMISTRY**

**M.Sc., CHEMISTRY**

**Semester: I - CC-: Inorganic Chemistry – I**

**Ins. Hrs. /Week: 6** **Course Credit: 5** **Course code: 22PCH101**

**UNIT I : MAIN GROUP CHEMISTRY (19 Hours)**

Chemistry of boron – borane, higher boranes, car boranes, borazines and boron nitrides – chemistry of silicon – silanes, higher silanes, multiple bonded systems, di silanes, silicon nitrides. P-N compounds, cyclophosphazanes and cyclophosphane's – S-N compounds – S2N2, S4N4, (SN)x, polythiazyl SxN4 compounds – S-N cations and anions, S-P compounds – molecular sulphides such as P4S3, P4S7, P4S9 and P4S10 – homocyclic inorganic systems – oxo carbon anion Ionic model – lattice energy – Born-Lande equation – Kapuscinski equation – high Tc superconductors – solid state reactions – tarnish reaction decomposition, solid-solid reaction and photographic process – factors affecting reaction rate.

**UNIT II : PRINCIPLES OF COORDINATION CHEMISTRY (19 Hours)**

Studies of coordination compounds in solution – detection of complex formation in solution – stability constants – stepwise and overall formation constants. Simple methods (potentiometric, pH metric and photometric methods) of determining the formation constants. Factors affecting stability – statistical and chelate effects – forced configurations.

**UNIT III: THEORIES OF METAL-LIGAND BOND (18 Hours)**

Crystal field theory – splitting of d-orbitals under various geometries – factors affecting splitting – CFSE and evidences for CFSE (structural and thermodynamic effects). Spectrochemical series – Jahn-Teller distortion – spectral and magnetic properties of complexes – site preferences. Limitations of CFT – ligand field theory – MO theory – sigma- and pi-bonding in complexes – Nephelauxetic effect – the angular overlap model.

**UNIT IV: REACTION MECHANISM IN COORDINATION COMPLEXES(16 Hours)**

Kinetics and mechanism of reactions in solution – labile and inert complexes – ligand displacement reactions in octahedral and square planar complexes – acid hydrolysis, base hydrolysis and anation reactions. Trans effect – theory and applications – electron transfer reactions – electron exchange reactions – complementary and non-complementary types – inner sphere and outer sphere processes – application of electron transfer reactions in inorganic complexes – isomerisation and racemisation reactions of complexes.

**UNIT V: INORGANIC PHOTOCHEMISTRY (18 Hours)**

Electronic transitions in metal complexes, metal-cantered and charge-transfer transitions – various photophysical and photochemical processes of coordination compounds. Unimolecular charge-transfer photochemistry of cobalt (III) complexes – mechanism of CTTM, photoreduction – ligand-field photochemistry of chromium (III) complexes – Adamson's rules, photoactive excited states, V-C model – photo physics and photochemistry of ruthenium – polypyridine complexes, emission and redox properties.

Photochemistry of organometallic compounds – metal carbonyl compounds – compounds with metal-metal bonding – Reinecke's salt chemical actinometer

**Total Lecture Hours: 90**

**COURSE OUTCOME**

**The student should able to,**

1. Describe the fundamentals of the Chemistry of the main group elements, and important real-world applications of many of these species.
2. Determine the stability constant of particular complex through pH Metry, Polarographic methods Etc.,
3. Justify the implication of nuclear chemistry in energy generation.
4. Draw structures of different ionic solids.
5. Apply their understanding about the photochemical reactions of industrial significance
6. Discuss about acids, bases, chains, rings, clusters and iso poly anions of inorganic compounds

**TEXT BOOKS**:


1. James E. Huheey, Ellen, Keiter and RichardL. Keiter, Inorganic Chemistry: Principles of Structure and Reactivity, Addison-Wesley, New York, 2003.
2. Chatwal, Gurdeep Chatwal, Instrumental Methods of Chemical Analysis,2018
3. R. K. Sharma, Inorganic Reactions Mechanism; Discovery Publishing House, New Delhi, 2007
4. A. W. Adamson and P. D. Fleischauer, Concepts of Inorganic Photochemistry; R. E. Krieger Pubs, Florida, 1984.
5. J.D. Lee, Concise Inorganic Chemistry, Fourth Edition, 2021, Wiley India Pvt Ltd.


**REFERENCES**


1. M. C. Day, J. Selbin and H. H. 2012. Sisler, Theoretical Inorganic Chemistry; Literary Licensing (LLC), Montana,

2. F. A. Cotton and G. Wilkinson, C. A. Murillo and M. Bochmann, 1999. Advanced Inorganic Chemistry; 6th Ed., A Wiley - Interscience Publications, John Wiley and Sons, USA,
3. J. E. Huheey, 2006.Inorganic Chemistry; 4th Ed., Harper and Row publisher, Singapore,
4. A. W. Adamson, 1975.Concept of Inorganic Photochemistry; John Wiley and Sons, New York,.
5. Lee J D, 1998.Concise Inorganic Chemistry, 6th Ed., ELBS, London,

**E-RESOURCES:**

1.http://summit.sfu.ca
2.https://pubs.acs.org
3.https://www.accessscience.com/content/inorganic-photochemistry/345400
4.https://en.wikipedia.org/wiki/Main-group_element
5. https://chemed.chem.purdue.edu/genchem/topicreview/bp/ch12/ligand.php

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**DEPARTMENT OF CHEMISTRY**

M.Sc., CHEMISTRY

**Semester: I - CC- I: ORGANIC CHEMISTRY - I**

**Ins. Hrs. /Week: 6** **Course Credit: 5** **Course Code: 22PCH102**

## UNIT I: AROMATICITY (16 Hours)

Aromatic character: Five-, six-, seven-, and eight-membered rings – other systems with aromatic sextets – Huckel's theory of aromaticity, concept of homo aromaticity and anti aromaticity. Electron occupancy in MO's and aromaticity – NMR concept of aromaticity and anti aromaticity, systems with 2,4,8 and 10 electrons, systems of more than 10 electrons (annulenes), Mobius aromaticity. Bonding properties of systems with $(4n+2)\pi$-electrons and $4n\pi$-electrons, alternant and non-alternant hydrocarbons (azulene type) – aromaticity in hetero aromatic molecules, sydnones and fullerenes.

## UNIT II: REAGENTS IN ORGANIC SYNTHESIS (16 Hours)

Reduction: palladium / platinum / rhodium / nickel based heterogeneous catalysts for hydrogenation, Wilkinson's catalyst, Noyori asymmetric hydrogenation – reductions using Li/Na/Ca in liquid ammonia. Hydride transfer reagents from group III and group IV in reductions. (i) tri acetoxy borohydride, L-selectride, K-selectride, Luche reduction, Red-Al, $NaBH_4$ and $NaCNBH_3$, trialkyl silanes and trialkylstannane, (ii) stereo/enantio selectivity reductions (Chiral Boranes, Corey-Bakshi-Shibata).

## UNIT III: STEREOCHEMISTRY AND CONFORMATIONAL ANALYSIS (20 Hours)

Stereoisomerism – symmetry – enantiomers and diastereomers – *R* and *S* nomenclature – optical activity and chirality – types of molecules exhibiting optical activity – absolute configuration – chirality in molecules with non-carbon stereo centres (N, S and P) – molecules with more than one chiral centre – atropisomerism. Molecular chirality – allenes, spiranes, biphenyls, helicenes and cyclophanes – methods of determining configuration – *E* and *Z* nomenclature – determination of configuration of geometrical isomers – stereochemistry of addition and elimination reactions – stereospecific and stereoselective synthesis [elementary examples].Basic concepts of conformational analysis – conformations of cyclopentane, cyclohexane, cyclohexene and fused (decalin) and bridged (norbornane type) ring systems – anomeric effect in cyclic compounds.

**UNIT IV: ORGANIC PHOTOCHEMISTRY (19 Hours)**

Organic photochemistry – fundamental concepts – energy transfer – characteristics of photoreactions – photoreduction and photooxidation, photo sensitization. Photoreactions of ketones and enones – Norrish Type I and II reactions – Paterno-Büchi reaction – photo-Fries rearrangement – photochemistry of alkenes, dienes and aromatic compounds – di-π-methane rearrangement. Reactions of un activated centres – photochemistry of α, β-unsaturated carbonyl compounds – photolytic cycloadditions and photolytic rearrangements – photo additions – Barton reaction.

**UNIT V: PERICYCLIC REACTIONS (19 Hours)**

Concerted reactions – orbital symmetry and concerted symmetry – Woodward and Hoffmann rules – selection rules for electrocyclic reactions – frontier molecular orbital approach – correlation diagram – examples. Selection rules for cycloaddition reactions – frontier molecular orbital approach – correlation diagram – examples – cheletropic and ene reactions. Sigma tropic rearrangements – 1,3, 1,5 and 1,7-hydrogen shifts – examples – Cope and Claisen rearrangements – 1,3-dipolar cycloaddition reactions: types of dipoles, selectivity, scope and applications.

**Total Lecture Hours: 90**

**COURSE OUTCOME**

**The Students Should be able to**

1. Apply the basic rules of organic nomenclature to interrelate between structures of organic molecules.
2. Describe the concept of Heterocyclic compounds.
3. Identify the stereo centres in a molecule and assign the configuration.
4. Recognize the Stereo chemical factors.
5. Discuss the mechanisms of the various synthetic reagents and their structure

**TEXT BOOK(S)**

1. Eliel. E.L.2017. Stereochemistry of Carbon Compounds, McGraw Hill, New Delhi.

2.Jonathan Clayden, Nick Greeves, Stuart Warren, 2000. Organic Chemistry, Oxford University Press, USA.

3.Kalsi. P.S. 2004. Stereochemistry, Conformations and Mechanism, New International Private Limited, New Delhi.

4. March. J, Smith.M.B. March's, 2013. AdvancedOrganicChemistry.Reactions Mechanisms, and Structure. 7 Edition. Wiley, New York.

5. Nasipuri. D. 2020. Stereochemistry of Organic Compounds, 4th Edition. New Age International Private Limited, New Delhi.

**REFERENCES**


1. J. March and M.B.Smith, March's 2019. Advanced OrganicChemistry: Reactions, Mechanisms, and Structure: 7th Ed., Wiley, New York,
2. L. Finar, Organic Chemistry; Vol.II, 7thEd. 2009., Pearson education Ltd, New Delhi,
3. Panico, W.H. Powell, L. Jean,C. Richer, 1993. A Guide of IUPAC Nomenclature of Organic compounds,
4. Jerry March 2017,Advanced Organic Chemistry– Reaction Mechanisms and Structure, John Wiley, New York,
5. D. Nasipuri, 2019 Stereochemistry of Organic Compounds, New Age International Private Limited, New Delhi,.
6. P.S. Kalsi, Stereochemistry, Conformations and Mechanism, New Age International Private Limited, New Delhi, 2004.
7. Ahluwalia V K, Organic Reaction Mechanism, Narosa Publication, 2010.
   M. Mukherjiand S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., Patna, 1990.
9. R.S. Cahn and O.C.Dermer, Introduction to Chemical Nomenclature, Butterworths, London,1979.
10. Peter Sykes, A Guide Gook to Mechanism in Organic Chemistry, Pearson Education, New Delhi,2004.
11. E.L. Eliel, Stereochemistry of Carbon Compounds, McGraw Hill, New Delhi, 2003.
12. Jonathan Clayden, Nick Greeves, Stuart Warren, Organic Chemistry, Oxford University Press,USA,2000


**E- RESOURCES**

1. https://en.wikipedia.org/wiki/Aromaticity www.spinger.com
2. http://www.adichemistry.com/organic/organicreagents/reagents-organic-synthesis.html
3. https://www.tcichemicals.com/pdf/ReagentGuide_8th_SynthesticOrganicChemistry_MaterialsChemistry.pdf
4. http://courses.washington.edu/medch562/pdf/MEDCH400_Stereochem.pdf
5. https://Introduction+to+Stereochemistry+and+Conformational+Analysis-p-

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**DEPARTMENT OF CHEMISTRY**

M.Sc., CHEMISTRY

**Semester: I: CC- III: Physical Chemistry - I**

**Ins. Hrs. /Week: 6** **Course Credit: 5** **Course Code: 22PCH103**

## UNIT I : CONCEPTS OF GROUP THEORY (16 Hours)

Symmetry elements and operations – point groups – assignment of point groups to molecules – group postulates and types of groups – group multiplication tables, sub groups, similarity transformations – conjugate elements and classes.

Matrix representation of symmetry operations and point groups – reducible and irreducible representations – properties of irreducible representation.

The great orthogonality theorem – construction of character table – direct product – projection operators – symmetry of hybrid orbitals.

## UNIT II : QUANTUM CHEMISTRY – I (18 Hours)

Inadequacy of classical mechanics – black body radiation – Planck's quantum concept – photoelectric effect – Bohr's theory of hydrogen atom – hydrogen spectra – wave-particle dualism – uncertainty principle – decline of old quantum theory.

Schrödinger equation – postulates of quantum mechanics – operator algebra: linear operator, Hermitian operators, eigenfunctions and eigenvalues, angular momentum operator – commutation relations and related theorems – orthogonality and normalization.

Applications of wave mechanics to simple systems – particle in a box, one and three dimensional, particle with finite potential barrier – the quantum mechanical tunnelling.

## UNIT III: CHEMICAL KINETICS – I (18 Hours)

Theories of reaction rate – absolute reaction rate theory (ARRT) – transmission coefficient, reaction coordinate – potential energy surfaces – kinetic isotope effect – Hinshelwood theory – Kassel, Rice and Ramsperger theory (KRRT) – Slater's treatment.

Principle of microscopic reversibility – steady-state approximation – chain reactions: thermal and photochemical reactions between hydrogen and halogens – explosions and hydrogen-oxygen reactions.

**UNIT IV: STATISTICAL THERMODYNAMICS (19 Hours)**

Thermodynamic probability – probability theorems – relation between entropy and probability (Boltzmann-Planck equation), ensembles, phase space, Ergodic hypothesis, microstates and macrostates, Maxwell-Boltzmann distribution law
– partition functions – translational, rotational, vibrational and electronic partition functions. Relationship between partition functions and thermodynamic properties – calculation of equilibrium constants from partition functions – heat capacities of monatomic crystals – Einstein theory and Debye theory.
Quantum statistics – Bose-Einstein (B.E.) and Fermi-Dirac (F.D.) distribution equations – comparison of B.E. and F.D. statistics with Boltzmann statistics – applications of quantum statistics to liquid helium, electrons in metals and Planck's radiation law – concept of negative Kelvin temperature

**UNIT V: FAST REACTION TECHNIQUES, PHOTOCHEMISTRY AND RADIATION CHEMISTRY (19 Hours)**

Introduction – flow methods (continuous and stopped flow methods) – relaxation methods (T and P jump methods) – pulse techniques (pulse radiolysis, flash photolysis) – shock tube method – molecular beam method – lifetime method.
Photophysical processes of electronically excited molecules – Jablonski diagram
– Stern-Volmer equation and its applications – experimental techniques in photochemistry – chemical actinometers – lasers and their applications.
Differences between radiation chemistry and photochemistry – sources of high energy radiation and interaction with matter – radiolysis of water, solvated electrons – definition of G value, Curie, linear energy transfer (LET) and Rad – scavenging techniques – use of dosimetry and dosimeters in radiation chemistry – applications of radiation chemistry.

**Total Lecture Hours: 90**

**COURSE OUTCOME**

The student should able to,

1. Predict the material properties from group theory.
2. Applying the limitations and uses of models of Quantum Chemistry
3. Predict chemical and physical properties of molecules.
4. Understand the Chemical kinetics reasonably guide as to know how to control the reaction conditions and improve the main reaction rate in order to increase the production of chemical products.
5. Explain from thermodynamics, fundamental thermodynamic properties
6. Propose a method for mechanistic studies of a particular photochemical system.

**TEXT BOOKS**


1. F. A. Cotton, 2018. Chemical Applications of Group Theory; 3rd Ed., John Wile and Sons, Singapore,
2. S. F. A. Kettle, 2018 Symmetry and Structure; 2nd Ed., John Wiley and Sons, Chichester,
3. D. A. Mcquarrie, 2008 Quantum Chemistry; University Science Books, Sausalito,.
4 A.N. Levine, 2000.Quantum Chemistry; 5th Ed., Prentice Hall, New Jersey,
5. R.K. Prasad, Quantum Chemistry; 2014 4th Ed., New Age International Publishers, New Delhi,.


**REFERENCES**


1. M. Mortimer and P. G. Taylor, , 2002 Chemical Kinetics and Mechanism; 1st Ed., Royal Society of Chemistry, UK.
2. J. N. Gurtu and A. Gurtu, 2006. Advanced Physical Chemistry; 5th Ed., Pragathi Prakashan, Meerut,
3. J. I. Steinfeld, J. S. Francisco and W. L. Hase, 1999. Chemical Kinetics.
4. P. W. Atkins, , 2001 Physical Chemistry; 7th Ed., Oxford University Press, Oxford.
5. J. Rajaram and J. C. Kuriacose, 2013.Thermodynamics for Students of Chemistry - Classical, Statistical and Irreversible; Pearson Education, New Delhi,
6. Horia Metiu, Physical Chemistry, Thermodynamics; Taylor and Francis,Singapore, 2006.
7. K. K. Rohatgi-Mukherjee, Fundamentals of Photochemistry; 3rd Ed., New Age International Pvt. Ltd., New Delhi, 2014.
8. J.W.T. Spinks and R. J. Woods, Introduction to Radiation Chemistry; 3rd Ed., John Wiley and Sons, New York, 1990.xrrr


**E- RESOURCES**

1.https://en.wikipedia.org/wiki/Group_theory
2. https://www.jstor.org/stable/3482970
3. http://ursula.chem.yale.edu/~batista/classes/vvv/v570.pdf
4. https://www.google.com
5. https://uh.edu/engines/StatisticalThermodynamics.pdf

**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE**
(AUTONOMOUS)
**SUNDARAKKOTTAI, MANNARGUDI- 614016**
*(For the Candidates admitted in the academic year 2022-2023)*
**DEPARTMENT OF CHEMISTRY**
**M.Sc., CHEMISTRY**

**Semester: I- CP- I: Inorganic Chemistry Practical**

**Ins. Hrs. /Week: 6** **Course Credit:3** **Course Code: 22PCH104P**

**SEMI-MICRO QUALITATIVE ANALYSIS** **(30 Marks)**

**1. Semi-micro qualitative analysis** of a mixture containing two common cations (Pb, Bi, Ca, Cd, Fe, Cr, Al, Co, Ni, Mn, Zn, Ba, Sr, Ca, Mg, $NH_4$) and two less common cations (W, Tl, Se, Te, Mo, Ce, Th, Zr, Ti, V, U, Li).

**2.Preparation of complexes** **(10 Marks)**

1. Tris(thiourea)copper(I) chloride
2. Tetraamminecopper(II) sulphate
3. Potassium trioxalatoferrate
4. Potassium trioxalatoaluminate(III)
5. Potassium trioxalatochromate(III)
6. Hexamminecobalt(III) chloride

**COLORIMETRIC ESTIMATION** **(20 Marks)**

3. Estimation of copper, Ferric, nickel, chromium and manganese ions using photoelectric colorimeter

**COURSE OUTCOME**

**The student should able to**

1. Identify the Qualitative analysis of common metals
2. Discuss the Qualitative analysis of rare metals
3. Understand Beer-Lamberts' law
4. Estimate Colorimetric analysis of some common metals

**TEXT BOOK(S)**

1.Cotton. F. A.,Wilkinson. G. Murillo, C. A , Bochmann . M. 2021. Advanced Inorganic Chemistry. A Wiley India Pvt Ltd.

2.Huheey. J. E. 2006. Inorganic Chemistry. 4th Harper and Row publisher, Singapore.

3.James Huheey. E, Ellen, Keiter.A,Richard L.Ke 2003.Inorganic Chemistry. Principles of Structure and Reactivity, Addison-Wesley, New York

4.Lee, J .D. 1998. Concise Inorganic Chemistry, 6th Edition, ELBS, London

5.Sharma . R. K. 2007. Inorganic Reactions Mechanism, Discovery Publishing House, New Delhi.

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1. V. V. Ramanujam, 1988 Inorganic Semimicro Qualitative Analysis; 3rd Ed., National Pubs, London,.
2. G. Svehla, 1987.Macro and Semimicro Qualitative Inorganic Analysis; 5th Ed., Longman group Ltd, London,
3. Vogel, Text Book of Quantitative Inorganic Analysis;2000 6th Ed., Longman, New Delhi,
4. Willard. H.H, Merritt. L.L , Dean. J.A and Settle. F.A , 1986. Instrumental Methods of Analysis, 6 th Ed., CBS Publishers and Distributors, Chennai.
5. Vogel . A.I. 2000 .Quantitative Inorganic Analysis, 6th Ed., Longman, New Delhi.

**E- RESOURCES**

1. https://ncert.nic.in
2. http://www.iscnagpur.ac.in/study_material
3. https://www.hindawi.com
4. https://link.springer.com/content/pdf/bfm%3A978-94-017-2744-0%2F1.pdf
5. http://www.freebookcentre.net/chemistry.

**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE**

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**DEPARTMENT OF CHEMISTRY**

**M.Sc., CHEMISTRY**

**Semester: I - EC- IIA: Analytical Chemistry**

**Ins. Hrs. /Week: 6** **Course Credit: 4** **Course Code:22PCHE1A**

## UNIT I: INSTRUMENTAL METHODS OF ANALYSIS (15 Hours)

Principles and applications of extended X-ray absorption fine structure (EXAFS) – surface extended X-ray absorption (SEXAFS) – atomic absorption spectroscopy (AAS) – flame emission spectroscopy (FES) – turbidimetry – theory and applications.

## UNIT II: DATA AND ERROR ANALYSIS (19 Hours)

Various types of error – accuracy, precision, significant figures – frequency distributions, the binomial distribution, the Poisson distribution and normal distribution – describing data, population and sample, mean, variance, standard deviation, way of quoting uncertainty, robust estimators, repeatability and reproducibility of measurements.

Hypothesis testing, levels of confidence and significance, test for an outlier, testing variances, means t-Test, paired t-Test – analysis of variance (ANOVA) – correlation and regression.

Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals – general polynomial equation fitting, linearizing transformations, exponential function fit – r and its abuse – multiple linear regression analysis, elementary aspects.

## UNIT III: CHROMATOGRAPHY (18 Hours)

Solvent extraction – principles of ion exchange, paper, thin-layer and column chromatography techniques – columns, adsorbents, methods, Rf values, Mc Reynold's constants and their uses – HPTLC, HPLC techniques – adsorbents, columns, detection methods, estimations, preparative column – GC-MS techniques – methods, principles and uses.

## UNIT IV: THERMO ANALYTICAL METHODS AND FLUORESCENCE SPECTROSCOPY (18 Hours)

Principles – instrumentations and applications of thermogravimetry analysis (TGA), Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC) –thermometric titrations – types – advantages. Basic aspects of synchronous fluorescence spectroscopy – spectral hole burning – flow cytometry – fluorometers (quantization) – instrumentation – applications.

**UNIT V: ELECTROANALYTICAL TECHNIQUES (20 Hours)**

Electrochemical sensors, ion-sensitive electrodes, glass – membrane electrodes, solid-liquid membrane electrodes – ion-selective field effect transistors (ISFETs) – sensors for the analysis of gases in solution. Polarography – principles and instrumentation – dropping mercury electrode – advantages – Illkovic equation – applications of polarography – polarographic maxima – oculographic polarography, AC polarography – cyclic voltammetry – advantages over polarographic techniques – chronopotentiometry – advantages – controlled potential coulometry – amperometric titrations: principles – techniques – applications – estimation of lead.

**Total Lecture Hours: 90**

**COURSE OUTCOME**

The student should able to

1. Understand the principles, instrumentation and applications of various instruments.
2. Explain statistical tools behind analytical chemistry.
3. State the principles, instrumentation and applications of chromatographic techniques.
4. Discuss the principles, instrumentation and applications of thermo analytical techniques.
5. Observe the principles, instrumentation and applications of electro analytical techniques.

**TEXT BOOK(S)**


1. Banwell . C.N , McCash .E.M 2017. Fundamentals of Molecular Spectroscopy; 4th Ed., Tata McGraw-Hill, New Delhi.
2. Braithwaite ,A, Smith .J.F 2021. Chromatographic Methods, 5th Ed., Springer, Germany.
3. Gary . D ,Christian 2013. Analytical Chemistry, John Wiley & Sons, 7th edition.
4. Gupta. S.C 2018. Fundamentals of Statistics, 6th Ed., Himalaya Publications, Delhi,
5. Harris. D.C 1995. Quantitative Chemical Analysis, 4th Ed., W. H. Freeman Publications, New York.
6. Sharma. A, Schulman. S.G , 1999. Introduction to Fluorescence Spectroscopy, Wiley Inter Science, New York.
7. Sivasankar. B, 2012. Instrumental methods of analysis, Oxford University Press.
8. Srivastava. V.K and Srivastava .K.K 1985. Introduction to Chromatography, 2 nd, Ed., Holden Day, New York.


**REFERENCE BOOK(S)**


1. Gopalan ,R .2020. Elements of Analytical Chemistry, 3rd edition, Sultan Chand and Co, New Delhi.
2. Heftmann. E .2014. Chromatography, Volume 69A, 6th edition, Elsevier.

3. Sergey .V. yazovkin , Nobuyoshi Koga Christoph Schick 2018, Handbook of Thermal Analysis and Calorimetry, v.6, Recent Advances, Techniques and Applications, Elsevier.
4. Skoog. D.A, West. D.M and Holler. D.J 2014. Fundamentals of Analytical Chemistry, 7th Ed., Harcourt College Publishers, Singapore.
5. Topping . J, 1984. Errors of Observation and Their Treatment, 4th Ed., Chapman Hall, London.

**E- RESOURCES**

1. https://pubs.acs.org/doi/10.1021/ac60112a013
2. https://web.pa.msu.edu/courses/2014summer/phy451/lectures/lecture_data_error_analysis.pdf
3. https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod5.pdf
4. https://www.currenta.com/analytics/methods/thermoanalytical-methods.html
5. http://www.umich.edu/~chem241/lecture13final.pdf

**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE**

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*(For the Candidates admitted in the academic year 2022-2023)*

**DEPARTMENT OF CHEMISTRY**

**M.Sc., CHEMISTRY**

**Semester: I - EC- II B Supramolecular Chemistry**

**Ins. Hrs. /Week: 6** **Course Credit: 4** **Course Code:22PCHE1B**

## UNIT I: CONCEPTS OF SUPRAMOLECULAR CHEMISTRY (19 Hours)

Concepts and languages of supramolecular chemistry – various types of non-covalent interactions – hydrogen bonds, C-H···X interactions, halogen bonds – π-π interactions, non–bonded interactions – various types of molecular recognition.

Crystal engineering of organic solids – hydrogen bonded supramolecular patterns involving water / carboxyl / halide motifs – concepts of different types of synthons based on non-covalent interactions – principles of crystal engineering and non-covalent synthesis – polymorphism and pseudo polymorphism – supramolecular isomorphism / polymorphism – crystal engineering of pharmaceutical phases.

## UNIT II: METALLO ORGANIC FRAMEWORKS (18 Hours)

M.O.F (Metallo Organic Frameworks) – organometallic systems – combinations of different interactions to design molecular rods, triangles, ladders, networks, etc. – design of nano porous solids – inter ligand hydrogen bonds in metal complexes – implications for drug design – crystal engineering of NLO materials, OLED.

## UNIT III: CO-RECEPTOR MOLECULES AND MULTIPLE RECOGNITION(17 Hours)

Di nuclear and poly nuclear metal ion cryptates – linear recognition of molecular length by ditopic co-receptors – heterotopic co-receptors – cyclophane receptors, amphiphilic receptors and large molecular cages – multiple recognition in metallo receptors – supramolecular dynamics.

## UNIT IV: SUPRAMOLECULAR REACTIVITY AND CATALYSIS (18 Hours)

Catalysis by reactive macrocyclic cation receptor molecules – catalysis by reactive anion receptor molecules – catalysis with cyclophane type receptors – supramolecular metallo catalysis – co catalysis – catalysis of synthetic reactions – biomolecular and abiotic catalysis. Supramolecular chemistry in solution – cyclodextrin, micelles, dendrimers, gelators – classification and typical reactions – applications.

## UNIT V: SUPRAMOLECULAR DEVICES (18 Hours)

Supramolecular devices and sensors – various types of supramolecular devices – an overview – supramolecular photochemistry – molecular and supramolecular photonic devices – light conversion and energy transfer devices– molecular and supramolecular electronic devices – electronic conducting devices – molecular wires, modified and switchable molecular wires – molecular and supramolecular ionic devices – tubular mesophases, molecular protonics – switching devices – electro-photo switch – ion and molecule sensors – role of supramolecular chemistry in the development of nanoscience and technology.

**Total Lecture Hours: 90**

## COURSE OUTCOME

The student should able to

1. Know the fundamentals of supramolecules.
2. Explain co-receptor molecules and multiple recognition
3. Study the supramolecular reactivity and catalysis.
4. Crystal engineering of NLO materials are known.
5. Co-receptor molecules and multiple recognitions understood.

## REFERENCES


1. J. M. Lehn, 2010 Supramolecular Chemistry; VCH, Weinheim, Germany.
2. G. R. Desiraju, Crystal Engineering: 2014 The Design of Organic Solids; Elsevier, United States,.
3. G. R. Desiraju, and T. Steiner, 2019. The Weak Hydrogen Bond in Structural Chemistry and Biology; Oxford University Press, Oxford.
4. G. A Jeffrey, 2021 Introduction to Hydrogen Bonding; Oxford University Press: UK,.
5. J. M. Lehn, 1999 Transition Metals in Supramolecular Chemistry; John Wiley and Sons: New York,.


## E- RESOURCES

1.https://www.sciencedirect.com/topics/chemistry/supramolecular-chemistry

2.https://www.newworldencyclopedia.org/entry/supramolecular_chemistry

3.http://dl.iranchembook.ir/ebook

4. https://www.researchgate.net/publication

5. https://en.wikipedia.org/wiki/Supramolecular_chemistry

**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE**

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**M.Sc., CHEMISTRY**

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**Semester-I: VAC-I Environmental Chemistry**

**Ins. Hrs. /Week: 2** **Course Credit: 2** **Course Code:22PCHVA11**

**UNIT-I: BIODIVERSITY AND ITS CONSERVATIONS (6 Hours)**

Introduction – Definition : genetic, species and ecosystem diversity. - Biogeographical classification of India -Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels- India as a mega-diversity nation Hot-sports of biodiversity. -Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. - Endangered and endemic species of India Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**UNIT-II: ENVIRONMENTAL POLLUTION (6 Hours)**

Air pollution-carbon Monoxide (CO) Nitrogen Oxides (NO) Hydrocarbons and photochemical smog-Sulphur Dioxide, Acid Rain-Water Pollution Trace elements in Water Chemical Speciation Copper Lead Mercury Arsenic Selenium Chromium; Land Pollution.

**UNIT-III: RENEWABLE ENERGY RESOURCES (6 Hours)**

Renewable energy sources: types of renewable energy sources. Solar cells: basic principles types and their applications. Fuel cells: basic principles, types and their applications. Working principle and applications of Biofuel cells-brief introduction about hydroelectric, biomass, wind power and geothermal power and their applications and limitations-energy from some other natural source.

**UNIT: IV-WASTE TREATMENT MANAGEMENT AND RECYCLING (6 Hours)**

Waste Classification Solid Waste Disposal Solid Waste Management Ocean Dumpling. Solid Wast Treatment -Chemical Toxicology -Toxic Chemicals in the Environment. Impact of Chemicals of Enzymes, Bio water Agents.

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**UNIT: V-SOCIAL ISSUES AND THE ENVIRONMENT (6 Hours)**

From Unsustainable to sustainable development. Urban problems related to energy.

Water conservation, Rain water harvesting, Watershed management.

Environmental Ethics: Issues and Possible solutions. Climate Change, Global warming, Ozone Layer depletion. **Total Lecture Hours: 30**

**COURSE OUTCOME:**

1. Environmental Pollution or problems cannot be solved by mere laws.
2. Development and improvement in standard of living has lead to serious environmental disasters
3. Create the social issues in and around our environment

**TEXT BOOKS:**


1. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science, 2 nd Edition ,Pearson, Education 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata MC Graw-Hill , New Delhi,2006.


**REFERENCES:**


1. R.K. Trivedi."Hand Book of Environmental Las,Rules,Guidelines,CompliancesansStandard",Volume I and II, Enviro Media.
2. Cunningham, W.P.Cooper, T.H.Gorhani , 'Environmental Encyclopedia', Jaico Publications,House.Mumbai,2001.
3. Dharmendra S.Sengar,'Environmental Law', Prentice Hall of India PVT LTD, NewDelhi.2007.
4. Rajagopalan .R 'Environmental Studies – From Crisis to cure', Oxford University Press.2005.


**E- RESOURCES:**

1.https://byjus.com/biology/biodiversity-conservation
2. https://www.vedantu.com/biology/conservation-of-biodiversity
3. https://www.conserve-energy-future.com/waste-management-and-waste-disposal-methods.php

# SEMESTER II

**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE**
(AUTONOMOUS)
**SUNDARAKKOTTAI, MANNARGUDI- 614016**
*(For the Candidates admitted in the academic year 2022-2023)*
**DEPARTMENT OF CHEMISTRY**
**M.Sc., CHEMISTRY**

**Semester: II -CC- IV: Inorganic Chemistry - II**

**Ins. Hrs. /Week: 5** **Course Credit: 5** **Course Code:**

## UNIT I: GENERAL PRINCIPLES OF BIOINORGANIC CHEMISTRY (16 Hours)

Occurrence and availability of inorganic elements in biological systems – biomineralization – control and assembly of advanced materials in biology – nucleation and crystal growth – various biominerals – calcium phosphate – calcium carbonate – amorphous silica, iron biominerals – strontium and barium sulphate. Function and transport of alkali and alkaline earth metal ions: characterization of $K^+$, $Na^+$, $Ca^{2+}$ and $Mg^{2+}$ – complexes of alkali and alkaline earth metal ions with macrocycles – ion channels – ion pumps, catalysis and regulation of bioenergetic processes by the alkaline earth metal ions – $Mg^{2+}$ and $Ca^{2+}$. Metals at the centre of photosynthesis – primary processes in photosynthesis – photosystems I and II-light absorption (energy acquisition) – exciton transport (direct energy transfer) – charge separation and electron transport – manganese catalyzed oxidation of water to O2.

## UNIT II: COORDINATION COMPLEXES IN BIOLOGICAL SYSTEMS (16 Hours)

Cobalamins: reactions of the alkyl cobalamin– one electron reduction and oxidation – Co-C bond cleavage – coenzyme B12 – alkylation reactions of methyl cobalamin.

Heme and non-heme proteins – haemoglobin and myoglobin – oxygen transport and storage – electron transfer and oxygen activation – cytochromes, ferredoxins and rubredoxin – model systems, mononuclear non-heme iron enzymes. Copper containing proteins – classification and examples – electron transfer – oxygen transport-oxygenation – oxidases and reductases – cytochrome oxidase– superoxide dismutase (Cu, Zn) – nickel containing enzyme: urease.

## UNIT III: MEDICINAL BIOINORGANIC CHEMISTRY (16 Hours)

Bioinorganic chemistry of quintessentially toxic metals – lead, cadmium, mercury, aluminium, chromium, copper and plutonium – detoxification by metal chelation – drugs that act by binding at the metal sites of metalloenzymes. Chemotherapy – chemotherapy with compounds of certain non-essential elements – platinum complexes in cancer therapy – cisplatin and its mode of action – cytotoxic compounds of other metals. Gold containing drugs as anti-rheumatic agents and their mode of action – lithium in psychopharmacological drugs – radiopharmaceuticals – technetium.

**UNIT IV: ORGANOMETALLICS (13 Hours)**

Nitrosyl complexes – bridging and terminal nitrosyls, bent and linear nitrosyls – dinitrogen complexes – metallocene and arene complexes – metal carbenes, carbenes, carboxylate anions. Classification based on captivity and polarity of M-C bond, organometallic compounds of lanthanides and actinides – fluxional organometallic compounds – organometallics in medicine, agriculture, horticulture and industry.

**UNIT V: REACTIONS AND CATALYSIS BY ORGANOMETALLICS (14 Hours)**

Organometallic reactions – ligand association and dissociation – oxidative addition and reductive elimination – insertion reactions.

Reactions of coordinated ligands in organometallics – hydrogenation, hydroformylation, epoxidation, metathesis. Polymerization of olefins, olefin oxidation (Wacker process) and carbonylation of methanol.

**Total Lecture Hours:75**

**COURSE OUTCOME:**

1. Apply the principles of transition metal coordination complexes in understanding functions of biological systems.
2. Plot equations and functions representing kinetic behaviour of chemical systems in ground and electronically excited states.
3. Identify the medicinal applications of inorganic compounds.
4. Find the structure and bonding aspects of simple organometallic compounds.
5. Understand the different types of organometallic reactions and apply the above concepts to explain different catalytic reactions.
6. Write the principle of catalysis and reaction mechanisms of organometallics.

**TEXT BOOKS**

1. G.S.Sodhi. 2021.Advanced Inorganic chemistry : Applications in Everyday Life, book by Narayan Sadashiv Hosmane.

2. P.Powell, 2021.Principles of Organometallic Chemistry;2nd Ed., Chapman and Hall, London,.

3. B. Douglas, D. H. McDaniel and J. J. Alexander, Concepts and Models of Inorganic Chemistry;3rdEd., John Wiley and sons, New York,

4. I. Haiduc and J. J. Zuckerman, 2010.Basic Organometallic Chemistry; Walter De GruyterInc, USA,

5. P. Collman, L. S. Hegedus, J. R. Norton and R. G. Finke, 2011.Principles and Applications of Organotransition Metal Chemistry, University Science Books, California,

## REFERENCES


1. J. E. Huheey,2010. Inorganic Chemistry;4th Ed., Harper and Row Publishers, Singapore,
2. K. F. Purcell and J. C. Kotz, 2013.Inorganic Chemistry; Thomson Learning, Boston,
3. S. J. Lippard and J. M. Berg,2017. Principles of Bioinorganic Chemistry; Panima Publishing Company, New Delhi,
4. W. Kaim and B. Schewederski, 2013.Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life; 2ndEd., John Wiley and Sons, New York, USA,.
5. G. L. Eichhorn, 2018.Inorganic Biochemistry; Volumes 1 and 2, 2nd Ed., Elsevier Scientific Publishing Company, New York,.
6. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry; 6th Ed., John Wiley and Sons, New York,1999.
7. R. C. Mehrotra and A. Singh, Organometallic Chemistry; 2nd Ed., New Age International Ltd. New Delhi,2014.
8. R. H. Crabtree, The Organometallic Chemistry of the Transition Metals; 3rd Ed., John Wiley and Sons, New York,2001.


## E-RESOURCES

1.https://medchemistry.umsa.edu.ua

2. https://adamasuniversity.ac.in/coordination-chemistry-and-life-in-the-earth/

3. https://en.wikipedia.org/wiki/Organometallic_chemistry

4.https://academic-accelerator.com/Impact-of-Journal/Organometallics

**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE**

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**SUNDARAKKOTTAI, MANNARGUDI- 614016**

*(For the Candidates admitted in the academic year 2022-2023)*

**DEPARTMENT OF CHEMISTRY**

**M.Sc., CHEMISTRY**

**Semester: II-CC- V: Organic Chemistry – II**

**Ins. Hrs. /Week: 5** **Course Credit: 5** **Course Code: 22PCH206**

## UNIT I: NUCLEOPHILIC SUBSTITUTION REACTIONS (15 Hours)

Aliphatic nucleophilic substitution – mechanisms – SN1, SN2, SNi – ion-pair in SN1 mechanisms – neighbouring group participation, non-classical carbocations – substitutions at allylic and vinylic carbons.

Reactivity – effect of structure, nucleophile, leaving group and stereochemical factors – correlation of structure with reactivity – solvent effects – rearrangements involving carbocations – Wagner-Meerwein and dienone-phenol rearrangements.

Aromatic nucleophilic substitutions – SN1, SNAr, Benzyne mechanism – reactivity orientation – Ullmann, Sandmeyer and Chichibabin reaction – rearrangements involving nucleophilic substitution – Stevens – Sommelet-Hauser and von-Richter rearrangements.

## UNIT II: ELECTROPHILIC SUBSTITUTION REACTION (15 Hours)

Aromatic electrophilic substitution reaction – orientation, reactivity and mechanisms based on transition state theory with suitable reactions – substitutions in thiophene and pyridine – N-oxide – quantitative treatment of the structural effects on reactivity.

Substituent effects – origins of Hammett equation – principles of Hammett correlation – effect of structure on reaction mechanisms Hammett parameters – sigma and ρ, modified forms of Hammett equation, Taft Equation.

Aliphatic electrophilic substitution – SE2, SEi and SE1 mechanisms – diazonium coupling reactions – metals as electrophile in substitution reactions and decomposition of diazonium salts.

## UNIT III: ADDITION AND ELIMINATION REACTIONS (18 Hours)

Addition to carbon-carbon multiple bonds – electrophilic, nucleophilic and free radical additions – orientation of the addition – stereochemical factors influencing the addition of bromine and hydrogen bromide, hydroxylation, 1,2-dihydroxylation – hydroboration leading to formation of alcohols – oxidation and ozonolysis.

Addition to carbonyl and conjugated carbonyl systems – mechanism – Grignard reagents – 1,2- and 1,4-additions (lithium dimethylcuprate) – addition to carbon-oxygen double bond – Benzoin, Knoevenagel, Stobbe, Darzens glycidic ester condensation and Reformatsky reactions.

Elimination reactions – mechanisms; E1, E2, E1cB – stereochemistry of elimination, Hofmann's and Zaitsev's rules – competition between elimination and substitution – pyrolytic *cis*-elimination, Chugaev reaction – examples such as dehydration, dehydrohalogenation, Hofmann degradation, Cope elimination – Bredt's rule with examples.

**UNIT IV: HETEROCYCLES (13 Hours)**

Nomenclature: Trivial, systematic and replacement nomenclature – non-aromatic heterocycles – synthesis of tetrahydrofuran's – pyrrolidines – tetrahydropyrans – piperidines.
Synthesis and reactivity of heterocycle: oxiranes

**UNIT V: NATURAL PRODUCTS (14 Hours)**

Steroids: introduction – partial synthesis of androsterone and testosterone (from Cholesterol) – total synthesis: Johnson's synthesis of progesterone and Vollhardt's synthesis of estrone.
Alkaloids: introduction – biosynthesis of nicotine, camptothecin – total synthesis: Corey's synthesis of epibatidine, Comin's asymmetric synthesis of Camptothecin and Woodward's synthesis of reserpine.

**Total Lecture Hours:75**

**COURSE OUTCOME**

The student should able to

1. Understand the Nucleophilic aliphatic Substitution reactions.
2. Explain rearrangement process.
3. Gain more knowledge of Electrophilic Aromatic Substitution reactions..
4. Identify the Electrophilic Aliphatic Substitution reactions.
5. Analyse importance of natural products.
6. Study the aspects of aliphatic nucleophilic and aromatic nucleophilic substitution reactions and its applications. To appreciate the principles of addition reactions

**TEXTBOOK(S)**

1.Bansal . R. K. 2019. Organic Reaction Mechanism.11 Edition. Tata Mc Graw Hill, Noida.

2.Finar. L. 2009 . Organic Chemistry. Vol.II, 7 th Edition. Pearson education Ltd, New Delhi.

3.Jerry March. 2004. Advanced Organic Chemistry . Reaction Mechanisms and Structure,

4.Lowry .T. H. E and Richardson . K. S.1997. Mechanism and Theory in Organic

5.Morrison . R.T. and Boyd . R.N.2018. " Organic Chemistry" (6th edition), New York, Allyn & Bacon Ltd.,

6.O.P. Agarwal . 2015, "Natural products", Krishna Prakashan media Pvt Ltd, Uttar Pradesh.

## REFERENCES

1. Jerry March,Advanced Organic Chemistry – Reaction Mechanisms and Structure, John Wiley, New York, 2020.

2. R. K. Bansal, Organic Reaction Mechanisms; 11th Ed., Tata McGraw Hill, Noida,2006.

3. J. Clayden, N. Greeves, S. Warren, and P. Wothers, Organic Chemistry, 2nd Ed., Oxford University Press, UK,2012.

4. F. A. Carey, and R. J. Sundberg, Advanced Organic Chemistry, Parts A and B, 5th Ed., Springer, Germany,2007.

5. L. Finar, Organic Chemistry; Vol.II, 7th Ed., Pearson Education Ltd., New Jersey, 2009.

6.Longifolene: F. A. Carey and R. J. Sundberg, Advanced Organic Chemistry; Vol.2. 5th Ed., Springer, Berlin,2008.

## E-RESOURCES

1.https://www.sciencedirect.com/topics/materials-science/nucleophilic-substitution

2.https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Organic_Chemistry_with_a_Biological_Emphasis_v2.0_(Soderberg)/08%3A_Nucleophilic_Substitution_Reactions

3.https://chem.libretexts.org/Ancillary_Materials/Reference/Organic_Chemistry_Glossary/Addition-Elimination_Mechanism

4.https://www.masterorganicchemistry.com/2013/01/22/addition-reactions-the-opposite-of-elimination/

5.https://www.nature.com/subjects/natural-products

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**DEPARTMENT OF CHEMISTRY**

**M.Sc., CHEMISTRY**

**Semester: II-CC- VI: Physical Chemistry – II**

**Ins. Hrs. /Week: 6** **Course Credit: 5** **Course Code:22PCH207**

## UNIT I: QUANTUM CHEMISTRY - II AND GROUP THEORY (18 Hours)

Applications of wave mechanics – the harmonic oscillator, rigid rotator – hydrogen and hydrogen like atoms – shapes and nodal properties of orbitals – space quantization – approximation methods – methods of variation, application to hydrogen and helium atoms – perturbation method – non-degenerate systems – helium atom – effective nuclear charge.

Electron spin – many electron atoms – Pauli's principle – Slater determinants – atomic structure calculation – self-consistent field method – Hartree-Fock method for atoms – angular momentum in many electron systems – spin-orbit interaction, L-S and j-j coupling schemes.

Symmetry adapted linear combinations (SALC) – vibrational spectra – symmetry properties of normal molecules – symmetry coordinates – selection rules for fundamental vibrational transition – IR and Raman activity of fundamentals in CO2, H2O, N2F2 – the rule of mutual exclusion and Fermi resonance.

## UNIT II: ELECTROCHEMISTRY (16 Hours)

Ion transport in solution – migration, convection and diffusion – Fick's laws of diffusion conduction – Debye-Huckel theory – ionic atmosphere – Debye-Huckel-Onsager equation – verification and extension – Debye-Falkenhagen effect and Wien effect, Debye-Huckel limiting law – activity coefficients and ionic strength – Bjerrum model.

The electrode – electrolyte interface – electrical double layer and multi layers – theories – electrocapillary curves – Lipmann equation and Lipmann potential.

Electrokinetic phenomena – classification – Tiselius method of separation of proteins – membrane potential – electrocatalysis.

## UNIT III: ELECTROCHEMISTRY – II (18 Hours)

Dynamics of electron transfer – Marcus theory – tunneling – the rate of charge transfer – current density – Butler-Volmer equation – Taft equation –polarization and overvoltage – mechanism of hydrogen evolution and oxygen evolution reactions.

Principles of electrodeposition of metals – corrosion and passivity – Pourbaix and Evans diagrams – methods of protection of metals from corrosion.

Power storage systems – fuel cells – construction and functioning – applications – photovoltaic cells.

**UNIT IV: SURFACE CHEMISTRY AND CHEMICAL KINETICS-II (20 Hours)**

Surface phenomena – Gibbs adsorption isotherm – solid-liquid interfaces – contact angle and wetting – solid-gas interface – physisorption and chemisorption – Langmuir, BET isotherms – surface area determination.

Kinetics of surface reactions involving adsorbed species – Langmuir-Hinshelwood mechanism, Langmuir-Rideal mechanism – Rideal-Eley mechanism – some interfacial aspects on micelles, reverse micelles, microemulsions and membranes.

Application of ARRT to solution kinetics – effect of solvent and ionic strength, influence of pressure on rates in solution – enzyme catalysis – mechanism of single substrate reactions – Michaelis-Menten law – acidity functions – kinetics of processes in micellar and reverse micellar systems.

**UNIT V: CLASSICAL THERMODYNAMICS ( 18 Hours)**

Third law – thermodynamics – significance – Nernst heat theorem and other forms of stating the third law – thermodynamic quantities at absolute zero – apparent exceptions to the third law.

Thermodynamics of systems of variable composition – partial molar properties

– chemical potential – relationship between partial molar quantities – Gibbs-Duhem equation and its applications (the experimental determination of partial molar properties not included).

Thermodynamic properties of real gases – fugacity concept – calculation of fugacity of real gas – activity and activity coefficient – concept – definition – standard states and experimental determinations of activity and activity coefficient of electrolytes.

Thermodynamics of irreversible processes: coupled flow – Onsager's reciprocal relations – entropy production.

**Total Lecture Hours:90**

**COURSE OUTCOME**

The student will able to

1. Understand the principles, techniques and application of Electrochemistry.
2. Observe the mechanisms and applications of kinetic Processes.
3. Understand the mechanisms involved in Photochemistry, their importance and applications.
4. Derive high energy radiators and applications.
5. Understand the general Principles, Kinetics and experimental procedures of Solid State Chemistry.
6. limitations and uses of models by applying Quantum Chemistry

**TEXTBOOK(S)**


1. Anthony. R. West., 2021. Solid state Chemistry and its Applications ., Wiley, 2nd Edition.
2. Bockris .J.O , Conway .2012. Modern aspects of electrochemistry, Springer.
3. Chakrabarty. D.K. 2021" Solid state chemistry", New Age International Publishers, 2nd Ed,.

4. John. R.W. Wiley. Sons. Solid state chemistry and its application .
5. Shubhrata . R MSHRA, 2011. Text book of Photochemistry, Discovery publishing Pvt Ltd.

**REFERENCES**

1. I. N. Levine, 2013. Quantum Chemistry; 7th Ed., Prentice Hall, New Jersey,
2. R. K. Prasad, 2014. Quantum Chemistry; 4th Ed., New Age International Publishers, New Delhi,
3. P. Atkins and J. de Paula, 2009. Physical Chemistry; 9th Ed., W. H. Freeman Publications, New York, .
4. Glasstone, 2014.An Introduction to Electrochemistry; Read Books, New Delhi, .
5. M. Mortimer and P. G. Taylor,2002 Chemical Kinetics and Mechanism; 1st Ed., Royal Society of Chemistry, UK, .
6. I. Amdur and G. G. Hammes, 2008. Chemical Kinetics Principles and Selected Topics; 3rd Ed., McGraw Hill, New York,.
7. J. Rajaram and J. C. Kuriacose, 2013.Thermodynamics for Students of Chemistry - Classical, Statistical and Irreversible; Pearson Education, New Delhi,

**E-RESOURCES**

1. https://ncert.nic.in/textbook/pdf/lech103.pdf
2.https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Map
3. https://stannescet.ac.in/cms/staff/qbank/CSE/Notes/CY8151-Engineering%20Chemistry-431878289-unit_2%20(1).pdf
4. https://byjus.com/jee/chemical-kinetics/
5. https://cds.cern.ch/record/1339527/files/978-3-540-92872-0_BookBackMatter.pdf

**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE**

(AUTONOMOUS)

**SUNDARAKKOTTAI, MANNARGUDI- 614016**

*(For the Candidates admitted in the academic year 2022 – 2023)*

**DEPARTMENT OF CHEMISTRY**

**M.Sc., CHEMISTRY**

**Semester: I - CP- II: ORGANIC CHEMISTRY PRACTICAL**

**Ins. Hrs. /Week: 6** **Course Credit: 3** **Course Code:22PCH208P**

**1. QUANTITATIVE ANALYSIS OF ORGANIC COMPOUNDS (30 Marks)**

Estimation of phenol, aniline, ketone, glucose.

**2. QUALITATIVE ANALYSIS OF AN ORGANIC MIXTURE CONTAINING TWO COMPONENTS (30 Marks)**

Mixtures containing two components are to be separated (pilot separation) and purified (bulk separation) – the student should be analysing any one of the components and report.

**COURSE OUTCOME**

The student should able to

1. Create and carryout, work up and separation procedure.
2. Predict the outcomes of organic reactions using a basic understanding of the general reactivity of functional groups and mechanisms.
3. Determine identity, Purity and present yield of products.
4. Understand the concept of crystallization.

**TEXT BOOKS**

1.N. S. Gnanaprakasam and G. Ramamurthy,2011. Organic Chemistry Lab Manual; S.V.Printers,

2.Vogel's 2021.Textbook of Practical Organic Chemistry; 5th Ed., Prentice Hall,

3.Hibbert, D. Band Gooding . J.J 2006. Data Analysis for Chemistry, Oxford University Press, UK.

4.J. March and M.B.Smith, March's 2019.AdvancedOrganicChemistry: Reactions, Mechanisms, and Structure: 7th Ed., Wiley, New York,

5.Jerry March2017,Advanced Organic Chemistry– Reaction Mechanisms and Structure, John Wiley, New York,

**REFERENCES**

1.J. Mohan,2014 Organic Analytical Chemistry: Theory and Practice; Narosa,.

2.V. K. Ahluwalia, P. Bhagat, and R. Agarwal, Laborator Techniques in Organic Chemistry; I. K. International,

3.A. I. Vogel, A. R. Tatchell, B. S. Furniss, A. J. Hannaford and P. W. G. Smith

4.D. Nasipuri, 2019 Organic chemistry of Organic Compounds, New Age International Private Limited, New Delhi,.

5. . Jonathan Clayden, Nick Greeves 2000, Stuart Warren, Organic Chemistry, Oxford University Press,USA,

**E-RESOURCES**

1.https://www.toppr.com/guides/chemistry/organic-chemistry/quantitative-analysis/

2.https://ncert.nic.in/textbook/pdf/kech205.pdf

3.http://wwwchem.uwimona.edu.jm/lab_manuals/c10expt25.html

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**DEPARTMENT OF CHEMISTRY**
**M.Sc., CHEMISTRY**

**Semester: II-EC-II A: Solid State Chemistry**

**Ins. Hrs. /Week: 5** **Course Credit: 4** **Course Code:22PCHE21A**

## UNIT I: CRYSTAL STRUCTURE AND CRYSTAL ENGINEERING OF ORGANIC SOLIDS (15 Hours)

Types of close packing – hcp and ccp – packing efficiency – SC, BCC, and FCC, radius ratio rule – applications – polyhedral description of solids – structure types: Na2O, Cs2O, rutile, perovskite (ABO3), ReO3, K2NiF4, spinels and antispinels. Hydrogen bonded supramolecular patterns involving water / carboxyl / halide motifs – concepts of different types of synthons based on non-covalent interactions – principles of crystal engineering and non-covalent synthesis – polymorphism and pseudopolymorphism – supramolecular isomorphism, polymorphism and crystal engineering of pharmaceutical phases.

## UNIT II: METALLO ORGANIC FRAMEWORKS (14 Hours)

M.O.Fs (Metallo Organic Frameworks) – organometallic systems – combinations of different interactions to design molecular rods, triangles, ladders, networks, etc. Design of nanoporous solids. Interligand hydrogen bonds in metal complexes – implications for drug design – crystal engineering of NLO and OLED materials.

## UNIT III: PREPARATIVE METHODS IN SOLID STATE CHEMISTRY (18 Hours)

Experimental procedure, coprecipitation as a precursor to solid state reaction, other precursor methods, kinetics of solid state reactions – crystallizations of solutions, melts, glasses and gels, solutions and gels: zeolite synthesis – precipitation from solution or melt: flux method, epitaxial growth of thin layers, verneuil flame fusion method. Graphite intercalation compounds, transition metal dichalcogenide and other intercalation compounds, ion exchange reaction, synthesis of new metastable phases by 'Chimie Douce'. Electrochemical reduction methods – preparation of thin films, chemical and electrochemical methods, physical methods – growth of single crystals, Czochralski method, Bridgman-Stockbarger methods – zone melting. Vapour phase transport, hydrothermal methods, comparison of different methods – high pressure and hydrothermal methods and dry high pressure methods.

**UNIT IV: MAGNETIC MATERIALS AND OPTICAL PROPERTIES (14 Hours)**

Selected examples of magnetic materials and their properties – metals and alloys, transition metal oxides, spinels, garnets, ilmenite and perovskites. Magnetoplumbites – applications – structure/property relations – transformer,information storage, magnetic bubble memory devices, permanent magnets. Luminescence, Lasers and phosphors – definitions and general comments, configurational coordinate model, some phosphor materials, anti-Stokes phosphors – lasers – the ruby laser, Neodymium lasers

**UNIT V: ORGANIC SOLIDSTATE CHEMISTRY (14Hours)**

Topochemical control of solid state organic reactions – intramolecular reactions – conformational effects – intermolecular reactions – molecular packing effects – photodimerization of 2-ethoxycinnamic acid (α form, β form, γ form) – photopolymerization of 2,5-distyrylpyrazine – photopolymerizations of diacetylenes. Asymmetric syntheses – dimerization of anthracene – control of molecular packing arrangements. Organic reactions within inorganic host structures – electrically conductive organic solids – organic metals, conjugated systems, doped polyacetylene, polyparaphenylene, polypyrrole – organic charge transfer complexes – new superconductors

**Total Lecture Hours: 75**

**COURSE OUTCOME**

**The student should able to**

1. Identify crystal structures of few inorganic solids.
2. Study the chemistry of crystallization and vapour phase transport.
3. Explain the applications of magnetic materials.
4. Understand the chemistry of organic solids.
5. Design the molecular rods, triangles, ladders, networks

**TEXT BOOKS**

1.J. D. Lee,2011. Concise Inorganic Chemistry, 5th Ed., Blackwell Science, London,

2. D. F. Shriver and P. W. Atkins,2021 Inorganic Chemistry, 3rd Ed., W. H. Freeman and Co,

3 .B. R. Puri, L. R. Sharma, K. C. Kalia, 2019.Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., Delhi,.

4.J. M. Lehn, 2000.Transition Metals in Supramolecular Chemistry; Vol 5, John Wiley and Sons, New York,

5.C. N. R. Rao, 2001.Current Science, Royal Society of Chemistry, UK, .

## REFERENCES


1. A. R. West,2019. Solid State Chemistry and Its Applications; 2nd Ed., John Wiley and sons, New York,

2. J. M. Lehn, 2011.Supramolecular Chemistry; VCH, Weinheim,.

3. G. R. Desiraju,2013. Crystal Engineering: The Design of Organic Solids; Elsevier, Amsterdam,

4. G. R. Desiraju, and T. Steiner, 2002 The Weak Hydrogen Bond in Structural Chemistry and Biology; Oxford University Press: Oxford,.

5. G. A. Jeffrey, 1997 Introduction to Hydrogen Bonding; Oxford University Press, New York,.


## E-RESOURCES

1.https://link.springer.com/chapter

2.https://books.google.com/books/about/Crystal_Engineering

3.https://www.researchgate.net

4.https://engineering.virginia.edu/departments/materials-science-and-engineering/research/electrical-magnetic-optical-properties

5.https://www.nanowerk.com/mof-metal-organic-framework.php

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**DEPARTMENT OF CHEMISTRY**
**M.Sc., CHEMISTRY**

**Semester: II EC-IIB- Inorganic Photochemistry**

**Ins. Hrs. /Week: 5** **Course Credit: 4** **Course code: 22PCHE21B**

## UNIT I PRINCIPLES OF PHOTOCHEMISTRY ( 16 Hours)

Absorption, excitation, photochemical laws, quantum yield. Absorption and emission for complexes with different ground state /excited state for ML6complexes.Potential energy function and energy levels for ML6complexes.Flash photolysis, stopped flow techniques. Energy dissipation by radiative and non-radiative processes, absorption spectra. Frank-Codon principle, photochemical stages – primary and secondary processes. Jablonski diagram for photochemical process

## UNIT II PHOTOCHEMICAL PROPERTIES OF TRANSITION METAL COMPLEXES (13 Hours)

Photo physical process, Photochemical process, Photo substitution reactions, photoredox reactions, Photorearrangement reaction, Prompt and Delayed Photochemical reactions, Photolysis rules and ligand field theory

## UNIT III CHARGE TRANSFER PHOTOCHEMISTRY (13 Hours)

Introduction, charge transfer absorption spectra, types of charge transfer excitations and their energy level scheme for charge transfer excitations, Types of reactions observed by charge transfer metal complexes.

## UNIT IV LIGAND FIELD PHOTOCHEMISTRY OF TRANSITION METAL COMPLEXES (18 Hours)

Photochemistry Cr(III) of complexes : Photo-substitutions, properties of ligand field excited states, Photoaquation reactions, photolysis rule , photoisomerization , photo racemization, photoanation reactions, sensitizer, energy transfer process, Mechanism of photosensitization, photo reactive excited state. The Doublet hypothesis, Role of quartet excited states, Photochemistry of Co(III) complexes : Introduction, energy level diagram,

Photoaquations in Co(III) amine, Co(III) cyanide complexes, Fe(II) low spin complexes, Ru(II) ammine derivative complexes, Photo redox properties of Ce(III)and Ce(IV) complexes, photochemistry of Cu(II) (1,3 diketone) complexes.

**UNIT V PHOTOCHEMICAL REACTIONS ON SOLID SURFACE (15Hours)**

Introduction, photo electron transfer mechanism, energy level diagram of solid acceptor and donor levels, Examples of photo catalytic metal/mixed metal oxides and their applications, semiconductor supported metal oxides for photolysis of water, Decomposition of organic pollutants, experimental setup, end product of organic products, carbon dioxide reduction, nitrogen fixations, solar energy conversion and its storage. Chemiluminescence's in coordination complexes, Thexi state and Franck condon state

**Total Lecture Hours: 75**

**COURSE OUTCOME**

1.Understand, concepts of Bioinorganic Chemistry, Function and Transport of Alkali and Alkaline earth metals,

2. Introduce the principles of bioinorganic chemistry and advanced Transition Metal Complexes

3. knowledge in Inorganic Chemistry and Coordination Chemistry.

4.Draw the energy level diagram in Transition Metal Complexes.

5. Analyse decomposition of organic pollutants

**TEXT BOOKS**

1.Lippard, S. J., and Berg, J. M.,2018. Principles of Bioinorganic Chemistry, Panima Publishing Company, New Delhi,

2. Kaim W., and Schewederski, B., 2013 Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, John Wiley & Sons, New York, USA,.

3.Bertini, I., Gray, H. B., Lippard, S. J. and Valentine, J. S., 2007 Bioinorganic Chemistry, 1 st South Asia edition, Viva books Pvt. Ltd.,.

4. Huheey, J. E., Keiter, E. A. and Keiter, R. L., and Medhi, O. K., 2006. Inorganic Chemistry - Principles of Structure and Reactivity,4th edition, Pearson Education,

5. Behrens, P., Bauerlein, E., 2007. Hand Book of Biomineralization, 1st edition, Vol. 1& 2, Wiley-VCH.

**Reference Books**

1. Purcell, K. F. and Kotz, J. C., 2012. Inorganic Chemistry, Cengage Learning,

2. Cotton, F. A., Wilkinson, G., Carlos A. Murillo, 2007Manfred Bochmann, Advanced Inorganic Chemistry, 6th ed., A Wiley - Interscience Publication, John –Wiley & Sons, USA,.

3. Atkins, P., Overton, T., Rourke, J., Weller M., and Armstrong, F., , 2010. Inorganic Chemistry, 5th edition, Oxford University Press.

4. Lehninger, A., Nelson, D. L., Cox, M. M, 2008. Principles of Biochemistry, 5th edition, W.H Freeman,

5. Alessio, E., 2012. Bioinorganic Medicinal Chemistry, 1st Edition, Wiley-VCH Verlag GmbH Co. KGaA,

**E-RESOURCES**

1.https://cds.cern.ch/record/1254287/files/9780470014936_TOC.pdf

2.http://photobiology.info/Photochem.html

3.https://www.wiley.com

4https://patents.google.com/patent/EP3207992A1/en

5.http://www.eurekaselect.com/170683/article

**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE**

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**SUNDARAKKOTTAI, MANNARGUDI- 614016**

*(For the Candidates admitted in the academic year 2022 – 2023)*

**DEPARTMENT OF CHEMISTRY**

**M.Sc., CHEMISTRY**

**Semester: II-EDC- IA: Food Chemistry**

**Ins. Hrs. /Week :3** **Course Credit: 2** **Course Code: 22PCHED1A**

**UNIT I: NUTRIENTS–I** **(10 Hours)**

Protein–functions, sources, deficiency diseases, daily allowances. Carbohydrates–functions, sources, deficiency diseases, daily allowances.

Fats and oils–functions, sources, deficiency diseases, daily allowances, disorders due to excess of fat.

**UNIT -II: NUTRIENTS–II** **(9 Hours)**

Vitamins – H2O soluble and fat soluble vitamins – sources, functions, deficiency and disorders of taking excess of vitamins. H2O–functions, sources, deficiency diseases

**UNIT - III: FOOD PREPARATION** **(9 Hours)**

Food preparation-Effect of cooking and heat processing on the nutritive value of foods. Food faddism and faulty food habits. Cooking methods: Moist heat methods and dry heat methods–merits and demerits.

Preparation of Essence, Hand wash, Disinfectants and Antiseptic agents.

**UNIT - IV: FOOD PRESERVATION** **(9 Hours)**

Food preservation: Importance of food preservation, causes of food spoilage. Principles of food preservation. Home scale methods of food preservation.

Methods of food preservation: Low temperature, high temperature, preservatives, osmotic pressure, dehydration, irradiation–merits and demerits.

**UNIT - V: FOOD ADULTERATION** **(8 Hours)**

Food Adulteration–Types, international, Metallic, incidental adulteration and their ill effects. Simple physical and chemical tests for detection of food adulterants, consumer protection.

**Total Lecture Hours: 45**

**COURSE OUTCOME**

The student Should able to,

1. Discuss the functions, sources, deficiency diseases and daily allowances of major nutrients
2. Understand various kinds of Vitamins, Sources, functions and deficiency symptoms
3. Describe the different types of food adulteration.

**TEXT BOOK(S)**


1. Belitz. W. Grosch, P.Schieberle,2009, Food Chemistry, 4th Edition Oxford University Press, New York,..
2. Deman. J.M.(et al), 2018, Principles of Food Chemistry. University of Guelph. Guelph, Ontario.
3. Hamilton. R.J, 1998, Lipid Analysis in Oils and Fats.University Liverpool UK
4. Srilakshmi. B, 2003, Food Sceince, Third Edition, New Age international publishers.New Delhi.
5. Swaminathan. Dr. M, 2008, Handbook of food and Nutrition 'Reprint, published by The Bangalore printing and publishing co. ltd.NewDelhi.


**REFERENCE BOOK(S)**


1. Lakshmi, 2000. Food Science, Second Edition, New Age international publishers.New Delhi.
2. Sumathi. R. Mudambi,1983. 'Fundamentals of food and Nutrition', Second edition, Wiley Eastern Limited.New Delhi.

3. Swaminathan.M. Dr.1987. Food Science Chemistry and Experimental foods, second enlarged edition, Published by Bangalore press.

4. Swaminathan. M. Dr. 'Advanced test Book on Food and Nutrition Volume I and II second edition, The printing and publishing co. ltd .Bangalore.

5. Swaminathan .M.2021. Dr.'Advanced test Book on Food and Nutrition Volume III secondedition, The printing and publishing co. ltd. Bangalore


**E RESOURCES**

1. https://www.bing.com/aclick
2. https://medical-dictionary.thefreedictionary.com/nutrient
3. https://nios.ac.in/media/documents/srsec321newe/321-e-lesson-8.pdf
4. http://www.eagri.org/eagri50/ambe101/pdf/lec23.pdf
5. http://ijsit.com/admin/ijsit_files/food%20adulteration_1.2.4.pdf

**SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE**
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**M.Sc., CHEMISTRY**
*(For the Candidates admitted in the academic year 2022 – 2023)*
**DEPARTMENT OF CHEMISTRY**

**Semester: II-EDC-IIB-Medicinal Chemistry**

**Ins. Hrs. /Week: 3** **Course Credit: 2** **Course Code: 22PCHED1B**

## UNIT-I: BASIC CONCEPTS ( 9Hours)

Drug design - analogues and pro-drugs, factors governing drug design, rational Physical properties-factors governing drug action at active site, general anaesthetics-inhalation anaesthetics, intravenous anaesthetics and basal anaesthetics; mode of action; local anaesthetics-classification and syntheses, sedatives and hypnotics-classification, synthesis, mode of action and structure-activity relationship.

## UNIT-II: ANTICONVULSANTS, STIMULANTS AND ANTIPYRETIC ANALGESICS ( 9 Hours)

Anticonvulsants - classification, synthesis and mode of action; Muscle relaxants-classification, synthesis and mode of action. Central nervous system stimulants- classification, synthesis and mode of action; Antipyretic analgesics- classification, pyrazol in onessynthesis and mode of action;

## UNIT-III: ANALGESICS NARCOTIC OR OPIATE ANALGESICS ( 10 Hours)

Classification, preparation and mode of action; Narcotic antagonists; Cardiovascular drugs-classification, synthesis and mode of action; Autonomic drugs-synthesis and mode of action of sympathomimetic drugs, antiadrenergic drugs, cholinomimetic drugs, antimuscarinicdrugs, ganglionic blocking agents and adrenergic neurone blocking agents;

## UNIT-IV: ANTIHISTAMINES, ANDANTIPARKINSON DRUGS ( 8 Hours)

Antihistamines - synthesis and mode of action; prevention of histamine release; Antiparkinsonism agents-synthesis and mode of action of piperidine analogues, pyrolidine analogues and phenothiazine analogues.

## UNIT-V: NOVEL DRUGS ( 9 Hours)

Sulphonamides-preparation and mode of action of sulphonamides for general, urinary, intestinal and local infection; sulphonamide inhibition. Antimalarials-synthesis and mode of action of aminoquinoline analogues, aminoacridine analogues, guanidine analogues, pyrimidine analogues, sulfone and quinine analogues. Drug Analysis- X ray method, Blood analysis and Urine analysis and pregnancy test.

**Total Lecture Hours: 45**

**COURSE OUTCOME:**

1. Understand basic concepts of medicinal chemistry
2. Study Structure activity relationships of selected drug molecules .
3. Explain Antihistamines, and Antiparkinsonian drugs

**TEXT BOOKS**


1. AshutoshKar, 1996..Medicinal Chemistry, New Age International, New Delh
2. W.O.Foye, 1981.Principles of medicinal chemistry, 2nd edn., Lea &Febiger, Philadelphia,.
3. Nader Rifai 2010. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics, 8e: South Asia Edition. Elsevier India
4. Alagarsamy.2022. Textbook Of Medicinal Chemistry. CBS Publishers & Distributors Pvt. Ltd
5. Ashutosh Kar.2019. Medicinal Chemistry. Publisher: New Age International. United Kingdom


**REFERENCE BOOKS**


1. M.E.Wolff,2010 Burger's medicinal chemistry, 4th Edn., John Wiley &Sons, New York,
2. F.F.Blicke and R.H.Cox,2017. Medicinal Chemistry, John Wiley &Sons, New York,
3. D.Lednicer and L.A.Mitscher, Organic Chemistry of drug synthesis, John Wiley & Sons, New York,.
4. J.E.Hoover, Remington's Pharmaceutical sciences, 15th Edn. Mack Publ.Company, Easton,
5. Fischer, C. R. Ganellin. 2006 Analogue-based Drug Discovery. Oxford University Press


**E- RESOURCES**

1.https://rwjms.rutgers.edu/education/gsbs
2.https://www.researchgate.net
3.https://pubs.acs.org
4.https://www.apdaparkinson.org
5.https://en.wikipedia.org/wiki/Organometallic

# SEMESTER III

# SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

**(AUTONOMOUS)**

**SUNDARAKKOTTAI, MANNARGUDI- 614016**

*(For the Candidates admitted in the academic year 2022 – 2023)*

## DEPARTMENT OF CHEMISTRY

**M.Sc., CHEMISTRY**

**Semester: III - CC-VII: Coordination Chemistry**

**Ins. Hrs. /Week: 6** **Course Credit: 5** **Course Code**:

**UNIT-I: Theories of Metal –Ligand Bond (15 Hours)**

Crystal field theory- splitting of d-orbitals under various geometries- factors affection splitting-CFSE and evidences for CFSE (structural and thermodynamic effects). Spectrochemical series- Jahn-Teller distortion – spectral and magnetic properties of complexes- site. Limitations of CFT- ligand field theory- MO theory – sigma and pi-bonding in complexes – Nephelauxetic effect – the angular overlap model.

**UNIT-II: Inner Transition Elements and Molecular Rearrangements (15Hours)**

Inner transition elements – position in the periodic table – electronic configuration, oxidation states, solubility, color and spectra, magnetic properties – Separation of lanthanides - lanthanide contraction: Causes and consequences – Gadolinium break, shift reagents – Extraction of thorium and uranium. Comparison of actinides and lanthanides.Molecular rearrangements of four – and six – coordinate complexes – interconversion of stereoisomers – reaction of coordinated ligands – template effect and its applications for the synthesis of macro cyclic ligands – unique properties.

**UNIT- III: Spectral characteristics of complexes: (15Hours)**

Term states for d ions characteristics of d-d transitions charge transfer spectra selection rules for electronic spectra Orgel correlation diagrams Sugano-Tanabe energy level diagrams nephelauxetic series Racha parameter and calculation of inter-electronic repulsion parameter.

**UNIT-IV: Reactions and catalysis of organometallic compounds: (15Hours)**

Reactions of organometallic compounds: Oxidative addition, reductive elimination (α and β eliminations), migratory insertion reaction and metathesis reaction. Organo-metallic catalysis: Hydrogenation of olefins (Wilkinson's catalyst), hydroformylation of olefins using cobalt or rhodium catalysts (oxo process), oxidation of olefin (Wacker process), olefin isomerisation, water gas shift reaction, cyclo-oligomerisation of acetylenes using Reppe's catalysts, Monsonto process

**UNIT-V: Inorganic spectroscopy -I: (15Hours)**

IR spectroscopy: Effect of coordination on the stretching frequency-sulphato, carbonato, sulphito, aqua, nitro, thiocyanato, cyano, thiourea, DMSO complexes; IR spectroscopy of carbonyl compounds. NMR spectroscopy-Introduction, applications of 1H, 15N, 19F, 31P-NMR spectroscopy in structural identification of inorganic complexes, fluxional molecules, quadrupolar nuclei- effect in NMR spectroscopy

.

**Total Lecture Hours: 90**

**COURSE OUTCOME**

Student will able to

1. Understand the theories of bonding in coordination compounds.
2. Describe about the Basics of organometallics and structure and bonding in organometalliccompounds.
3. Analyze the Mechanisms of reactions of complexes.
4. Explain the Different types of magnetic behaviors and their measurement.

5. Predict the reactions in amines, proteins and enzymes.
6. Discuss about the applications of NMR, ESR and Mossbauer spectrometric methods in coordination compounds.

**TEXT BOOK(S)**


1. Cotton . F. A, Wilkinson. G, Murillo. C. A , Bochmann .M. 2021. Ad vanced InorganicChemistry. A Wiley India Pvt Ltd.
2. Drago . R S.1992. Physical Methods in Chemistry, 3rd Ed., W. B. Saunders Company, London.
3. Huheey .J E. Keiter ,E. A , Keiter. R. L.1993. Inorganic Chemistry Principles of Structure and Reactivity, 4th Ed., Harper Collins College Publishers, New York.
4. Miessler. G.L. Fischer.P.J , Tar. D.A, 2014 Inorganic Chemistry, 5th Ed., Pearson Education, Inc., New York.
5. Sutton. D. 1968 . Electronic Spectra of Transition Metal Complexes, McGraw Hill, Australia.


**REFERENCE BOOK(S)**


1. Cotton ,F.A ,Wilkinson. G. 1972. Inorganic Chemistry A Comprehensive Text, 3rd Ed., Inter science Publishers, New York.
2. Lee ,J. D. 1998 .Concise Inorganic Chemistry, 6th Ed., ELBS, London.
3. Lewis. J , Wilkins. R.G. 1960 . Modern Coordination Chemistry, Inter science Publishers, Inc., New York.
4. Purcell.,K.F and Kotz, J.C. 1977. Inorganic Chemistry, W B Saunders Company, Philadelphia,.
5. Shriver,D.Weller. M ,Overton. T Rourke. J and Armstrong. F. 2014. Inorganic Chemistry, 6th Ed., W H Freeman and Company, New York.


**E RESOURCES**

1. https://chem.yonsei.ac.kr/chem/upload/che3103-01/125298016336101.pdf
2. https://nptel.ac.in/content/storage2/courses/104101005/downloads/lecturenotes/chapter%2011.pdf
3. https://www.academia.edu/23549742/amines_amino_acids_proteins
4. http://www3.nd.edu/~nsl/lectures/laboratory/19_esr.pdf
5. http://scalettar.physics.ucdavis.edu/p298/squiddetectednmrandnqr.pdf

# SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

**(AUTONOMOUS)**

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*(For the Candidates admitted in the academic year 2021 – 2022)*

## DEPARTMENT OF CHEMISTRY

**M.Sc., CHEMISTRY**

**Semester: III- CC- VIII: Physical Chemistry – III**

**Ins. Hrs. / Week: 6** **Course Credit: 5** **Course Code:**

**UNIT I: QUANTUM CHEMISTRY – II (18 Hours)**

Applications of wave mechanics – the harmonic oscillator, rigid rotator – hydrogen and hydrogen like atoms – shapes and nodal properties of orbitals – space quantization – approximation methods – methods of variation, application to hydrogen and helium atoms – perturbation method — helium atom – effective nuclear charge.–atomic structure calculation – self consistent field method – Hartree-Fock method for atoms – angular momentum in many electron systems – spin-orbit interaction, L-S and j-j coupling schemes.

**UNIT II: Electro Chemistry Ionics**: **(18 Hours)**

Arrhenius theory -limitations, van't Hoff factor and its relation to colligative properties. Deviation from ideal behavior. Ionic activity, mean ionic activity and mean ionic activity coefficient-concept of ionic strength, Debye Huckel theory of strong electrolytes, activity coefficient of strong electrolytes Determination of activity coefficient ion solvent and ion-ion interactions. Born equation. Debye-Huckel Bjerrum model. Derivation of Debye-Huckel limiting law at appreciable concentration of electrolytes modifications and applications. Electrolytic conduction-Debye-Huckel Onsager treatment of strong electrolyte-qualitative and quantitative verification and limitations. Evidence for ionic atmosphere. Ion association and triple ion formations

**UNIT III Electrodics of Elementary Electrode Reactions: (18 Hours)**

Behavior of electrodes: Standard electrodes and electrodes at equilibrium. Anodic and Cathodic currents, condition for the discharge of ions. Nernst equation, polarizable and non-polarizable electrodes. Model of three electrode system, over potential. Rate of electro chemical reactions: Rates of simple elementary reactions. Butler-Volmer equation-significance of exchange current density, net current density and symmetry factor. Low and high field approximations. symmetry factor and transfer coefficient Tafel equations and Tafel plots. .

**UNIT-III: Kinetics of Reactions (15 Hours)**

Theories of reactions-effect of temperature on reaction rates, collision theory of reaction rates, Unimolecular reactions -Lindeman and Christiansen hypothesis- molecular beams, collision cross sections, effectiveness of collisions, Potential energy surfaces. Transition state theory-evaluation of thermodynamic parameters of activation-applications of ARRT to reactions between atoms and molecules, time and true order-kinetic parameter evaluation. Factors determine the reaction rates in solution - primary salt effect and secondary salt effect, Homogeneous catalysis- acid- base catalysis-mechanism of acid base catalyzed reactions-Bronsted catalysis law, enzyme catalysis-Michelis-Menton catalysis

**UNIT IV: Kinetics of complex and fast reactions: (18 Hours)**

Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions. Chain reactions-chain length, kinetics of H2 – Cl2 & H2 – Br2 reactions (Thermal and Photochemical reactions) - Rice Herzfeld mechanism. Study of fast reactions-relaxation methods-temperature and pressure jump methods electric and magnetic field jump methods -stopped flow flash photolysis methods and pulse radiolysis. Kinetics of polymerization-free radical, cationic, anionic polymerization -

**UNIT-V: Fast Reaction Techniques, Photochemistry and Radiation Chemistry (18 Hours)**

Introduction – flow methods (continuous and stopped flow methods) –relaxation methods (T and P jump methods) – pulse techniques (pulse radiolysis, flash photolysis) – shock tube method – molecular beam method –lifetime method.Photophysical processes of electronically excited molecules – Jablonski diagram

– Stern-Volmer equation and its applications – experimental techniques inphotochemistry – chemical actinometers – lasers and their applications.Differences between radiation chemistry and photochemistry – sources of highenergy radiation and interaction with matter – radiolysis of water, solvated electrons – definition of G value, Curie, linear energy transfer (LET) and Rad –scavenging techniques – use of dosimetry and dosimeters in radiationchemistry – applications of radiation chemistry.

**Total lecture Hours: 90**

**COURSE OUTCOME:**

Student should be able to

1. Account for the basic principles and concepts of quantum chemistry.
2. Describe chemical corrosion and recognize the primary oxidation and reduction reactions from electrochemistry
3. Design process to removal of toxic compounds from industrial waste water.
4. Calculate the free energy change for an electrochemical cell using the measured cell potential value.
5. Explain and discuss theories for photo induced electron transfer
6. Understand the concept and Mechanism for complex processes.

**TEXT BOOKS**


1. S. Mohan and V. Arjunan, Principles of Materials Science, MJP Publishers, 2016.
2. Arumugam, Materials Science, Anuradha Publications, 2007.
3. Giacavazzo et. al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010
4. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012.
5. James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science for Engineers. 6th ed., PEARSON Press, 2007


**REFERENCES**


1. F. A. Cotton, Chemical Applications of Group Theory; 3rd Ed., Wiley Eastern, New Delhi, 1990.
2. P. Atkins and J. de Paula, Physical Chemistry; 9th Ed., W. H. Freeman Publications, NeW York, 2009.
3. S. Glasstone, Introduction to Electrochemistry; Maurice Press, Philadelphia, 2008.
4. L. Antropov, Theoretical Electrochemistry; University Press of the Pacific, USA, 2001.
5. S. Glasstone, An Introduction to Electrochemistry; Read Books, New Delhi, 2007.
6. J. O'M Bockris and A. K. N. Reddy, Modern Electrochemistry; Vol. 1 and 2, 2nd Ed., Plenum Press, New York, 1998.
7. R. G. Compton, Electrode Kinetics: Reactions; Elsevier Science Press, Chennai, 1987.
8. G. W. Castellan, Physical Chemistry; Narosa, New Delhi, 1986.
9. J. W. Moore and R. G. Pearson, Kinetics and Mechanism; 3rd Ed., John Wiley and Sons, New York, 1981.
10. M. Mortimer and P. G. Taylor, Chemical Kinetics and Mechanism; 1st Ed., Royal Society of Chemistry, UK, 2002.
11. Amdur and G. G. Hammes, Chemical Kinetics Principles and Selected Topics; 3rd Ed., McGraw Hill, New York, 2008.
12. M. Gratzel and K. Kalyanasundaram, Kinetics and Catalysis in Micro heterogeneousSystems; Academic Press, New York, 1991..


**E-RESOURCES**

1. http://ursula.chem.yale.edu/~batista/classes/vvv/v570.pdf
2. https://vdoc.pub/download/quantum-chemistry-flabup9u6fc0
3. https://www.researchgate.net/publication/297532029_Chemical_Kinetics_Applications
4. https://pubmed.ncbi.nlm.nih.gov/15889409/
5. https://global.oup.com/academic/product/photochemistry-and-radiation-chemistry-9780841234994?cc=us&lang=en&

# SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

**(AUTONOMOUS)**

**SUNDARAKKOTTAI, MANNARGUDI- 614016**

*(For the Candidates admitted in the academic year 2022 – 2023)*

## DEPARTMENT OF CHEMISTRY

**M.Sc., CHEMISTRY**

**Semester: III - CC- IX: Scientific Research Methodology**

**Ins. Hrs. /Week: 6** **Course Credit: 5** **Course Code:**

**UNIT-I: RESEARCH ETHICS (18 Hours)**

Philosophy- Definition, nature, scope. Ethics-Definition, moral Philosophy, nature of moral judgements and reactions. Ethics with respect to science and research. Scientific misconducts- falsification, fabrication and plagiarism- use of plagiarism software-Turnitin, Urkund and other opensource software tools. Redundant publications- duplicate and overlapping publications. Publication Ethics- Definition and importance. Publication misconduct- Definition, concept, problems that lead to unethical behavior, types, violation of publication ethics, authorship and contributor ship. Software tool to identify predatory publications developed by SPPU. Subject specific ethical issues- authorships, conflicts of interest.

**UNIT- II: RESEARCH DESIGN, DATA COLLECTION AND INTERPRETATION (18 Hours)**

Research design; sampling techniques, categories of research design, Design of experiments, sample selection, Data collection – mapping and scaling, techniques and tools and documentation, presentation, Data analysis – Qualitative and quantitative and interpretation of data.

**UNIT- III: COMPUTER APPLICATION AND STATISTICS (18 Hours)**

Computer application: MS office, excel, power point, graphics (Origin), statistical software (SPSS), CHEMDRAW, Full Prof *etc*.Statistics: Standard deviation/error; Correlation coefficient, Regression equation, types of correlation, , test of significance, chi-square test, analysis of variance.

**UNIT-IV: FORMULATION OF SCIENTIFIC COMMUNICATION (18 Hours)**

Outline preparation, drafting title, sub titles, tables, illustrations; Formatting tables- title, body footnotes; figures & graphs- structure, title and legends, Journal- Definition-Various names of journal- Impact factor, citation sindices, plagiarism.

**UNIT- V: SCIENTIFIC WRITING (18 Hours)**

Forms of scientific writing- Article, notes, reports, review article, monographs, dissertations, popular science articles- Search Method through-Science Direct, SCI finder, Chem port, bibliographies, Project proposal writing- Convention of thesis writing.

**Total Lecture Hours: 90**

**COURSE OUTCOME**

**The students will be able to**

1. Demonstrate the concept of public health research
2. Apply and analyse the various quantitative research methods
3. Appraise and practice the various qualitative research methods
4. Develop operational research designs with n intent to improve the public health practices
5. Practice ethical approaches in research so as to uphold the principle of maximum benefit and minimum risk to human kind in the research process
6. Design and implement research programs
7. Develop an insight into the process of research which helps in designing an appropriate and feasible study for the Dissertation.

**TEXT BOOK(S)**


1. Research Methodology - Methods & Techniques, CR Kothri CR (1990), Vishva Prakashan, New Delhi.
2. Research Methodology & Statistical Techniques, S Gupta (1999) Deep & Deep Publications, New Delhi.
3. Research methodology for biological sciences, N Gurumani (2007), MJP Publishers, Chennai.
4. Research Methodology (Methods, Approaches and Techniques), Dr. Baidyanath Mishra, Ashok Kumar Mishra, & Sujata Misra Varanasi.
5. Research Methodology, Ranjith Singh(2021)


**REFERENCE(S)**


1. Introduction to Biostatistics, L Forthofer (1995), Academic Press, New York.
2. Biostatistical Analysis, JH Zar (2006), Prentice-Hall.
3. Research Design: Qualitative, Quantitative & Mixed Method Approaches. John W.Creswell (2009), Sage Publication, USA.
4. Experimental Design & Data Analysis for Biologists. PQ Gerry & JK Michael (2002),Cambridge University Press.
5. Choosing and Using Statistics: A Biologists Guide, D Calvin (2003), BlackwellPublisher.


**E-RESOURCES**

1.https://www.researchgate.net/publication/321964409_Research_Methodology

2. https://www.scribbr.com/dissertation/methodology/

3. https://gradcoach.com/what-is-research-methodology/

4. https://www.euacademic.org/BookUpload/9.pdf

5.. http://ihmgwalior.net/pdf/research_methodology.pdf

# SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

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## DEPARTMENT OF CHEMISTRY

**M.Sc., CHEMISTRY**

**Semester: III - CP-III: Physical Chemistry Practical**

**Ins. Hrs. /Week: 6** **Course Credit: 3** **Course Code:**

## PHYSICAL–NON ELECTRICAL

1. Kinetics-acid hydrolysis of Ester-Determination of energy of activation (Ea).
2. Determination of Critical Solution Temperature (CST) of phenol-water system and effect of impurity on CST.
3. Determination of molecular weight of a substance by Rast method.
4. Study of phase diagram of two components forming a simple eutectic.
5. Adsorption-Oxalic acid/Acetic acid on charcoal using freundlich isotherm.

## PHYSICAL -ELECTRICAL

1. Conductometry-Acid-alkali titrations.
2. Conductometry-Precipitation titrations.
3. Conductometry-Displacement titrations.
4. Conductometry-Determination of dissociation constant of weak acids.
5. Verification of Onsager equation-conductivity method.
6. Potentiometric titrations-Acid alkali titrations.
7. Potentiometric titrations-Precipitation titrations.
8. Potentiometric titrations-Redox titrations.

**SCHEME OF EVALUATION**:

**Physical Non electrical:**

| | |
|---|---|
| Execution of experiment | - 10 marks |
| Presentation of data | - 05 marks |
| Processing the data, graph and calculation | - 05 marks |
| Results | - 05 marks |
| UE | - 25 marks |

**Physical electrical**:

| | |
|---|---|
| Execution of experiment | - 10 marks |
| Presentation of data | - 05 marks |
| Processing the data, graph and calculation | - 05 marks |
| Results | - 05 marks |
| UE | - 25 marks |
| Viva voce | - 10 marks |
| Total Marks: IA | - 40 marks |

**RESULTS**:

| | |
|---|---|
| Less than 5% | - 20 marks |
| 5-7% | - 15 marks |
| 7-8 % | - 10 marks |
| 8-10 % | - 8 marks |
| Above 10 % | - 6 marks |

**COURSE OUTCOME**

The student will able to

1. Understand the molecular weight, CST, and rate constant.
2. Analyze the determination of Adsorption of Oxalic acid using Freundlich isotherm and Kinetics – Persulphate - Iodine reaction
3. Observe the conductometric titration and potentiometric titrations which canbe determined.
4. Design and carryout scientific experiments as well as accurately record andanalyze the results of experiments.
5. Apply the emf through potentiometer and apply in various field.
6. Determine the molecular weight of unknown compounds.

**TEXT BOOK(S)**


1. Alexander-Findlay. 2016. Practical Physical Chemistry. Wentworth Press,Sydney.
2. Amirtha Anand & Ramesh Kumari , 2020. Physical Chemistry Laboratory Manual; Dreamtech Press. India, Pvt Ltd.
3. Francis William Gray ., 2015.A Manual of Practical Physical Chemistry; Palala Press,
4. Renu gupta 2017. Practical Physical Chemistry 1 st edition, New Age international Publishers.
5. Viswanthan. B, Ragahvan. P.S.2015. Practical Physical chemistry,Viva Publishers.


**REFERENCE BOOK(S):**


1. Khosla. B.D, V.C .Garg, Adarsh Gulati, 2008. Senior Practical Physical Chemistry, R. Chand & Co, New Delhi.
2. Gurturand. J.N & Kapoor. R. Advanced Experimental Chemistry, Vol. I. Chand & Co., Ltd., New Delhi.
3. Levitt. B.P.1985. Findlay's Practical Physical Chemistry, Revised and edited by 9th ed., Longman, London.
4. Saroj.kr Maity , Naba Kr Ghosh , 2012, Practical Physical Chemistry; I st Ed, New cental Book Agency.
5. Yadav. J.B. 2001. "Advanced Practical Physical chemistry", 20th Ed., Goel publishing House, Krishna Pakashan Media Ltd.


## E-RESOURCES

1. https://ijsr.net/archive/v4i4/29031502.pdf
2. https://www.internetchemistry.com/chemistry/supramolecular-chemistry.php
   https://edoc.unibas.ch/55079/

# SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

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## DEPARTMENT OF CHEMISTRY

**M .Sc.**,CHEMISTRY

**Semester: II -EC-III A: Chemistry of Nanoscience and Nanotechnology**

**Ins. Hrs. /Week: 4 Course Credit: 4 Course Code:**

**OBJECTIVES**

- To know the synthetic methods of production of nanomaterials.
- To understand the characterization of nanomaterials.
- To understand carbon clusters and nanostructures.

**UNIT -I : Synthetic Methods (14 Hours)**

Synthetic Methods Definition of nano dimensional materials – historical milestones – unique properties due to nano size, quantum dots, classification of nanomaterials. General methods of synthesis of nanomaterials – hydrothermal synthesis, solvothermal synthesis – microwave irradiation– sol-gel and precipitation technologies – combustion flame – chemical vapour condensation process – gas-phase condensation synthesis – synthesis of nanomaterials using microorganisms and other biological agents – sono chemical synthesis – hydrodynamic cavitation.

**UNIT- II : Surface Imaging (12 Hours)**

Characterization of Nanoscale Materials Principles of Atomic Force Microscopy (AFM) – Transmission Electron Microscopy(TEM) Resolution and Scanning Transmission Electron Microscopy (STEM) – Scanning Tunneling Microscopy (STM) – Scanning Nearfield Optical Microscopy (SNOM). Scanning ion conductance microscope, scanning thermal microscope,

**UNIT -III : Nanotechnology Enabled Devices (10 Hours)**

Reactions in Nanoparticles Reactions in Nano space – nanoconfinement – nano capsules Cavitands, cucurbiturils, zeolites, M.O.Fs, porous silicon, nano catalysis.E

**UNIT -IV : One Dimensional and two-Dimensional Nanostructures (12Hours)**

Carbon Clusters and Nanostructures Nature of carbon bond − new carbon structures – discovery of C60−alkali doped C60−superconductivity in C60−larger and smaller fullerenes. Carbon nanotubes – synthesis − single walled carbon nanotubes − structure and characterization −mechanism of formation − chemically modified carbon nanotubes − doping − functionalizing nanotubes − applications of carbon nanotubes.

**UNIT -V : Biosensors (12 Hours)**

Nanotechnology and Nanodevices DNA as a nanomaterial – DNA – knots and junctions, DNA – nanomechanical device designed by Seeman. Force measurements in simple protein molecules and polymerase – DNA complexes– molecular recognition .

**Total Lecture Hours: 60**

**COURSE OUTCOME**

Students will able to,

1. Learn the Synthetic and microbiological production of nanomaterials .
2. Understand the Characterization of nanomaterials using different types of electromicroscopes and microscopy.
3. Understand the reactions of nanoparticles in nanospace.
4. Understand the Carbon Clusters, nanotubes and their synthesis and applications .
5. Learn the aspects of nanotechnology and nanodevices.

**TEXT BOOK(S)**


1. Asim . K.Das , Mahua Das. 2020. "An Introduction to Nano Materials And Nanoscience"CBS Publisher.
2. Khanna. O.P.2013. A text book of Nano Chemistry, Nehe Publishers, New Delhi.
3. Knoff . G.K. Bassi . A.S. 2006 . Text Book of Smart biosensor Technology, CRCPress.
4. Pradeep. T. 2017, Nano the Essentil. Ist Edition Mc graw- Hill Education, Bengaluru.
5. Thomas Varghese , K.M Balakrishna., 2012, "Nano Technology" Atlantic Publisher PvtLtd, New Delhi.


**REFERENCE BOOK(S)**


1. Klabunde. K.J. (Ed). 2009. Nanoscale Materials in Chemistry. 2nd Edition. Wiley Interscience, New York.
2. Maria Bennelmiki. 2015 .A Introduction to Nanoparticles and Nanotechnology, Claypool Publishers.
3. Poole. C.P and Owens. F.J 2003. Introduction to Nanotechnology. Wiley Inter science,New Jersey.
4. Pradeep.T. 2007 . Nano The Essentials in Understanding Nanoscience and Nanotechnology. 1st Edition Tata Mc Graw Hill, New York.
5. Rao. C. N. R, Muller. A , Cheetham. A. K. 2004 .(Eds), The Chemistry of Nanomaterials. Vol. 1 and 2. Wiley-VCH. Germany, Weinheim.


**E-RESOURCES**

1. http://oms.bdu.ac.in/ec/admin/contents/1_p16che5b_2020051904031942.pdf
2. https://sal.nanofab.utah.edu/imagi`ng-applications/
3. https://www.nano.gov/sites/default/files/pub_resource/sensors_nsi_2012_07_09_final_for_web.pdf
4. https://www.electronicshub.org/types-of-biosensors/

https://www.intechopen.com/books/nanostructures/two-dimensional-nanomaterials

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## DEPARTMENT OF CHEMISTRY

**M.Sc., CHEMISTRY**

**Semester: I - EC-IIIB: Green Chemistry**

**Ins. Hrs. /Week: Course Credit: 4 Course Code:**

**OBJECTIVES**

- To learn the green chemistry and their principles.
- To learn the importance of greener reactions.
- To understand the phase-transfer catalyst in green chemistry.

**UNIT -I : Principles and Green Chemistry synthesis (14 Hours)**

Green chemistry - relevance and goals, Anastas‟ twelve principles of green chemistry -Tools of green chemistry: alternative starting materials, reagents, catalysts, solvents and processes with suitable examples.

**UNIT -II : Addition And Condensation Reactions (12 Hours)**

Addition reactions – Michael addition in [aqueous medium and solid state] – Diels Alder reactions, in aqueous phase. Condensation reactions – Aldol condensation of aldehydes with nitroalkanes and nitriles, Knoevengal condensations–Wittig reactions– Aldol condensation in solid phase – benzoin condensation under catalytic conditions – applications.

**UNIT- III : Oxidation And Reduction Reactions (10 Hours)**

Oxidation reactions – Baeyer-Villiger oxidation in aqueous phase and solid state – enzymatic Baeyer-Villiger oxidation-Reduction reactions – Clemmensen reduction – mechanism – multi-component reactions, limitations – applications.

**UNIT -IV : Phase-Transfer Catalyst Reactions (12 Hours)**

Heck reaction – Michael addition reaction – oxidation of toluene to benzoic acid – Reimer-Tiemann reaction – Baker-Venkataraman synthesis – Williamson ether synthesis – Dozen reaction. -Baker‟s yeast mediated bio-transformations–Bio-catalyst mediated Baeyer-Villigerreactions Microbial polyester synthesis.

**UNIT - V : Sono Chemistry (12 Hours)**

Barbieri reaction – Reformat sky reaction – Simmons-Smith reaction – Strecker synthesis – Ullmann coupling reaction – Wurtz reaction – Bouveault reaction.

**Total Lecture Hours: 60**

**COURSE OUTCOME**

Students will able to

1. Understand the 12 principles of green chemistry.
2. Understand the various addition and condensation reactions involved in green Chemistry.

3. Understand the various Oxidation and reduction reactions involved in green Chemistry
4. Learn the mechanism of Phase transfer catalysed reactions
5. Understand the significance of Sonication reactions

**TEXT BOOK(S)**


1. AnjuGiyal . 2014. Green chemistry. a new approach towards science, vol. I, discovery chemistry.
2. Mary M Kirchhoff, 2013. Green chemistry – Principles and practice, American chemical society.
3. Mike Lancaster. 2010. Green Chemistry – an introductory text, 2nd Edition, Royal Society of Chemistry publishers,
4. Syed AftabIqbal . 2016. Textbook of green chemistry, Discovery Publishing Pvt.Ltd.
5. Albert Matlack. 2010. Introduction to Green Chemistry, CRC Press, Newyork, London.


**REFERENCE BOOK(S)**


1. Ahluwalia. V. K . 2016. Green Chemistry. 2nd Edition. Ane Books Pvt Ltd. New Delhi.
2. Ahluwalia. V.K and Agarwal . K. 2007. Organic Synthesis, Special Techniques. 2nd Edition. Narosa Publishing House, New Delhi.
3. Anastas .P .T and Warner . J . C 2005. Green chemistry Theory and Practice. Oxford University Press, New York.
4. Kumar .V. 2013. An introduction to Green Chemistry, Vishal publishing Co.
5. Suresh .C. Ameta RakshitAmeta Garima Ameta 2018, Sonochemistry. An Emerging Green Technology, Apple academic press, Kindle Edition.


**E- RESOURCES:**

1. https://application.wiley-vch.de/books/sample/3527324186_c01.pdf
2. https://chem.pg.edu.pl/documents/614792/2c6c0579-c52b-400e-a396-07a03363f4e0
3. https://www.scribd.com/document/150973913/sonochemistry-pdf
4. https://cbseportal.com/files/chemistry-oxidation-reduction.pdf
5. https://www.nptel.ac.in/content/storage2/courses/104101005/downloads/lecturenotes/chapter% 208.pdf

# SEMESTER IV

# SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

**(AUTONOMOUS)**

**SUNDARAKKOTTAI, MANNARGUDI- 614016**

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## DEPARTMENT OF CHEMISTRY

**M .Sc., CHEMISTRY**

Semester - I: CC X: **ORGANIC CHEMISTRY -III**

**Ins. Hrs. / Week: 4** **Course Credit: 4** **Course Code:**

**Objectives**

- To understand the molecular complexity of carbon skeletons and the presence of functional groups and their relative positions.
- To study various synthetically important reagents for any successful organic synthesis.
- To apply disconnection approach and identifying suitable synthons to effect successful organic synthesis.
- To learn the concepts of pericyclic reaction mechanisms.
- To gain the knowledge of photochemical organic reactions

**UNIT-I: Planning an Organic Synthesis and Control elements: (15Hours)**

Preliminary Planning – knowns and unknowns of the synthetic system studied, analysis of the complex and interrelated carbon framework into simple rational precursors, retrosynthetic analysis, alternate synthetic routes, key intermediates that would be formed, available starting materials and resulting yield of alternative methods. Linear Vs convergent synthesis. synthesis based on umpolung concepts of Seeback, regiospecific control elements. Use of protective groups, activating groups and bridging elements. Examples on retrosynthetic approach, calculation of yield, advantages of connvergent synthesis, synthesis of stereochemistry-controlled products

**UNIT-II: Organic Synthetic Methodology: (15Hours)**

Retrosynthetic analysis; Alternate synthetic routes. Synthesis of organic mono and bifunctional compounds via disconnection approach. Key intermediates, available starting materials and resulting yields of alternative methods. Convergent and divergent synthesis, Synthesis based on umpolung concepts of Seebach. Protection of hydroxyl, carboxyl, carbonyl, thiol and amino groups. Illustration of protection and deprotection in synthesis. Control elements: Regiospecific control elements. Use of protective groups, activating groups, and bridging elements. Stereospecific control elements. Functional group alterations and transposition.

**UNIT-III: Rearrangements: (15Hours)**

Rearrangements to electron deficient carbon: Pinacol-pinacolone and semi-pinacolone rearrangements -applications and stereochemistry, Wagner-Meerwein, Demjanov, Dienone-phenol, Baker-Venkataraman, Benzilic acid and Wolff rearrangements. Rearrangements to electron deficient nitrogen: Hofmann, Curtius, Schmidt, Lossen, Beckmann and abnormal Beckmann rearrangements. Rearrangements to electron deficient oxygen: Baeyer-Villiger oxidation and Dakin rearrangements. Rearrangements to electron rich atom: Favorskii, Quasi-Favorskii, Stevens, [1,2]-Wittig and [2,3]-Wittig rearrangements. Fries and Photo Fries rearrangement. Intramolecular rearrangements – Claisen, abnormal Claisen, Cope, oxy-Cope Benzidine rearrangements.

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**UNIT-IV Organic Photochemistry-I: (15Hours)**

Photochemical excitation: Experimenta techniques; electronic transitions; Jablonskii diagrams; intersystem crossings; energy transfer processes; Stern Volmer equation.

Reactions of electronically excited ketones; $\pi \rightarrow \pi^*$ triplets; Norrish type-I and type-II cleavage reactions; photo reductions; Paterno-Buchi reactions;

**UNIT-V**:

**Reagents and Modern Synthetic Reactions: (15Hours)**

Lithium diisopropylamine (LDA), Azobisisobutyronitrile (AIBN), Sodium cyanoborohydride ($NaBH_3CN$), *meta*-Chloroperbenzoic acid (m-CPBA), Copper diacetylacetonate ($Cu(ACAC)_2$), $TiCl_3$, $NaIO_4$, Pyridinium chlorochromate (PCC), Pyridinium dichromate (PDC), Meisenheimer complex**.** Suzuki coupling, Heck reaction, Negishi reaction, Baylis-Hillman reaction.

Reagents and Modern Synthetic Reactions: Lithium diisopropylamine (LDA), Azobisisobutyronitrile (AIBN), Sodium cyanoborohydride ($NaBH_3CN$), meta-Chloroperbenzoic acid (m-CPBA), Dimethyl aminiopyridine (DMAP), n-$Bu_3SnD$, Triethylamine (TEA), , Heck reaction, Negishi reaction, Baylis-Hillman reaction.

**COURSE OUT COME**

1.To predict the suitable reagents for the conversion of selective organic compounds.
2. To correlate the principles of substitution, elimination, and addition reactions.
3. To design new routes to synthesis organic compounds.
4.To study various synthetically important reagents for any successful organic synthesis.
5.To apply disconnection approach and identifying suitable synthons to effect successful organic synthesis.
6.To gain the knowledge of photochemical organic reactions.

**TEXT BOOK(S)**

J. March and M. Smith, *Advanced Organic Chemistry*, 5th ed., John-Wiley and Sons. 2001.
2. E. S. Gould, *Mechanism and Structure in Organic Chemistry,* Holt, Rinehart and Winston Inc., 1959.
3. P. S. Kalsi, *Stereochemistry of carbon compounds*, 8thedn, New Age International Publishers, 2015.
4. P. Y.Bruice, *Organic Chemistry*, 7thedn.,Prentice Hall, 2013.
5. R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee*Organic Chemistry*, 7th edn., Pearson Education, 2010.

**REFERENCE BOOK(S)**

S. H. Pine, *Organic Chemistry*, 5thedn, McGraw Hill International Editionn, 1987.
2. L. F. Fieser and M. Fieser, *Organic Chemistry*, Asia Publishing House, Bombay, 2000.
3. E.S. Gould, *Mechanism and Structure in Organic Chemistry*, Holt, Rinehart and Winston Inc., 1959.
4. T. L. Gilchrist, *Heterocyclic Chemistry*, Longman Press, 1989.
5. J. A. Joule and K. Mills, *Heterocyclic Chemistry*, 4thed., John-Wiley, 2010

**E- RESOURCES:**

1.https://sites.google.com/site/chemistryebookscollection02/home/organic-chemistry/organic
2. https://www.organic-chemistry.org/
**3.https://rushim.ru/books/praktikum/Monson.pdf**

# SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

**(AUTONOMOUS)**

**SUNDARAKKOTTAI, MANNARGUDI- 614016**

*(For the Candidates admitted in the academic year 2021 – 2022)*

## DEPARTMENT OF CHEMISTRY

**M.Sc., CHEMISTRY**

**Semester: III-CC-XI: Spectral Techniques in Inorganic Compounds**

**Ins. Hrs. /Week: 6 Course Credit: 5 Course**

**UNIT-I: ELECTRONIC SPECTROSCOPY (18 Hours)**

Microstates, terms– Intensity of bands –group theoretical approach to selection rules - Effect of distortion and spin-orbit coupling on spectra –Evaluation of 10Dq and β for octahedral complexes of cobalt and nickel–applications to simple coordination compounds–charge transfer spectra–Optical rotatory dispersion and circular dichroism and Magnetic circular dichroism – applications to metal complexes- Recent applications

**UNIT-II: INFRARED SPECTROSCOPY (18 Hours)**

Vibrations in simple molecules ($H_2O$, $CO_2$) and their symmetry notation for molecular vibrations– Group vibrations and the limitations- combined uses of IR and Raman Spectroscopy in the structural elucidation of simple molecules like N**2**O, Cl F**3**, NO**3**-, $ClO_4^-$ - effect of coordination on ligand vibrations – uses of groups vibrations in the structural elucidation of metal complexes of urea, thiourea ,cyanide, thiocyanate, nitrate, sulphate and di methyl sulfoxide- vibrational spectraof metal carbonyls with reference to the nature of bonding, geometry and number of C-O stretching vibrations (group theoretical treatment) . Raman spectroscopy- principle, theory and its application- Resonance Raman spectroscopy- Recent applications.

**UNIT-III: NMR SPECTROSCOPY ( 18 Hours)**

Examples for different spin systems – chemical shifts and coupling constants (spin-spin coupling)involving different nuclei (1H, 19F, 31P, 13C) interpretation and applications to inorganic compounds – Effect of quadrupolar nuclei (2H,10B,11B) on the1HNMR spectra,- Systems with chemical exchange - evaluation of thermodynamic parameters in simple systems – study of fluxional behavior of molecules– NMR of paramagnetic molecules–isotropic shifts contact and pseudo-contact interactions–Lanthanide shift reagents. Recent applications.

**UNIT - IV: EPR SPECTROSCOPY AND MAGNETIC PROPERTIES (18 Hours)**

Theory of EPR spectroscopy- Spin densities and McConnell relationship –Factors affecting the magnitude of g and A tensors in metal species- Zero-field splitting and Kramer's degeneracy– Applications of EPR to a few biological molecules containing Cu (II) and Fe (III)ions.Types of magnetism – Día –para – ferro and anti-ferro magnetism. Magnetic properties of free ions – first order Zeeman effect – Second order Zeeman effect – states KT – states<<KT. Determination of Magnetic moments –temperature independent Para magnetism. Magnetic properties of lanthanides and actinides.Recent applications.

**UNIT - V: MOSSBAUER & NQR SPECTROSCOPY (18Hours)**

Mossbauer Spectroscopy-Isomer shifts–Magnetic interactions–Mossbauer emissionspectroscopy applications to iron and tin compounds.

NQR Spectroscopy - Characteristics of quadrupolar nucleus–effects of field gradient and magneticfield upon quadrupolar energy levels –NQR transitions – applications of NQR Spectroscopy.

**Total Lecture Hours: 90**

## COURSE OUTCOME

Student will able to

1. Construct electronic configurations and term symbols for atoms and molecule.
2. Discuss the vibrating diatomic molecule, energy levels of diatomic molecule as required in electronic Spectroscopy,
3. Determine the structure of typical inorganicchemical compounds and application of NMR Spectroscopy.
4. Make students aware of the fine structure of ESR absorption and theory application of EPRSpectroscopy.
5. Understand principles and applications of Mossbauer and NQR

## TEXTBOOK(S)


1. Banwell. C.N,Elaine.M,. Mc.Cash, July 2017. Fundamentals of molecularspectroscopy, (4th Ed), Mc Graw Hill Education.
2. Drago..R.S. Physical Methods in Chemistry, Saunders W.B. Company,Philadelphia, London.
3. Jurgen .H. Gross., 2014, A Text of Mass Spectrometry. 2nd Ed, Springer. USA.
4. Sathya Narayana.Nov 2013.D.N. Introduction to Magnetic Resonance Spectroscopy (ESR, NMR, NQR), 2nd Ed, I K International Publishing house Pvt Ltd.
5. Veera Reddy. K, 2020. Symmetry and spectroscopy of molecules,2nd Ed, NewAge International Publisher, Kerala.


## REFERENCE BOOK(S)


1. Cotton .F.A and Wilkinson.G, Carlos A. Murillo and Manfred Bochmann, ( March 2021)Advanced Inorganic Chemistry, Wiley-Eastern Company, New Delhi.
2. Ebsworth ,E.A.Vand David W H Rankin Stephen Cradock, Sep 1991. Structural Methodsin Inorganic Chemistry,2nd Ed., Blackwell.
3. Helmet Gunzler and Herbert M. Heise. August 2021.IR spectroscopy an introduction, 2ndEd, Wiley VCH.
4. Lakshmi Reddy,S, Tamio Endo et al.Jan 2016. Electronic Spectroscopy, 1stEd.Mabnumpublisher.
5. Roman.,A. Valiulin, October 2019 . NMR multiplet interpretation, 1st Ed, De Gruyter.


## E-RESOURCES

1. http://web.mit.edu/5.33/www/lec/spec6.pdf
2. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/spectrpy/infrared/infrared.htm
3. https://global.oup.com/ukhe/product/nmr-spectroscopy-in-inorganic-chemistry- 9780198794851
4. http://chemistry.du.ac.in/study_material/4101-b/epr%20spectroscopy.pdf
5. https://www.lehigh.edu/~kjs0/carey-13.pdf

# SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

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*(For the Candidates admitted in the academic year 2022 – 2023)*

## DEPARTMENT OF CHEMISTRY

**M .Sc., CHEMISTRY**

Entrepreneurship / Industry Based Course

**Semester - I: Industrial Chemistry**

**Ins. Hrs. / Week: 4 Course Credit: 4 Course Code:**

**OBJECTIVES**

- To know the basic ideas of an industry and industrial wastes.
- To understand the functions of petroleum, petrochemicals, Portland cement, pulp andpaper.
- To describe the preparation of soaps, detergents and perfumes.

**UNIT- I : Basic Ideas and Industrial Wastes (14 Hours)**

Basics idea about unit operation – flow chart – chemical conversion – batch versus continuous processing – chemical process selection – design – chemical process control. Types of industrial wastes – treatment of wastes or effluent with organic impurities – treatment of wastes or effluent with inorganic impurities.– Treatment of wastes: biological treatment, composting, anaerobic digestion, combustion, incineration and landfills, ultimate disposal.

**UNIT -II : Petroleum And Petrochemical (12 Hours)**

Petroleum and Petrochemicals - Introduction – saturated hydrocarbons from natural gas – uses of saturated hydrocarbons – unsaturated hydrocarbons – acetylene, ethylene, propylene, butylene – aromatic hydrocarbons – toluene and xylene. Petrochemicals - petroleum refining, outline of chemicals derived from ethylene, xylene and naphthalene. Preparation of rectified spirit from beer – methylated spirit – preparation of absolute alcohol from rectified spirit –. petroleum and petrochemicals industries in India.

**UNIT -III : Silicate Industries (12 Hours)**

Glass: Glassy state and its properties, classification (silicate and non silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armored glass, safety glass, borosilicate glass, fluorosilicate, colored glass, photosensitive glass. Ceramics: Important clays and feldspar, ceramic, their types and manufacture. Fabrication and processing of ceramics. High technology ceramics and their applications, super conducting and semi conducting oxides, fullerenes carbon nanotubes and carbon fiber. Cements: Manufacture of Cement Introduction – types of cement – high alumina cement, water proof cement, slag cement, acid resisting cement, white cement, colored cement, Pozzolana cement. Setting of cement – properties of cement – testing of cement – uses of cement – concrete
– cement industries in India.

**UNIT -IV : Pulp and Paper Industry (10 Hours)**

Pulp and Paper - Manufacture of Paper - Introduction – manufacture of pulp – types of pulp - sulphate or craft pulp, soda pulp, Rag pulp – beating, refining, filling, sizing and coloring. Calendaring – uses – environmental problems- paper industries in India.

**UNIT- V : Soaps, Detergents and Perfumes (12 Hours)**

Soaps and Detergents - Introduction – types of soaps – hard and soft soaps – manufacture of soap(hot and continuous process only) – cleansing action of soap – detergents – surface activeagents – biodegradability of surfactants, amphoteric detergents.

Perfumes: Introduction – production of natural perfumes – flower perfumes – jasmine, rose and lily – production of synthetic perfumes – muscone and nitro-musks, psychology and other reasons for using perfumes.

**Total Lecture Hours: 60**

**COURSE OUTCOME:**

Students are able to

1. Learn the basic Principle and significance of Industrial Processes and industrial Chemistry.
2. Learn the Significance of Petroleum and Petrochemicals.
3. Learn the manufacturing methods and properties of Cement, Ceramics and Glasses.
4. Learn the raw materials, and manufacturing Processes of Paper in the Pulp industry.
5. Learn the preparation, Properties and significance of soaps, detergents and perfumes.

**TEXT BOOK(S)**


1. James R. Couper, Roy Penney. W, James . R., Fair Stanley . M. Walas, Chemical Process Equipment - Selection and Design, 2nd Edition, Gulf Professional Publishing,2005.
2. John A. Tyrel. Fundamentals of Industrial Chemistry,Wiley, 2014.
3. Kent J.A, Riegel's. Handbook of Industrial Chemistry Paperback, 9th Edition January 1,1997, Kindle book
4. Vermani.O.P & Narula . A.K, Industrial Chemistry, Galgotia publications Pvt. Ltd., NewDelhi, 2008.
5. Rose Phille . K.J. and Joyes Jacob .Industrial Chemicals and Environment.VishalPublication, 2019.


**REFERENCE BOOK(S)**


1. Sharma. B.K, Industrial Chemistry. 8th Ed., Goel Publishing House, New Delhi, 1997.
2. Shreve. R.N and Brink Jr.J.A. Chemical Process Industries; 4th Ed., McGraw Hill,Toronto, 1977.
3. Brain. C.S. Production and Properties of Industrial Chemicals. Reinhold, New York,1989.
4. Sharma. B.K, Industrial Chemistry. 10 th Ed., Goel Publishing House, New Delhi, 1997.
5. Serge Kaliaguine & Jean – Luc Duboi, Industrial Green Chemistry, 2020.


**E-RESOURCES**

1. https://www.nptel.ac.in/content/storage2/courses/104101005/downloads/lecturenotes/cha pter%208.pdf
2. https://www.eolss.net/sample-chapters/c09/e4-11-02-03.pdf
3. https://www.scribd.com/document/366774039/pulp-and-paper-industry-pdf
4. https://www.vanbaerle.com/en/silicates/markets-applications/industry
   http://ethesis.nitrkl.ac.in/5371/1/109ch0476.pdf

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## DEPARTMENT OF CHEMISTRY

**M .Sc., CHEMISTRY**

Value Added Course II

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**VAC-II Semester-IV:**

**Course Credit: 2** **Course Code:** **Total hours 30**

## SUSTAINABLE WATER RESOURCES MANAGEMENT

### Objectives

- To know and understand the importance of water quality.
- To know the salient features of Ground water resources
- To know the role of watershed in water resources management.

**UNIT I** **(6hrs)**

Water resources survey – Water resources of India andTamilnadu – Description of water resources planning –National Water Policy- Properties of water - Water quality standards-WHO& APHA Standards.

**UNIT II** **(6hrs)**

Water resources development - Scope and aims of master plan for irrigation tanks–Farm ponds and percolation ponds –Rain water harvesting.

**UNIT III** **(6hrs)**

Watershed – Concept – Classification – Characteristics – Watershed Programmes –Watershed Management Practices.

**UNIT IV** **(6hrs)**

Occurrence of Ground water –Utilization of Ground water- Aquifer and its types –Ground water recharge- Ground water status atState and National level.

**UNIT V** **(6hrs)**

Sample Collection-Processing Preservations –Testing Kit -Determination of pH- Acidity and Alkalinity – Turbidity - Total Solids- Total volatile solids- Total suspended solids- Water level indicator at different location demonstration- Safety precautions in the Laboratory.

### Course Outcomes

At the end students can

1. Understand the importance of Water resources
2. Understand the importance of Water resources Development
3. Understand the concept of Watershed practices.
4. Understand the Occurrence of Ground water
5. Experimental practice according to the present water issues.

**TEXTBOOKS**

1. Suresh, R. "Soil and Water Conversation", Standard Publication, New Delhi, 1982.
2. Duggal K.N., "Elements of Environmental Engineering" S.Chand and Co. Ltd., New Delhi, 2014.
3.Raghunath,H.m., "Groundwater", 2nd edition, Wiley Eastern Ltd., New Delhi,1987.
4.Santhosh Kumar Garg.,"Textbook of Environmental Engineering" Vol II, Khanna Publishers, New Delhi,2017.

**REFERENCES**

1. Manual on Sewerage and Sewage Treatment Systems Part A, B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2. R.K. Trivedi."Hand Book of Environmental Las,Rules,Guidelines,CompliancesansStandard",Volume I and II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani , 'Environmental Encyclopedia', Jaico Publications,House.Mumbai,2001.
4. Dharmendra S.Sengar,'Environmental Law', Prentice Hall of India PVT LTD, NewDelhi.2007.
5. Rajagopalan .R 'Environmental Studies – From Crisis to cure', Oxford University Press.2005.

**E- RESOURCES:**

1.https://byjus.com/biology/biodiversity-conservation
2. https://www.vedantu.com/biology/conservation-of-biodiversity
3. https://www.conserve-energy-future.com/waste-management-and-waste-disposal-methods.php