CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

Nationally Accredited with "A" Grade By NAAC

ISO 9001:2015 Certified

TIRUCHIRAPPALLI

PG DEPARTMENT OF CHEMISTRY

M.Sc., CHEMISTRY

SYLLABUS

2022-2023 and Onwards

CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

PG DEPARTMENT OF CHEMISTRY

VISION

- To progress into a centre of superiority in Chemistry that will blend state-of-the-art practices in professional teaching in a communally enriching way, with the holistic progress of the students as its prime emphasis.

MISSION

- To produce graduates committed to integrity, professionalism and lifelong learning by widening their knowledge horizons in range and depth.
- To awaken the young minds and discover talents to achieve personal academic potential by creating an environment that promotes frequent interactions, independent thought, innovations, modern technologies and increased opportunities.
- To enhance the quality through basic and applied research frameworks, and encourage the students to take part in entrance and competitive examinations for higher studies and career.
- To enhance services to the community and build partnerships with the industry.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Statements
PEO1	**LEARNING ENVIRONMENT** To facilitate value-based holistic and comprehensive learning by integrating innovative learning practices to match the highest quality standards and train the students to be effective leaders in their chosen fields.
PEO2	**ACADEMIC EXCELLENCE** To provide a conducive environment to unleash their hidden talents and to nurture the spirit of critical thinking and encourage them to achieve their goal.
PEO3	**EMPLOYABILITY** To equip students with the required skills in order to adapt to the changing global scenario and gain access to versatile career opportunities in multidisciplinary domains.
PEO4	**PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY** To develop a sense of social responsibility by formulating ethics and equity to transform students into committed professionals with a strong attitude towards the development of the nation.
PEO5	**GREEN SUSTAINABILITY** To understand the impact of professional solutions in societal and environmental contexts and demonstrate the knowledge for an overall sustainable development.

PROGRAMME OUTCOMES FOR M.Sc., Mathematics,

M.Sc., Physics, M.Sc., Chemistry PROGRAMMES

PO NO.	On completion of M.Sc., Programme, the students will be able to
PO1	**PROBLEM ANALYSIS** Provide opportunities to develop innovative design skills, including the ability to formulate problems, to think creatively, to synthesize information, and to communicate effectively.
PO2	**SCIENTIFIC SKILLS** Create and apply advanced techniques and tools to solve the societal environmental issues.
PO3	**ENVIRONMENT AND SUSTAINABILITY** Ascertain eco-friendly approach for sustainable development and inculcate scientific temper in the society.
PO4	**ETHICS** Imbibe ethical and social values aiming towards holistic development of learners.
PO5	**LIFELONG LEARNING** Instill critical thinking, communicative knowledge which potentially leads to higher rate of employment and also for higher educational studies.

PROGRAMME SPECIFIC OUTCOMES FOR M.Sc. CHEMISTRY

PSO NO.	The students of M.Sc., Chemistry will be able to	POs Addressed
PSO1	Acquire knowledge in basic concepts, fundamental principles, and applications of chemical and scientific theories and their relevancies in the day-to-day life.	PO1 PO2
PSO2	Design experiments, analyze, synthesize and interpret data to provide solutions to different industrial problems by working in the pure, inter and multi-disciplinary areas of chemical sciences.	PO1 PO2 PO3
PSO3	Attain maneuver in diverse contexts with Global Perspective	PO3 PO4
PSO4	Gain a thorough Knowledge in the subject to be able to work in projects at different research as well as academic institutions.	PO1 PO2 PO5
PSO5	Afford Global level research opportunities to pursue Ph.D programme targeted approach of CSIR – NET examination	PO1 PO2 PO3 PO4 PO5

Cauvery College for Women (Autonomous), Trichy-18
M.Sc. Chemistry
(For the Candidates admitted from the Academic year 2022-2023 and onwards)

Semester	Course	Title	Subject code	Inst. Hrs/ Week	Credit	Exam	Marks		Total
						Hrs	Int	Ext	
I	Core Course-I	Organic Chemistry-I	22PCH1CC1	6	6	3	25	75	100
	Core Course-II	Inorganic Chemistry-I	22PCH1CC2	6	5	3	25	75	100
	Core Course-III	Physical Chemistry-I	22PCH1CC3	6	5	3	25	75	100
	Core Practical-I	Organic Chemistry Practical-I	22PCH1CC1P	6	3	6	40	60	100
	Elective Course -I	Instrumentation Techniques Practical/ Nanoscience and Nanotechnology Practical/ Biochemistry Practical	22PCH1EC1AP/ 22PCH1EC1BP/ 22PCH1EC1CP	6	3	6	40	60	100
	Total			**30**	**22**				**500**

Semester I	Internal Marks: 25			External Marks: 75
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**
22PCH1CC1	**ORGANIC CHEMISTRY-I**	**CORE**	**6**	**6**

Course Objective

- To learn the basic concepts of aromaticity and stereochemistry of various organic molecules
- To give ideas of nucleophilic and electrophilic substitution reactions and makes to learn about the oxidizing and reducing reagents for organic synthesis

Prerequisites

Aromaticity, oxidation, reduction and symmetry

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Classify different types of concerted reactions in organic chemistry and orbital correlation approaches	K2
CO2	Identify the stereo centres in a molecule and assign the configuration as R or S	K3
CO3	Distinguish between aromatic, anti-aromatic and non-aromatic compounds by their structure.	K4
CO4	Discuss the relative stability of conformational isomers of cyclohexanes, decalins and norboranes	K6
CO5	Predict the reagents used for different type of organic reactions in synthesis	K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	3	2	3	1	1	1	3
CO2	3	2	1	3	2	2	3	1	1	2
CO3	3	3	1	1	2	3	2	2	2	3
CO4	3	3	2	2	3	3	2	1	2	3
CO5	3	3	2	3	3	3	3	2	1	2

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

UNIT I **(18 Hours)**

Electronic Effects and Aromaticity: Electronic Effects - inductive, resonance and hyper conjugative effects and their influence. Aromatic character: Huckel's theory of aromaticity - three, four, five, six, seven, and eight membered rings – other systems with aromatic sextet - concept of homo aromaticity and anti-aromaticity - Craig's rule and its applications. Consequences of aromaticity - non alteration in bond length- Huckel's MO calculation. Electron occupancy in MO's and aromaticity - NMR concept of aromaticity and anti-aromaticity.

UNIT II **(18 Hours)**

Stereochemistry and Conformational Analysis: Stereoisomerism – optical activity and chirality – types of molecules exhibiting optical activity – R, S and E, Z configuration, absolute configuration – chirality in molecules with non-carbon stereo centers (N, S and P) – molecules with more than one chiral center. Stereochemistry of molecules with axial chirality. Biphenyls, allenes, spiranes and analogues - Atropisomerism - Helicity and chirality - Resolution – methods of Resolution. Conformations of mono and disubstituted six membered ring systems- conformations of decalin. Quantitative correlation between conformation and reactivity.

UNIT III **(18 Hours)**

Aliphatic Substitution Reactions: Aliphatic electrophilic substitution: selected reactions - migration of double bonds - halogenation of aldehydes and ketones - Stork-Enamine reaction- decarboxylation of aliphatic acids - Haloform reaction. Aliphatic nucleophilic substitution - mechanisms - SN_1, SN_2, SN_i - ion-pair mechanisms - neighboring group participation, nonclassical Carbocations – substitutions at allylic and vinylic carbons. Reactivity - effect of substituents, nucleophilic, leaving group and stereo chemical factors -correlation of structure with reactivity - solvent effects- Von-Braun Reaction. Claisen and Deickmann condensation.

UNIT IV **(18 Hours)**

Pericyclic Reactions: Concerted reactions – orbital symmetry and concerted symmetry – Woodward and Hoffmann rules – selection rules for electrolytic reactions – frontier molecular orbital approach correlation diagram – examples – Chelotropic and ene reactions. Sigmatropic rearrangements – 1,3, 1,5 and 1,7-hydrogen shifts – examples –Cope and Claisen rearrangements – 1,3-dipolar cycloaddition reactions.

UNIT V **(18 Hours)**

Reagents in Organic Synthesis: Oxidation: Jacobsen epoxidation, Shi epoxidation, Jones reagent, PCC, PDC, DMP, Selenium oxide, Swern oxidation, Sommelet reaction, Elbs reaction, Prevost reaction and Woodward modification. Reduction: palladium / platinum / rhodium / nickel based heterogeneous catalysts for hydrogenation, Noyori asymmetric hydrogenation. Red-Al, $NaBH_4$ and $NaCNBH_3$, tri alkyl silanes and tri alkyl stannane.

UNIT VI - Self Study for Enrichment **(Not to be included for External Examination)**

Rules of resonance – tautomerism - steric effects- Enantiomers and diastereomers- SE_1 and SE_2 and SEi mechanisms- selection rules for cycloaddition reactions Thermal and photochemical reaction of pericyclic reaction- MCPBA reagent and Wilkinson's catalyst.

Text Books

1. Mukherji, S. M Singh.S. P. (2015). Reaction Mechanism in Organic Chemistry (Revised Edition): Trinity; New Delhi.
2. Kalsi. P.S. (1993). Stereochemistry. Wiley eastern limited; New Delhi.
3. Jagdamba singh. (2016). Organic synthesis: Pragati Prakashan.
4. Bansal.R.K. (1975). Organic Reaction Mechanisms. Tata McGraw Hill.

Reference Books

1. Marchand Smith. M.B March's Advance Organic Chemistry Reactions, Mechanisms and Structure, 7th Edition. (2013), Wiley, New York.
2. Finar. I. R, Organic Chemistry Vol. II 7th edition. (2009), Pearson, New Delhi.
3. Nasipuri. D, Stereochemistry of organic compounds Principles, 2ndEdition. (2002), New Age International and applications.
4. Lowry. T. H. E and Richardson. K. S, Mechanism and Theory in Organic chemistry, 3rdedition. (1997), Benjamin Cummings Publishing, USA.
5. Carey. F. A and Sundberg. R.J, Advanced Organic chemistry Part A and B, 5th edition.(2007), Springer, Germany.

Web References

1. https://hithaldia.in/faculty/sas_faculty/Dr_Gora_Das/Class%20Notes%20(CH-101%20&CH-201)%20Module-4%20(Structure%20&%20reactivity%20of%20Organic%20Molecules).pdf
2. http://courses.washington.edu/medch562/pdf/MEDCH400_Stereochem.pdf
3. https://byjus.com/chemistry/substitution-reaction/
4. http://www.ancpatna.ac.in/departments/Chemistry/lectures/PG/Sem-II/Pericyclic%20Reactions%20By%20Dr%20Tripti%20Gangwar.pdf
5. https://www.tcichemicals.com/assets/brochure-pdfs/Reagent_Guide_8th_Synthetic_Organic_Chemistry_Materials_Chemistry_E.pdf

Pedagogy

Chalk and talk, PPT, Discussion, Assignment, Demo, Quiz, Seminar

Course Designers

1. Dr. P. Pungayee Alias Amirtham
2. Ms. S. Jeevitha

Semester I	Internal Marks: 25			External Marks: 75
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**
22PCH1CC2	**INORGANIC CHEMISTRY-I**	**CORE**	**6**	**5**

Course Objective

- To articulate the learning of coordination chemistry in Inorganic Chemistry
- This subject will also create a foundation to learn inorganic photochemistry.

Prerequisites

Metals, ligands, complexes and stereoisomers

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Acquire knowledge on basic concepts of inorganic complexes	K3
CO2	Understand the concepts of photoreactions in inorganic chemistry	K2
CO3	Create the nature of inorganic chemical reactions	K4
CO4	Apply the chemistry of inorganic complexes	K3
CO5	Critical thinking on organometallics	K4

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	1	3	2	2	3	1	1	3
CO2	3	2	2	3	3	3	3	2	2	3
CO3	3	3	2	3	2	3	2	2	1	2
CO4	3	3	3	3	3	3	3	2	2	3
CO5	2	3	2	3	3	3	3	2	1	3

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

UNIT I **(18 Hours)**

Clusters And Polynuclear Compounds: Introduction- clusters of the p-block elements, clusters of p-block Elements in a ligand shell: Boron hydrides, Clusters in a ligand shell of the heavier elements of Group 13 and14, Bare clusters of p-block Elements. Clusters of d-block elements, Low-valent metal clusters, Metal carbonyl clusters, Low-valent metal clusters stabilized by other πligands, Clusters of late transition metals stabilized by phosphines.

UNIT II **(16 Hours)**

Principles Of Coordination Chemistry: Studies of coordination compounds in solution – detection of complex formation in solution –stability constants–step wise and overall formation constants -methods of determination (potentiometric, pH metric and photometric) – factors affecting stability– statistical and chelate effects– forced configurations.

UNIT III **(20 Hours)**

Reaction Mechanism In Coordination Complexes: Kinetics and mechanism of reactions in solution–labile and inert complexes–ligand displacement 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. Molecular rearrangements of four- and six-coordinate complexes – interconversion of stereoisomers –reactions of coordinated ligands.

UNIT IV **(18 Hours)**

Organometallic Compounds -Classification of organometallic compounds – structure of methyl lithium, Zeise's salt and Ferrocene- Metal carbonyls - EAN rule – Mono and poly nuclear carbonyls - preparation, reactions and structure ($Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$, $Mn_2(CO)_{10}$, $Co_2(CO)_8$, and $Fe_2(CO)_9$) - Bonding in metal Carbonyls - Metal-ethylenic complexes - methods of formation – bonding - chemical properties**.**

UNIT V **(18 Hours)**

Inorganic Photochemistry: Fundamental concepts- Electronic transitions in metal complexes, metal-centered and charge-transfer transitions – various photo physical and photochemical processes of coordination compounds. Unimolecular charge transfer photochemistry of cobalt (III) complexes–mechanism of CTTM, photo reduction –ligand field photo chemistry 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**.**

UNIT VI - Self Study for Enrichment **(Not to be included for External Examination)**

High-valent metal Clusters and halide Clusters- Importance and applications of coordination compounds- Template effect and its applications for the synthesis of macro cyclic ligands- Fullerene Ligands and Metal complexes- Reinecke's salt chemical actinometer.

Text Books

1. Greenwood., Greenwood. (1996). Chemistry of the Elements. United Kingdom: Elsevier Science & Technology Books.
2. Kaesz, H., Adams, R., Shriver, D., Kaesz, H., Adams, R., Shriver, D. (1990). The Chemistry of Metal Cluster Complexes.
3. Sharma, L. R., Puri, B. R., Sharma, L. R., Puri, B. R. (1976). Principles of Inorganic Chemistry: For B. Sc. and B. Sc. (Hons.) Classes of Indian Universities. India: S. Nagin.
4. Day, M. C., Selbin, J., Day, M. C., Selbin, J. (1976). Theoretical Inorganic Chemistry.
5. Cotton, F. A., Wilkinson, G., Cotton, F. A., Wilkinson, Advanced Inorganic Chemistry, 6th Edition. (2007). India: Wiley India Pvt. Limited.
6. Keiter, E. A., Keiter, R. L., Medhi, O. K., Huheey, J. E., Keiter, E. A., Keiter, R. L., Medhi, O. K., Huheey, J. E. (2006). Inorganic Chemistry: Principles of Structure and Reactivity. India: Pearson Education.
7. Arthur W. Adamson, Paul D. (1975). Fleischauer, Concepts of Inorganic Photochemistry. United Kingdom: Wiley.
8. Kettle, S. F. A., Kettle, S. F. A. (2019). Physical Inorganic Chemistry: A Coordination Chemistry Approach. Germany: Springer Berlin Heidelberg.

Reference Books

1. J. D. Lee, Concise Inorganic Chemistry, 5th Edition. (2008). India: Wiley India Pvt. Limited.
2. Gurdeep Raj, Advanced Inorganic Chemistry Vol-1(2020). Krishna Prakashan.
3. Ferraudi, G. J., Ferraudi, G. J. (1988). Elements of Inorganic Photochemistry. United Kingdom: Wiley.
4. Pearson, R. G., Basolo, F., Pearson, R. G., Basolo, F. (1967). Mechanisms of Inorganic Reactions: A Study of Metal Complexes in Solution. United kingdom: Wiley.
5. Sharma, R. K., Sharma, R. K. (2007). Inorganic Reaction mechanisms. India: Discovery Publishing House.

Web References

1. https://www2.chemistry.msu.edu/courses/cem151/chap24lect_2019.pdf
2. http://www.vpscience.org/materials/Unit%203%20B%20Coordination%20chemistry.pdf
3. https://www.usb.ac.ir/FileStaff/2896_2019-4-18-0-9-32.pdf
4. https://www.uou.ac.in/sites/default/files/slm/BSCCH-101.pdf
5. https://www.chem.uci.edu/~lawm/11-16.pdf
6. https://www.usb.ac.ir/FileStaff/5269_2018-9-18-10-21-39.pdf

Pedagogy

Chalk and talk, PPT, Discussion, Assignment, Demo, Quiz, Seminar

Course Designer

Dr. K. Shenbagam

Semester I	Internal Marks: 25			External Marks: 75
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**
22PCH1CC3	**Physical Chemistry-I**	**CORE**	**6**	**5**

Course Objective

- To understand the principles of quantum chemistry and group theory
- To learn about theories of reaction rates, kinetics of reactions in solution phase and catalysis
- To study in detail the basic concepts of statistical thermodynamics

Prerequisites

Diatomic, rigid rotator and symmetry operations

Course Outcome and Cognitive Level Mapping

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

CO Number	CO Statement On the successful completion of the course students will be able to	Cognitive Level
CO1	Understand and apply the concept of quantization of energy and its modes for particles in box, rigid rotor, harmonic oscillators	K2 & K3
CO2	Classify the molecule into point groups and relate symmetry of the molecules to their properties	K2 & K3
CO3	Analyze and apply the principles of kinetics to a reaction in gas phase, solution phase, chain reactions and fast reactions in real world problems	K3 & K4
CO4	Combined surface chemistry to understand theory of enzyme catalysis and analyses the factors influencing the kinetics of catalysis	K2 & K4
CO5	Apply statistics to understand the thermodynamic properties of macroscopic systems	K2 & K3

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3	3	3	1	1	3
CO2	2	2	1	2	2	3	3	1	2	2
CO3	3	3	2	3	3	3	3	2	1	3
CO4	3	2	2	2	2	2	2	2	2	2
CO5	3	3	2	3	3	3	3	2	2	3

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

UNIT I **(18 Hours)**

Quantum Theory: Concept of operators-sums and products of operators-commutator-linear and non-linear operators-Hermitian and Hamiltonian Operators- -postulates of quantum mechanics-. Applications Schrodinger wave equation to free particle-particle in a one-dimensional box, simple linear harmonic oscillator and its limitations, Rigid rotator- model for a rotating diatomic molecule-solutions. Solving of Schrodinger equation for the H-atom (or H-like species)-energy levels. Introduction to the methods of self – consistent field. Virial theorem - Huckel theory of conjugated systems, bond order and charge density calculations, Application to ethylene, 1, 3-butadiene, and benzene**.**

UNIT II **(18 Hours)**

Group Theory: Definition of a mathematical group and its properties – multiplication table - cyclic groups-subgroups - classes – symmetry elements - symmetry operation – classes of symmetry operations-classification of molecular point groups. Matrix representations of symmetry operations-representation of groups-reducible and irreducible representations. Great Orthogonality theorem and its consequences-character tables – construction of character tables for C_{2v} and C_{3v} point groups –

UNIT III **(18 Hours)**

Kinetics of Complex and Fast Reactions: Theories of reaction rates- absolute reaction rate theory-thermodynamic formulation of ARR theory-Lindeman's theory of uni molecular reactions. Chain reactions-characteristics, kinetics of decomposition of acetaldehyde (Rice-Herzfeld scheme), photochemical reaction of H_2-Br_2. Thermal reaction-non-stationary chain reaction, H_2-O_2 reaction and explosion limits. Effect of temperature, relative permittivity, ionic strength, and solvent (Grunwald- Weinstein equation) on reaction rates. Reactions in solutions - effect of pressure, dielectric constant, and ionic strength on reactions in solutions.

UNIT IV **(18 Hours)**

Surface Chemistry and Catalysis: Adsorption-physisorption and chemisorption, Gibb's adsorption isotherm - Langmuir theory, kinetic and statistical derivation, multi-layer adsorption BET theory, use of Langmuir and BET isotherms for surface area determination. Application of Langmuir adsorption isotherm in surface catalyzed reactions. Catalysis by enzymes - Kinetics of enzyme-catalyzed reaction - Michaelis - Menten equation and its interpretation. Effect of substrate

concentration, pH and temperature on enzyme-catalyzed reactions - inhibition of enzyme-catalyzed reactions - Competitive, Non-competitive and uncompetitive inhibition.

UNIT V **(18 Hours)**

Statistical Thermodynamics: Calculation of thermodynamic probability of a system- micro and macro states-different methods of counting macro states - distinguishable and indistinguishable particles, classical statistics-derivation of Maxwell-Boltzmann distribution law. Physical significances of translational, rotational, vibrational, electronic partition functions - application to mono atomic and diatomic molecules. Quantum statistics-Bose- Einstein and Fermi-Dirac distribution equations comparison of B.E and F.D statistics.

UNIT VI - Self Study for Enrichment **(Not to be included for External Examination)**

Eigen values and Eigen functions- physical interpretation of wave function-orthogonality and normalization theorems-Space group and Schoen flies symbol for point group-Kinetics of fast reactions-flow method and relaxation methods-Comparison of physisorption and chemisorption and types of adsorption isotherms-Difference between thermodynamic and statistical probability.

Text Books

1. Akins, P.W. (2008). Physical Chemistry. Oxford, UK. Oxford University Press, 8th Edition.
2. Puri, Sharma, Pathania, (2019). Principle of Physical Chemistry. Jalandhar, India. Vishal publication &Co. 47th Edition.
3. Grutu, J. N. & Grutu, A. (2015). Advanced Physical Chemistry. Pune, India. Pragathi publisher, 18th Edition.

Reference Books

1. Prasad, R.K. (2006). Quantum Chemistry. New Delhi, India. New Age International (P) Ltd., Revised 3rd Edition.
2. Albert Cotton, F. (2008). Chemical Applications of Group theory. New Delhi, India. Willy India Pvt Ltd publisher, 3rd Edition.
3. Laidler, K.J. (2003). Chemical Kinetics. New Delhi, India. Tata Mecra Hill, Revised 3rd Edition.
4. Gupta, M.C. (2011). Statistical Thermodynamics. New Delhi, India. New Age International (P)Ltd., 3rd Edition.

Web References

1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=13G8VouhmrFfuhs6rkiyTA
2. https://www.chem.tamu.edu/rgroup/hughbanks/courses/673/lecturenotes/lecturenotes.html

3. http://www.kpgcollege.org/admin/upload/1586604901.pdf
4. https://youtu.be/ALwziZSRiqM
5. https://youtu.be/ACY-Wbudg0o
6. https://youtu.be/yO8v0nszUz8

Pedagogy

Chalk and talk, PPT, Discussion, Assignment, Demo, Quiz, Seminar

Course Designers

Dr. V. Sangu

Semester I	Internal Marks: 40		External Marks: 60	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**
22PCH1CC1P	**ORGANIC CHEMISTRY PRACTICAL-I**	**Core Practical**	**6**	**3**

Course Objective

- To perform the qualitative analysis of a given organic mixture and to carry out the preparation of Organic compounds.

Prerequisites

Nitration, acylation and oxidation.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Apply the principles of separation in organic mixtures.	K3
CO2	Prepare the organic compounds by single stage method.	K3
CO3	Identify various functional group in of organic compounds.	K1
CO4	Develop skills in separating techniques	K2
CO5	Analyze the nature of organic mixture containing two components.	K4

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	2	2	1	3	2	1
CO2	2	3	2	2	2	3	2	1	3	2
CO3	2	3	3	2	3	1	1	1	2	1
CO4	3	2	2	3	2	2	3	2	3	2
CO5	2	3	3	3	2	1	2	2	2	2

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

I QUALITATIVE ANALYSIS OF AN ORGANIC MIXTURE CONTAINING TWO COMPONENTS

Mixtures containing two components are to be separated (pilot separation) and purified (bulk separation).

II PREPARATION OF ORGANIC COMPOUNDS (SINGLE STAGE)

1. Methyl-*m*-nitrobenzoate from methylbenzoate(nitration)
2. Glucose pentaacetate from glucose(acetylation)
3. Resacetophenone from resorcinol(acetylation)
4. Benzophenone oxime from benzophenone (addition)
5. *o*-Chlorobenzoic acid from anthranilic acid (Sandmayer reaction)
6. *p*-Benzoquinone from hydroquinone (oxidation)
7. Phenylazo-2-naphthol from aniline(diazotization)

Text Books

1. Mohan. J. (2003), Organic Analytical Chemistry: Theory and Practice, Narosa
2. Ahluwalia. V.K Bhagat. P and Agarwal. R. (2005), Laboratory Techniques in Organic Chemistry, I. K. International

Reference Books

1. Gnanaprakasam, N. S. and Ramamurthy. G (1987), Organic Chemistry Lab Manual, S.V. Printers
2. Vogel, A., ITatchell, A. R., Furniss B. S., Hannaford. A. J., and Smith P. W. G. (1989), Vogel's Textbook of Practical Organic Chemistry, 5th Ed., Prentice Hall

Web References

1. https://authors.library.caltech.edu/25034/10/BPOCchapter9.pdf
2. http://do.chem.uni.wroc.pl/system/files/Preparatory%20classes.pdf.

Pedagogy

Demonstration and practical sessions

Course Designers

1. Dr. P. Pungayee Alias Amirtham
2. Dr. R. Subha

Semester I	Internal Marks: 40		External Marks: 60	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**
22PCH1EC1AP	**INSTRUMENTATION TECHNIQUES PRACTICAL**	**CORE**	**6**	**3**

Course Objective

- Gain proficiency in the use of analytical pipettes, volumetric measurements, and analytical instruments.
- learn how to correctly use a UV/Vis spectrophotometer.
- Gain familiarity with a new technique.
- Perform quantitative analytical methods including titrations, pH measurements, spectrophotometry, and chromatography. chromatography

Prerequsites

Chromatography, qualitative analysis and spectroscopy.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	To be trained in lab safety, preparation of solutions numerically.	K1
CO2	To develop students' ability and skill to acquire expertise in calibration techniques.	K2
CO3	Become familiar with fundamental concepts of instruments.	K1
CO4	Develop the core skills to parse existing chromatographic protocols and identify the key factors influencing a chromatography experiment	K2
CO5	Learn application of Instrumentation Techniques	K2

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	3	2	3	2	3	3
CO2	2	2	2	1	2	2	2	3	2	2
CO3	3	2	2	2	2	1	2	2	2	2
CO4	3	2	3	2	2	3	2	2	2	3
CO5	2	3	2	3	3	2	2	2	2	2

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

1. Use and calibration of volumetric equipment (volumetric flasks, pipette's and burette's).
2. Separation of monosaccharide present in a given mixture by paper chromatography.
3. Determination of chlorine in water using colorimetry.
4. Analysis of soil
   i) Determination of pH of soil.
   ii) Determination of total soluble salts by conductometry
5. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH- meter.
6. Separation of a mixture of metals by TLC.
7. Determine the concentration of citric acid in soft drink using titration.
8. Determination of equilibrium constant by colorimetry.
9. Verification of Beer- Lambert's law by colorimetry.
10. Determination of ascorbic acid in lime juice by titration.
11. Spectrophotometric determination of iron in vitamin tablets.
12. Estimation of aspirin from tablet using titration method.
13. Determination of strength of commercial vinegar by conductometry.
14. Analysis of potassium permanganate by UV/Visible spectrophotometer.
15. Estimation of sugar by titrimetric method.

Text Book

1. Fifield, F.W. (2011). Principles and Practice of Analytical Chemistry. United States: Springer
2. Lundanes, E., Reubsaet, L., Greibrokk, T., Lundanes, E., Reubsaet, L., Greibrokk, T. (2013)
3. Chromatography: Basic Principles, Sample Preparations and Related Methods. Germany: Wiley.
4. Franson, S., Mary, H. (2007). Standard Methods for the Examination of Water and Wastewater. United States: American Public Health Association.

Reference Books

1. Harris, D. C. (2012). Exploring Chemical Analysis: International Edition. United Kingdom: Macmillan Learning.
2. Dilts, R. V. (2010). Analytical Chemistry: Methods of Separation. United Kingdom: Van

Nostrand.
3. Harris, D. C., Lucy, C. A. (2019). Quantitative Chemical Analysis. United States: W. H. Freeman.
4. Mikeš, O., Mike S, O., Chalmers, R. A. (2007). Laboratory Handbook of Chromatographic Methods United Kingdom: Van Nostrand.

Web Reference

1. https://www.epa.gov/sites/default/files/2015-12/documents/9214.pdf
2. https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_10_Experiments/11%3A_Titration_of_Vinegar_(Experiment)
3. https://www.lacitycollege.edu/Departments/Chemistry/documents/Chemistry-101-Experiments-Documents/E12B_titration2016
4. https://www.uobabylon.edu.iq/eprints/publication_10_11891_250.pdf

Pedagogy

Table Work

Course Designers

- Dr. G. Sivasankari.

Semester I	Internal Marks: 40		External Marks: 60	
COURSECODE	**COURSE TITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**
22PCH1EC1BP	**NANOSCIENCE AND NANOTECHNOLGY PRACTICAL**	**CORE**	**6**	**3**

Course Objective

- Covers the whole spectrum of nanomaterials ranging from overview, synthesis, properties, and characterization of nano phase materials to application including some new developments in various aspects.
- Provides an introduction to the theory and practice on Nanomaterials and various techniques used for the fabrication and characterization of nanostructures.

Prerequisites

Precipitation, reduction and absorption methods.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	To foundational knowledge of the Nanoscience and related fields	K1
CO2	Apply principles of basic science concepts in understanding, analysis and prediction of matter at Nano scale.	K1
CO3	Acquire an understanding the Nanoscience and Applications	K2
CO4	Understand in broad outline of Nanoscience and Nanotechnology.	K2
CO5	Understand the synthesis of nanomaterials and their application and the impact of nanomaterials on environment	K2

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	2	2	1	3	2	2
CO2	2	3	2	3	2	3	2	1	3	2
CO3	2	3	3	2	3	1	1	2	2	1
CO4	3	2	2	3	2	2	3	2	2	2
CO5	2	3	3	3	2	1	2	2	2	2

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

1. Synthesis of CuO nanoparticles by sonochemical method
2. Synthesis of ZnO nanoparticles by sonochemical method
3. Synthesis of Carbon nano particles by Microwave Irradiation Method.
4. Characterization of nanoparticles by UV- Visible Spectrophotometer.
5. Synthesis of Silver nanoparticles by chemical reduction method and their UV-Vis absorption studies.
6. Synthesis of Iron Oxide Nanoparticles by Polyol method and their UV-Vis absorption studies.
7. Synthesis of ZnO Nanoparticles by Co-Precipitation Method.
8. Preparation of thiolated silver nanoparticles.
9. Synthesis of Nanoparticles from plant materials by Sonochemical Method.

Text Book

1. Edelstein, A.S., Cammaratra, R.C. (2017). Nanomaterials: Synthesis, Properties and Applications, Second Edition. United Kingdom: Taylor & Francis.
2. Wiederrecht, G. (2010). Handbook of Nanofabrication. Italy: Elsevier Science.
3. Altavilla, C., Ciliberto E.(2017). Inorganic Nanoparticles: Synthesis, Applications, and Perspectives. United Kingdom: CRC Press.

Reference Books

1. Fritzsche, W., Köhler, M., Fritzsche, W., Köhler, M. (2008). Nanotechnology: An Introduction to Nanostructuring Techniques. Germany: Wiley.
2. Muller, A., A. K., Cheetham., Rao C. N. R. (2006). The Chemistry of Nanomaterials: Synthesis, Properties and Applications. Germany: Wiley.

Web Reference

1. https://www.researchgate.net/publication/229419482_Sonochemical_synthesis_size_controlling_and_gas_sensing_properties_of_NiO_nanoparticles
2. https://www.sciencedirect.com/science/article/pii/S1569441018301445
3. https://pubs.rsc.org/en/content/articlelanding/2019/nj/c9nj01360a
4. https://www.researchgate.net/publication/231240704_UreaMelt_Assisted_Synthesis_of_NiNiO_Nanoparticles_Exhibiting_Structural_Disorder_and_Exchange_Bias

Pedagogy

Table Work

Course Designers

1. Dr. G. Sivasankari
2. Dr. R. Subha

Semester I	Internal Marks: 40	External Marks: 60		
COURSE CODE	**COURSETITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**
22PCH1EC1CP	**BIOCHEMISTRY PRACTICAL**	**ELECTIVE**	**6**	**3**

Course Objective

- To expertise the student to identify and isolate various biomolecules.
- To acquire training to estimate the quantity of biomolecules present by applying biochemical techniques

Prerequisites

Chromatographic techniques, biomolecules and plant pigments.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Gain expertise in the isolation of various biomolecules	K1
CO2	Acquire hands-on training in basic separation techniques in biochemistry	K1
CO3	Develop their skills in handling various chromatographic techniques and apply them in different biological molecules	K2
CO4	Apply various techniques for identification of biomolecules	K3
CO5	Quantitatively evaluate the amount of biomolecules present	K5

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	3	2	2	3	2	2	3
CO2	3	3	2	3	3	3	3	2	2	3
CO3	3	3	3	3	3	3	3	3	2	3
CO4	3	3	3	3	3	2	3	2	2	3
CO5	2	3	3	3	2	2	3	2	2	3

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

(i) EXTRACTION OF BIOMOLECULES

* Starch from potato.
* Casein from milk.
* Oil from oil seeds.
* Cellulose from plant material.

(ii) BIOCHEMICAL TECHNIQUES

* Identification of amino acid by circular and ascending paper chromatography.
* Separation of amino acids and carbohydrates in a mixture by paper chromatography.
* Separation of lipids by thin layer chromatography.
* Separation of a mixture of proteins and salt by column chromatography.
* Separation of plant pigments using Chromatography techniques - TLC, Paper Chromatography.

(iii) QUALITATIVE ANALYSIS OF BIOMOLECULES

* Carbohydrate – Glucose, Fructose, Sucrose, Lactose and Starch.
* Proteins – Precipitation reactions of proteins, Colour reactions of proteins, Colour reactions of amino acids like tryptophan, tyrosine, cysteine, methionine, arginine, proline and histidine.
* Lipids– solubility, acrolein test, Salkowski test, Lieberman-Burchard test.
* Qualitative tests for nucleic acid.

(iv) COLORIMETRIC ESTIMATION

* Glucose by DNS method.
* Protein by Biuret / Bradford and Lowry’s method.
* Uric acid.
* Urea by DAM method.
* Creatinine by Jaffe’s method.
* Phosphorous by Fiske and Subbarow’s method.

Text Books

1. Rajan, S. & Selvi Christy. R. (2018). Experimental Procedures in Life Sciences. CBS Publishers & Distributors.
2. Wilson, K. & Walker, J. (2000). Principles and Techniques of Practical Biochemistry. Fifth edition. Cambridge University Press.
3. Upadhyay & Upadhyay Nath (2016). Biophysical Chemistry: Principles and Techniques. Himalaya Publishing House.

Reference Books

1. Hofmann, A. & Clokie, S. (2018). Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. 8th edition. Cambridge University Press.
2. Wood, W. B. (1981). Biochemistry- A problem Approach. Addison Wesley.

Web References

1. http://nec.edu.np/Publications/Chemistry_LAB_Manual/Experiment%204.pdf
2. https://www.mlsu.ac.in/econtents/1616_Biochemical%20Tests%20of%20Carbohydrate,%20protein,%20lipids%20and%20salivary%20amylase.pdf
3. https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/2%20ESTIMATION%20OF%20PROTEIN%20BY%20LOWRY.pdf
4. https://orbitbiotech.com/estimation-of-reducing-sugars-by-dnsa-method/
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8575183/
6. http://atlas-medical.com/upload/productFiles/208011/Creatinine%20Package%20Insert.pdf

Pedagogy

Demonstration and practical sessions

Course Designer

1. Dr. P. Pungayee Alias Amirtham
2. Dr. S. Saranya