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

CAUVERYCOLLEGEFORWOMEN (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.	Programme Outcome Oncompletionof M.Sc., Programme,thestudentswillbeableto
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.	ProgrammeSpecificOutcomes` Studentsof M.Sc., Chemistrywillbeableto	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
PG Departmentof Chemistry

M.Sc., Chemistry

(For the Candidates admitted from the Academic year 2022-2023 onwards)

Semester	Course	Course Title	Course Code	Inst. Hrs. / week	Credits	Exam			Total
						Hrs.	Marks		
							Int.	Ext.	
I	Core Course– I (CC)	Organic Chemistry – I	22PCH1CC1	6	5	3	25	75	100
	Core Course – II (CC)	Inorganic Chemistry – I	22PCH1CC2	6	5	3	25	75	100
	Core Course –III (CC)	Physical Chemistry – I	22PCH1CC3	6	5	3	25	75	100
	Core Practical - I (CP)	Organic Chemistry – I (P)	22PCH1CC1P	6	5	6	40	60	100
	Discipline Specific Elective Course-I (DSE)	A. Instrumentation Techniques (P)	22PCH1DSE1AP	6	3	6	40	60	100
		B. Nanoscience and Nanotechnology (P)	22PCH1DSE1BP						
		C. Biochemistry (P)	22PCH1DSE1CP						
	Total			**30**	**23**				**500**
15 Days INTERNSHIP during Semester Holidays									
II	Core Course– IV (CC)	Physical Methods in Chemistry – I	22PCH2CC4	6	5	3	25	75	100
	Core Practical – II (CP)	Organic Chemistry – II (P)	22PCH2CC2P	6	5	6	40	60	100
	Core Choice Course– I (CCC)	A. Organic Chemistry – II	22PCH2CCC1A	6	4	3	25	75	100
		B. Chemistry of Natural Products	22PCH2CCC1B						
		C. Molecular Rearrangement	22PCH2CCC1C						
	Core Practical – III (CP)	Inorganic Chemistry– I (P)	22PCH2CC3P	6	5	6	40	60	100
	Discipline Specific Elective Course-II (DSE)	A. Green Chemistry	22PCH2DSE2A	6	3	3	25	75	100
		B. Forensic Chemistry	22PCH2DSE2B						
		C. Analytical Chemistry	22PCH2DSE2C						
	Internship	Internship	22PCH2INT	-	2	-	-	100	100
	Extra Credit Course	SWAYAM	As per UGC Recommendation						
	Total			**30**	**24**				**600**

III	Core Course– V (CC)	Physical Chemistry- II	22PCH3CC5	6	5	3	25	75	100
	Core Practical – IV (CP)	Inorganic Chemistry –II (P)	22PCH3CC4P	6	5	6	40	60	100
	Core Choice Course– II (CCC)	A. Cyber Security	22PGCS3CCC2A	5	4	3	25	75	100
		B. Photochemistry and Advanced Chemical Kinetics	22PCH3CCC2B						
		C. Applied Chemistry	22PCH3CCC2C						
	Core Practical - V (CP)	Physical Chemistry – I (P)	22PCH3CC5P	6	5	6	40	60	100
	Discipline Specific Elective Course-III (DSE)	A. Chemistry for Competitive Examinations	22PCH3DSE3A	4	3	2	-	100	100
		B. Bioorganic Chemistry	22PCH3DSE3B			3	25	75	
		C. Pesticide Chemistry	22PCH3DSE3C						
	Generic Elective Course -I (GEC)	Nanoscience and Nanotechnology	22PCH3GEC1	3	2	3	25	75	100
	Extra Credit Course	SWAYAM	As per UGC Recommendation						
	Total			**30**	**24**				**600**
IV	Core Course–VI (CC)	Physical Methods in Chemistry - II	22PCH4CC6	6	5	3	25	75	100
	Core Choice Course– III (CCC)	A. Chemistry of Nanoscience	22PCH4CCC3A	6	4	3	25	75	100
		B. Biofuels	22PCH4CCC3B						
		C. Bioinorganic Chemistry	22PCH4CCC3C						
	Core Practical - VI (CP)	Physical Chemistry - II (P)	22PCH4CC6P	6	5	6	40	60	100
	Generic Elective Course-II (GEC)	Corrosion and Pollution Management	22PCH4GEC2	3	2	3	25	75	100
	Project	Project Work	22PCH4PW	9	5	-	-	100	100
			Total	**30**	**21**				**500**
			Grand Total	**120**	**92**				**2200**

Courses & Credits for PG Science Programmes

S. No	Courses	No. of Courses	No. of Credits	Marks
1.	Core Course – (CC)	6	30	600
2.	Core Choice Course– (CCC)	3	12	300
3.	Core Practical - (CP)	6	30	600
4.	Discipline Specific Elective- (DSE)	3	09	300
5.	Generic Elective Course - (GEC)	2	04	200
6.	Project	1	05	100
7.	Internship	1	02	100
	Total	**22**	**92**	**2200**

The internal and external marks for theory and practical papers are as follows:

Subject	Internal Marks	External Marks
Theory	25	75
Practical	40	60

Separate passing minimum is prescribed for Internal and External

For Theory:

a) The passing minimum for CIA shall be 40% out of 25 marks (i.e. 10 marks)

b) The passing minimum for End Semester Examinations shall be 40% out of 75 marks (i.e.30 marks)

c) The passing minimum not less than 50% in the aggregate.

For Practical:

a) The passing minimum for CIA shall be 40% out of 40 marks (i.e. 16 marks)

b) The passing minimum for End Semester Examinations shall be 40% out of 60 marks (i.e.24 marks)

c) The passing minimum not less than 50% in the aggregate.

For Project:

Marks for Dissertation: 80

Marks for Viva Voce : 20

Total marks : 100

Internal Component (Theory)

Component	Marks
Library	05
Assignment & Seminar	10
CIA -I	05
CIA-II	05
Total	**25**

Internal Component (Practical)

Component	Marks
Observation	05
Record	10
Continual performance	10
Model	15
Total	**40**

Question Paper Pattern

PART A (10X2=20)
Answer all the questions

PART B (5X5=25)
Answer all the questions

PART C (3X10=30)
Answer any three questions

Semester I	InternalMarks:25		ExternalMarks:75	
COURSECODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
22PCH1CC1	**ORGANIC CHEMISTRY-I**	**CORE**	**6**	**5**

Course Objectives

- To learn the basic conceptsof aromaticity andstereochemistryof various organicmolecules
- To give ideas of nucleophilic and electrophilic substitution reactions and makes to learn about the oxidizing and reducing reagents for organic synthesis.

Prerequisites

Aromaticity, substitution, 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	Recall and summarize the fundamentals of aromaticity, stereochemistry, selection rules and reagents inorganic synthesis.	K1,K2
CO2	Interpret the concept to Huckels theory, conformation analysis, substitution, FMO method, oxidation and reduction reactions.	K3
CO3	Categorize the aromaticity, configuration, reactivity and reagents.	K4
CO4	Evaluate aromatic character, stereoanalysis, pathway of reactions and catalysis.	K5
CO5	Predict the conditions and product of substitution mechanism, Pericyclic reactions and suitable reagents in redox reactions.	K6

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO 5
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	3

"1"–Slight (Low)Correlation "2"–Moderate(Medium)Correlation
"3"–Substantial (High)Correlation "-"indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVELEVEL
I	**Electronic Effects and Aromaticity:** Electronic Effects-inductive, resonance and hyperconjugative 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.	18	CO1, CO2, CO3, CO4	K1, K2, K3, K4,K5
II	**StereochemistryandConformationalAnalysis:** Stereoisomerism – optical activity and chirality – typesof molecules exhibiting optical activity – R, S and E, Z configuration, absolute configuration chirality in molecules with non-carbon stereocenters(N,SandP) Molecules with more than one chiral center.Stereochemistry of molecules with axial chirality. Biphenyls, allenes, spiranes and analogues-Atropisomerism - Helicity and chirality - Resolution – methodsof Resolution. Conformations of mono anddisubstituted six membered ring systems conformations of decalin. Quantitative correlation between conformation and reactivity.	18	CO1, CO2, CO3, CO4	K1, K2, K3, K4,K5
III	**AliphaticSubstitutionReactions:** Aliphatic Electrophilic substitution:selected reactions-migration of double bonds-halogenation of aldehydes and ketones - Stork-Enamine reaction-decarboxylation	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4,K5,K6

	of aliphatic acids-Haloform reaction. Aliphatic nucleophilic substitution-mechanisms-SN1,SN2,SNi-ion-pair mechanisms - neighboring group participation ,non-classical 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.			
IV	**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, 1,5and1,7-hydrogenshifts–examples–Cope and Claisen rearrangements–1,3-dipolar cycloadditions reactions.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4,K5,K6
V	**ReagentsinOrganicSynthesis:** Oxidation:Jacobsen epoxidation, Shiepoxidation, Jonesreagent, PCC, PDC, DMP, Seleniumoxide, 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 $NaCNBH_3$,trialkylsilanes andtrialkylstannane.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4,K5,K6

VI	**Self-StudyforEnrichment:** **(Not to be included for External Examination)** Rules of resonance–tautomerism-stericeffects-Enantiomers and diastereomers-SE1 and SE2 andSEi mechanisms-selection rules for cycloaddition reactions Thermal and photochemical reaction of pericyclic reaction- MCPBA reagent and Wilkinson's scatalyst.		CO1, CO2 CO3	K1, K2,K3,K4

Text Books

1. Mukherji,S.M Singh.S.P. (2015). Reaction Mechanism in Organic Chemistry (RevisedEdition):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. TataMcGrawHill.

Reference Books

1. March and Smith.M.B March's Advance Organic Chemistry Reactions, Mechanisms andStructure,7th Edition.(2013),Wiley,NewYork.
2. Finar. I.R,Organic ChemistryVol.II7th edition. (2009), Pearson, NewDelhi.
3. Nasipuri.D, Stereochemistry of Organic Compounds Principles, 2nd Edition.(2002), New Age International and applications.
4. Lowry.T.H.E and Richardson. K. S, Mechanism and Theory in Organic chemistry,3rd edition.(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. Dr. C. Rajarajeswari

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

Course Objectives

- 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 Onthesuccessfulcompletionofthecourse,studentswillbeable to	Cognitive Level
CO1	Recognize and execute the basic concepts of clusters and complexes in inorganic chemistry.	K1, K2
CO2	Sketch the synthesis of polynuclear compounds reaction mechanism of coordination compounds and their photochemical reactivity.	K2, K3
CO3	Examine the properties of clusters and coordination complexes.	K3, K4
CO4	Generalize the stabilization of clusters, kinetics of reactions, structure of metal carbonyls and ligand field photochemistry.	K5
CO5	Critical thinking on complex structure and properties of reactions.	K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	1	2	2	2	3	1	1	3
CO2	3	2	2	3	3	3	3	2	2	3
CO3	3	2	2	3	2	3	2	2	2	2
CO4	3	3	3	2	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	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**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.	18	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5** **K6**
II	**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.	16	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5** **K6**
III	**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 – isomerization and racemization reactions of complexes. Molecular rearrangements of four- and six-coordinate complexes – interconversion of stereoisomers –reactions of coordinated ligands.	20	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5** **K6**

IV	**Organometallic Compounds** -Classification of organometallic compounds – structure of methyl lithium, Zeise'ssalt 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 $Fe2(CO)_9$ – Bonding in metal Carbonyls – Metal-ethylenic complexes – methods of formation –bonding – chemical properties.	18	**CO1 CO2 CO3 CO4 CO5**	**K1 K2 K3 K4 K5 K6**
V	**Inorganic Photochemistry**: Fundamental concepts- Electronic transitions in metal complexes, metal-cantered 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, photo active excited states, V-C model – photo physics and photochemistry of ruthenium–polypyridine complexes, emission and redox properties.	18	**CO1 CO2 CO3 CO4 CO5**	**K1 K2 K3 K4 K5 K6**
VI	**Self- StudyforEnrichment** **(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 macrocyclic ligands-Fullerene Ligands and Metal complexes- Reinecke's salt chemical actinometer.		**CO1, CO2**	**K2, K3**

Text Books

1. Greenwood.(1996).ChemistryoftheElements.UnitedKingdom:Elsevier Science & Technology Books.
2. Kaesz,H.,Adams,R.,Shriver,D.,Kaesz,H.,Adams,R.,Shriver,D.(1990).TheChemistry of Metal Cluster Complexes.

3. Sharma, L. R., Puri, B. R., Sharma, L. R., Puri, B. R. (1976). Principles of Inorganic Chemistry:
ForB.Sc. andB.Sc.(Hons.)ClassesofIndianUniversities. 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,AdvancedInorganicChemistry,6th Edition. (2007). India: Wiley India Pvt. Limited.
6. Keiter,E.A.,Keiter, R.
Medhi,O.K.,Huheey,J.E.,Keiter,E.A.,Keiter,R.L.,Medhi,O.K.,Huheey,J.E.(2006).InorganicChemistry:PrinciplesofStructureand Reactivity. India: Pearson Education.
7. ArthurW.Adamson,Paul. D.(1975).Fleischauer,ConceptsofInorganicPhotochemistry. United Kingdom: Wiley.
8. Kettle, S. F. A., Kettle, S. F. A. (2019). Physical Inorganic Chemistry: ACoordination Chemistry Approach. Germany: Springer Berlin Heidelberg.

Reference Books

1. J.D.Lee,ConciseInorganicChemistry,5thEdition.(2008).India:Wiley IndiaPvt.Limited.
2. GurdeepRaj,AdvancedInorganicChemistryVol-1(2020).KrishnaPrakashan.
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). MechanismsofInorganic Reactions:
A Study of Metal Complexes in Solution. United Kingdom: Wiley.
5. Sharma,R.K.,Sharma,R.K.(2007).InorganicReactionmechanisms. 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

SemesterI	InternalMarks:25	ExternalMarks:75		
COURSECODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
22PCH1CC3	**PHYSICAL CHEMISTRY-I**	**CORE**	**6**	**5**

Course Objectives

- Tounderstandtheprinciplesofquantumchemistryandgrouptheory
- Tolearnabouttheoriesofreactionrates,kineticsofreactionsinsolutionphaseandcatalysis
- Tostudyindetailthebasicconceptsostatisticalthermodynamics.

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	COStatement Onthesuccessfulcompletion ofthecoursestudents willbeable to	Cognitive Level
CO1	Re-phrase and discuss the basic concepts of quantum mechanics, group theory, Kinetics of reactions, catalysis and statistical thermodynamics.	K1 &K2
CO2	Illustrate an insight on quantum mechanical operators, character table, and theories of reaction rate, adsorption isotherm and Maxwell's distribution law.	K3
CO3	Analyze and interpret particles in box, Applications of HMO theory, orthogonality theorem,kinetics of complex reaction, enzyme catalysis, types of statistical thermodynamics.	K4
CO4	Evaluate the energy of particles in a box, Symmetry operations, factors influencing reaction rate, kinetics of enzyme catalysis, partition functions for diatomic molecules.	K5
CO5	Develop and write wavefunction for hydrogen like particles, character table,Michaelis Menten equation, and quantum statistics.	K6

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	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	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.SolvingofSchrodingerequationfortheH-atom(orH-likespecies)-energylevels.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.	18	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5** **K6**
II	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.	18	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5** **K6**
III	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_2reactionandexplosionlimits.Effectoftemperature,relativepermittivity,ionicstrength,andsolvent(Grunwald Weinstein equation) on reaction rates. Reactions in solutions-effect of pressure,	18	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5** **K6**

	dielectric constant, and ionic strength on reactions in solutions.			
IV	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.	18	**CO1 CO2 CO3 CO4 CO5**	**K1 K2 K3 K4 K5 K6**
V	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 tomonoatomicanddiatomicmolecules.Quantumstatistics-Bose-Einstein and Fermi-Dirac distribution equations comparison of B.E and F.D statistics.	18	**CO1 CO2 CO3 CO4 CO5**	**K1 K2 K3 K4 K5 K6**
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.	-	**CO1, CO2**	**K2 K3**

Text Books

1. Akins,P.W.(2008).PhysicalChemistry.Oxford,UK.Oxford UniversityPress,8th Edition.
2. Puri,Sharma,Pathania,(2019).PrincipleofPhysicalChemistry.Jalandhar,India.Vishalpublication&Co. 47th Edition.
3. Grutu,J.N.&Grutu,A.(2015).AdvancedPhysicalChemistry.Pune,India.Pragathipublisher,18th Edition.

ReferenceBooks

1. Prasad,R.K.(2006).QuantumChemistry. New Delhi, India.NewAge International(P) Ltd.,Revised3rd Edition.
2. AlbertCotton,F.(2008).ChemicalApplicationsofGrouptheory. New Delhi, India. Willy India PvtLtd publisher, 3rdEdition.
3. Laidler,K.J.(2003).ChemicalKinetics.NewDelhi,India.TataMecraHill,Revised3rdEdition.
4. Gupta,M.C.(2011).StatisticalThermodynamics.NewDelhi,India.NewAgeInternational(P)Ltd., 3rdEdition.

WebReferences

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-I (P)**	**CORE**	**6**	**5**

Course Objectives

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

Pre requisites

Separation of components, Qualitative analysis

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.	K1
CO2	Prepare the organic compounds by single stage method.	K2
CO3	Identify various functional group in organic compounds.	K3
CO4	Develop skills in separating techniques	K3
CO5	Analyze the nature of organic mixture containingtwo components.	K4

Mapping of CO with PO and PSO

CCOs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO 1	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.KBhagat.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.IT atchell. A.RFurnissB.SHannaford.A.JandSmithP.W.G, (1989), Vogel's Textbook of Practical Organic Chemistry, 5th Ed., PrenticeHall

Web References

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

Semester I	Internal Marks: 40		External Marks: 60	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**

Pedagogy

Demonstration and practical sessions

Course Designers

- Dr.P.Pungayee Alias Amirtham
- Dr.R.Subha

22PCH1DSE1AP	**INSTRUMENTATION TECHNIQUES (P)**	**DISCIPLINE SPECIFIC ELECTIVE**	**6**	**3**

Course Objectives

- 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.

Prerequisites

Chromatography, qualitative analysis and spectroscopy

Course Outcome and Cognitive Level Mapping

CO Number	COStatement Onthesuccessful completionofthe course,studentswillbeableto	Cognitive Level
CO1	Become familiar with fundamental concepts of instruments.	K1
CO2	Observe the application of Instrumentation Techniques	K2
CO3	To be trained in lab safety, preparation of solutions numerically.	K4
CO4	Develop the core skills to parse existing chromatographic protocols and identify the key factors influencing a chromatography experiment	K5
CO5	To develop students' ability and skill to acquire expertise in calibration techniques.	K5

Mapping of COwithPO 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. Determining 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.

TextBooks

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

ReferenceBooks

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 References

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

CourseDesigner

1. Dr. G. Sivasankari.

Semester I	Internal Marks: 40		External Marks: 60	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**
22PCH1DSE1BP	**NANOSCIENCE AND NANOTECHNOLOGY (P)**	**DISCIPLINE SPECIFIC ELECTIVE**	**6**	**3**

Course Objectives

- 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	COStatement Onthesuccessful completionofthe course,students willbeableto	Cognitive Level
CO1	To foundational knowledge of the Nanoscience and related fields	K1
CO2	Understand in broad outline of Nanoscience and Nanotechnology.	K2
CO3	Acquire an understanding the Nanoscience and Applications	K3
CO4	Apply principles of basic science concepts in understanding, analysis and prediction of matter at Nano scale.	K3
CO5	Understand the synthesis of nanomaterials and their application and the impact of nanomaterials on environment	K2 & K5

Mapping of COwithPO 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 nano particles by sonochemical method
2. Synthesis of ZnO nano particles 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.

TextBooks

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., CilibertoE.(2017). Inorganic Nanoparticles: Synthesis, Applications, and Perspectives. United Kingdom: CRC Press.

ReferenceBooks

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 References

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

CourseDesigners

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

Semester I	Internal Marks:40	External Marks:60		
COURSECODE	**COURSE TITLE**	**CATEGORY**	**Hrs/Week**	**CREDITS**
22PCH1DSE1CP	**BIOCHEMISTRY (P)**	**DISCIPLINE SPECIFIC ELECTIVE**	**6**	**3**

Course Objectives

- Toexpertise thestudent to identifyand isolate various biomolecules.
- To acquire training to estimate the quantity of biomolecules present by applying biochemical techniques.

Prerequisites

Chromatographictechniques, biomoleculesandplantpigments.

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	Recall and understand the techniques involved in isolation, separation and estimationofvariousbiomolecules	K1 & K2
CO2	Develop and apply the skillsinhandlingvarious chromatographic and colorimetric techniques	K3
CO3	Qualitatively and quantitatively analyzethebiomolecules	K4

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

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

"3"–Substantial(High) Correlation "-"indicatesthereisnocorrelation.

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,LactoseandStarch.
* Proteins – Precipitation reactions of proteins, Colour reactions of proteins, colourreactions of amino acids like tryptophan, tyrosine, cysteine, methionine, arginine,prolineand histidine.
* Lipids–solubility,acroleintest,Salkowskitest,Lieberman-Burchardtest.
* 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.&SelviChristy.R.(2018).ExperimentalProceduresinLifeSciences.CBSPublishers & Distributors.
2. Wilson, K.&W alker,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 ofBiochemistryand MolecularBiology.8th edition.CambridgeUniversityPress.
2. Wood,W. B.(1981).Biochemistry-Aproblem 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% 20 ESTIMATION% 20 OF%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 Designers

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

Semester II	InternalMarks:25	ExternalMarks:75		
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
22PCH2CC4	**PHYSICAL METHODS IN CHEMISTRY-I**	**CORE COURSE**	**6**	**5**

Course Objectives

- To understand, Microwave Spectroscopy and Vibrational Spectroscopy
- To learn IR and UV-Vis spectroscopy
- To study NMR & EPR spectroscopy
- To learn, mass and ORD techniques

Prerequisites

Electromagnetic radiation, molecular energy level, Rigid rotor, selection rules for 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	Understand principle of various spectral techniques involving molecular absorption of electromagnetic radiations.	K1, K2
CO2	Apply NMR, IR, MS, UV-Vis spectroscopic techniques in solving structure of organic molecules and in determination of their stereochemistry	K3
CO3	Explain the principle, rules to analyses, compare and identify the structure of organic molecules using various spectral techniques.	K4
CO4	Discriminate structural and stereoisomers of compounds, radical and radical ion from adsorption pattern of molecules.	K5
CO5	Evaluate and identify configuration and conformation of isomers.	K6

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2	3	1	1	3	3
CO2	3	2	1	3	2	2	3	3	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	3

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Theoretical principles of Molecular Spectroscopy:** Microwave spectroscopy – rotational spectra of diatomic molecules, rigid and nonrigid rotors, - Intensity of spectral lines, - Effects of isotopic substitution - Stark effect. Applications of microwave spectroscopy - determination of bond length and atomic mass from microwave spectra. Infrared Spectroscopy: Linear harmonic oscillator- vibrational energies of diatomic molecules - zero point energy- force constant and bond strengths – anharmonicity- Morse potential energy diagram- vibration-rotation spectroscopy. Basic instrumentation, selection rules -normal modes of vibration - group frequencies - overtones - Fermi resonance - hot bands - factors affecting the band positions and intensities – problems - Hydrogen bonding (intermolecular and intramolecular). and NIR	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
II	**Electronic spectroscopy**:Franck-Condon principle – Selection Rules for Electronic Transitions Vibrational and rotational fine structure- Predissociation- spectroscopic determination of dissociation energy Electronic spectra of diatomic molecules – solvent effect - decay of an electronically excited state-photophysical processes, Jablonsky diagram, fluorescence and phosphorescence, excited state lifetime and quantum yield -fluorescence quenching- quenching by excimer and exciplex emission- fluorescence resonance energy transfer between photoexcited donor and acceptor system.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5

III	**Raman andUV-Visible Spectroscopy**: Raman spectra – Rotational Raman spectra of linear and symmetric top molecules – Vibrational Raman spectra, Rotational fine structure. Rayleigh and Raman scattering, Stokes and anti-Stokes linessFortrait diagram - applications of Raman spectroscopy. **UV-Visible Spectroscopy:** Introduction- Instrumentation, Sampling techniques - Woodward–Fieser and Scott rules for conjugated dienes and polymers, ketones, aldehydes, ∝,β-unsaturated acids, esters- identification of geometrical isomers and positional isomers.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
IV	**NMR Spectroscopy:** ^{1}H NMR spectroscopy – origin of NMR spectra – chemical shift – number of signals – peak areas – multiplicity – geminal, vicinal and long-range couplings – factors affecting chemical shifts and coupling constants, Karplus equation, AX, AX_3, AB_2, AMX and ABX pattern of first order spectra (problems in spin - spin splitting pattern), Simplification of complex spectra– Double resonance techniques, shifts reagents – an elementary treatment of NOE phenomenon. Carbon NMR spectroscopy: ^{13}C NMR Spectroscopy — Broad band decoupling – Off resonance decoupling ^{2}D Techniques: ^{1}H^{1}H COSY – ^{1}H^{13}C COSY and NOESY.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5

V	**NQR, X-Ray, Electron and Neutron Diffraction:** Characteristics of quadrupolar nucleus – Effects of field gradient and magnetic field upon quadrupolar energy levels – NQR transitions – Applications of NQR spectroscopy. X-Ray diffraction by single crystal method – spacegroups – systematic absences in X-ray data andidentification of lattice types, glide planes and screwaxes –Electron diffraction by gases – scattering intensity vs. scattering angle, Wierl equation – measurement techniques. Neutron diffraction bycrystals – magnetic scattering – measurementtechniques –elucidation of structure of magneticallyordered unit cell.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
VI	**Self-Study for Enrichment** **(Not to be included for External Examination)** Problems based on joint application of UV, IR, PMR, CMR, and Mass. (Including reaction sequences), DEPT, INTEPT, Chemical spin decoupling of rapidly exchangeable protons (OH, SH, COOH, NH, NH_2).	-	CO2, CO3, CO4	K3 K4 K5

Text Books

1. Banwell. C.N., (2017). Fundamentals of molecular Spectroscopy, 4th edition, McGraw Hill, New Delhi.
2. Silverstein.P.M.,&Western.F.X., (2014). Spectroscopic Identification of Organic compounds. 8th edition, John Wiley, New York.
3. Kalsi.P.S., (2016). Spectroscopy of Organic Compounds. 7th edition, New Age International Publishers, New Delhi.
4. William Kemp., (2019). Organic spectroscopy. 3rd edition, Macmillan publisher Pvt, Bangalure.

Reference Books

1. Drago. R.S., (2012). Physical Methods in Inorganic Chemistry. Affiliated East-West press Pvt. Ltd, New Delhi.
2. Kaur. K., (2014). Spectroscopy. 16th edition, Pragati Prakashan Educational Publisher.
3. Sharma. Y. R., (2016). Elementary organic spectroscopy. revised 4th edition, S. Chand &Co Ltd, New Delhi.
4. Jan Fleming.,& Dudley Williams., (2020). Spectroscopic Methods in Organic Chemistry, 7th edition, Tata McGraw-Hill Education, India.

Web References

1. http://www.organic-chemistry.org/
2. http://www.organicworldwide.net/
3. http://www.ccdc.cam.ac.uk/products/csd/
4. http://www.nou.ac.in/econtent/Msc%20Chemistry%20Paper%20IX/MSc%20Chemistry%20Paper-IX%20Unit-5.pdf
5. http://www.rcsb.org/pdb/home/home.do

Pedagogy

Chalk and talk, PPT, E-content, Discussion, Assignment, Demo,Quiz, Seminar

Course Designers

1. **Dr.V.Sangu**

Semester II	InternalMarks:40	ExternalMarks: 60		
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
22PCH2CC2P	**ORGANIC CHEMISTRY-II (P)**	**CORE PRACTICAL**	**6**	**5**

Course Objectives

To perform the quantitative analysis of a given organic compounds and to carry out the preparation of organic compounds**.**

Prerequisites

Hydrolysis, Acetylation, bromination, nitration and oxidation/ reduction

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	Explain the qualitative estimation and double stage preparation of organic compounds.	K2
CO2	Apply the methods and interpret results, while observing responsible and ethical scientific conduct.	K3
CO3	Analyze qualitatively organic components in the environment by hands-on experience with latest technical instrumentation.	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

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

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

Syllabus

I QUANTITATIVE ANALYSIS OF ORGANIC COMPOUNDS

1. Estimation of phenol
2. Estimation of aniline
3. Estimation of ketone
4. Estimation of glucose
5. Estimation of nitrobenzene
6. Estimation of glycine
7. Estimation of iodine value of oil

II PREPARATION OF ORGANIC COMPOUNDS (DOUBLE STAGE)

1. Acetylsalicylic acid from methyl salicylate (hydrolysis and acetylation)
2. 1,3,5-Tribromobenzene from aniline (bromination, diazotization and hydrolysis)
3. p-Nitroaniline from acetanilide (nitration and hydrolysis)
4. Benzilic acid from benzoin (rearrangement)
5. p-Aminobenzoic acid from p-nitrotoluene (oxidation and reduction)
6. Benzanilide from benzophenone (rearrangement)
7. m-Nitroaniline from nitrobenzene (nitration and reduction)

Text Books

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

Reference Books

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

Web References

1. http://rushim.ru › books › praktikum › Mann
2. http://do.chem.uni.wroc.pl/system/files/Preparatory%20classes.pdf.

Pedagogy

Chalk and talk, PPT, E-content, Discussion, Assignment, Demo,Quiz, Seminar

Course Designers

Dr. K. Shenbagam

Semester II	InternalMarks:25		ExternalMarks:75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
22PCH2CCC1A	**ORGANIC CHEMISTRY-II**	**CORE CHOICE COURSE**	**6**	**4**

Course Objectives

- To learn about the effect of structure on reactivity.
- Enable the students to acquire surplus knowledge about the addition, elimination mechanism, and the chemistry behind the photolytic reactions.
- Guide the students to know the role of heterocyclic compounds in drug development.

Prerequisites

Quantitative treatment, Substitution, Addition, Elimination, photoreaction and Heterocycles.

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	Outline the synthesis, reactivity of organic compounds, various methods for determining the mechanism and fundamentals of photochemistry.	K1&K2
CO2	Interpret the reaction mechanism of various organic reactions including photochemical and heterocycles.	K3
CO3	Classify the different types of substitution, addition, elimination, photolytic reactions and heterocyclic compounds.	K4
CO4	Categorize the techniques of investigating reaction pathways and naming reactions.	K5
CO5	Predict the mechanism and products of organic reactions	K6

Mapping of CO with PO and PSO

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

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Effect of Structure on reactivity:** Quantitative treatment : Hammett equation- linear free energy relationship, substituent constant and reaction constant and limitations of Hammett equation, Taft equation, thermodynamically and kinetically controlled reactions, Hammond's postulate, Non- kinetic methods of determining mechanism- isolation, trapping and detection of intermediates, isotopic labelling, crossover experiments, product analysis, stereo chemical evidence, kinetic method -kinetic isotope effect.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
II	**Aromatic Nucleophilic and Electrophilic Substitution:** SN1, SNAr, Benzyne mechanism, reactivity and orientation, Ullmann, Sandmeyer and Chichibabin reaction, Steven's – Sommelet Hauser and Von Richter Rearrangements. Aromatic electrophilic substitution – orientation, reactivity and mechanism based on transition state theory with suitable reactions. Ortho- para ratio, ipso attack, Vilsmeier- Haack, Jacobson and Scholl's reactions.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
III	**Addition and Elimination:** Addition to carbon-carbon multiple bonds - Electrophile, nucleophile and free radical addition, addition to carbonyl and conjugated carbonyl system-mechanisms. Knoevengal, Stobbe, Darzen'sglycidic ester condensation and Reformatsky reaction. Elimination reaction- Mechanism of E1, E2, E1CB, stereochemistry, Hoffmann's and Zaitsev's rules. Pyrolytic cis elimination, Chugaev reaction, Hoffmann exhaustive methylation, Cope elimination and Bredt's rule.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6

IV	**Organic Photochemistry:** Fundamental concepts, energy transfer, characteristic of photoreaction - photo-reduction, photo-oxidation and photosensitization. Classification of photoreactions of Ketones and enones- Norrish type I and II, Paterno-Buchi reaction, Photo-Fries rearrangement. Photochemistry of alkenes and aromatic compounds – Zimmerman's Di-pi methane rearrangement. Reaction of unactivatedcentres- Photochemistry of α,β - unsaturated carbonyl compounds, Barton Reaction.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
V	**Heterocycles:** Nomenclature, synthesis and reactivity of aromatic heterocycles – pyrazole, isothiazole, triazole, pyrimidine, purines, triazines, pyridazines and pyrazines. Synthesis and reactivity of non-aromatic heterocycles – tetrahydro furan, pyrrolidine, piperidine, oxirane, oxetane, oxazole and imidazole	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
VI	**Self-Study for Enrichment** **(Not to be included for External Examination)** Reactivity of intermediates, nature of substituents, Markovnikov's and Anti-Markovnikov's rule, syn-anti addition and elimination, Jablonski diagram and chemistry of simple heterocycles.	-	CO1 CO2 CO3	K1 K2 K3 K4

Text Books

1. Pine S.H, Hendrickson J B, Cram & Hammond, (1980), Organic Chemistry, 4th edition McGraw Hill, New York.
2. March J & Smith M.B (2020), Advanced Organic Chemistry, Reactions, mechanisms and Structure, 8th edition Wiley.
3. Carey F A & Sundberg R J, (2007), Advanced Organic Chemistry, Part A and Part B, 5th Corrected edition Springer.
4. Bansal. R .K, (1990), Reaction mechanism in Organic Chemistry, Tata McGraw Hill.
5. Finar I.L, (2009), Organic Chemistry, 6th edition, Pearson Education Ltd.

Reference Books

1. Peter sykes (2009), A guide book to mechanism in Organic Chemistry, 6th edition, Pearson
2. Education.
3. Raj K Bansal. (2009), Heterocyclic Chemistry, 4th edition, New Age International Publishers.
4. Gurdeep.R. Chatwal, (2015), Reaction Mechanism and Reagents in Organic Chemistry, Himalaya Publishing House.

Web References

1. https://chemicalnote.com/reaction-mechanism-methods-of-determining-reaction-mechanism/
2. https://www.chemistrylearner.com/addition-reaction.html
3. http://www-oc.chemie.uni-regensburg.de/OCP/ch/chb/oc5/Photochemie-08.pdf

Pedagogy

Chalk and talk, PPT, E-content, Discussion, Assignment, Demo,Quiz, Seminar

Course Designers

Dr. P. Pungayee Alias Amirtham

Dr. A. Sharmila

Semester II	InternalMarks:25		ExternalMarks:75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
22PCH2CCC1B	**CHEMISTRY OF NATURAL PRODUCTS**	**CORE CHOICE COURSE**	**6**	**4**

Course Objectives

- By the end of this course the student will be familiar with definition, isolation and uses of natural products.
- The students will be able to know the general properties and methods of preparation of natural products chemically and biosynthetically.

Prerequisites

Isolation, addition, elimination, substitution,oxidation,reduction reactions.

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	Differentiate the different types of alkaloids, terpenes, steroids, flavonoids and vitamins.	K1
CO2	Know the basic terms in natural product chemistry and their physiological significance.	K2
CO3	Evaluate the different methods of preparation of natural products	K3
CO4	Recognize the most important building blocks employed in the biosynthesis of natural products.	K4
CO5	Elaborate general methods of structural elucidation of compounds of natural origin.	K5

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	3

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Alkaloids**: Classification of alkaloids, general methods of structural determination of alkaloids, synthesis and biogenesis of Papaverine, Adrenaline, Ephedrine, Piperine, Hygrine and Reserpine	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
II	**Terpenoids and Carotenoid**: Classification of terpenoids, isoprene rules- structural elucidation & synthesis of geraniol, α-pinene and camphor. Diterpenoids: Carotenoid- Introduction- Structure and Synthesis of β-Carotene and Lycopene.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
III	**Steroids:** Introduction and nomenclature of steroids, Blanc's rule, Barbier-Wieland degradation, Oppenauer oxidation, Diel's hydrocarbon, chemistry of Cholestrol, Ergosterol and Vitamin-D.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
IV	**Flavonoids and Isoflavonoids:** Occurrence, nomenclature and general methods of structure determination, isolation, structure elucidation and synthesis of Kaempferol, Quercetin, Cyanidin, Genestein.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
V	**Vitamins:** Classification and structure of water soluble and fat soluble vitamins, plant and animal sources, vitamins as coenzymes, deficiency of vitamins and their effects.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5

VI	**Self-Study for Enrichment** **(Not to be included for External Examination)** Definition, isolation and purification of alkaloids, terpenes, and flavonoids.	-	CO2 CO3	K2 K3

Text Books

1. Chatwal G.R, (1990), Natural Products Chemistry-Vol. I & II, Himalaya Bombay.
2. Agarwal, O.P, Goel Gorakhpur (1985), Chemistry of Natural Products-Vol. I & II:
3. Longmann E.L, London B.S, (2000), Organic Chemistry-Vol. I-II: I. L. Finar.
4. Sujatha V. Bhat, Nagasampige B.A & Sivakumar M, (2006), Chemistry of Natural Products:, 2nd reprint, Springer.

Reference Books

1. Dewick P.M (2009), Medicinal Natural Products: A Biosynthetic Approach", 2nd Edition, Wiley & Sons,
2. Graham Solomons T.W, Craig B. Fryhle, Scott A. Snyder (2013), Organic Chemistry, 11th Edition, International Student Version, John Wiley &Sons..Himalaya Publishing House.

Web References

1. https://chemnote.weebly.com/uploads/2/5/8/6/25864552/alkaloids.pdf
2. https://www.vedantu.com/biology/steroid
3. https://www.slideshare.net/TareqAspirant/a-short-note-on-vitamins
4. https://www.tuscany-diet.net/2014/01/22/flavonoids-definition-structure-classification
5. https://www.intechopen.com/chapters/62573
6. https://gcwgandhinagar.com/econtent/document/1588068142ch-1.pdf

Pedagogy

Chalk and talk, PPT, E-content, Discussion, Assignment, Demo ,Quiz, Seminar

Course Designers

1. Dr. C.Rajarajeswari

Semester II	InternalMarks:25		ExternalMarks:75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
22PCH2CCC1C	**MOLECULAR REARRANGEMENT**	**CORE CHOICE COURSE**	**6**	**4**

Course Objectives

- To learn about the reactions intermediates involved in rearrangement reactions.
- To learn about the basic concepts about the electrophilic and nucleophilic rearrangement reactions.
- To learn the concept and mechanism of rearrangement reactions.

Prerequisites

Reaction intermediates, nitrenes, carbenes, electrophilic, nucleophilic, naming reactions.

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	Know the outline for determining nature of rearrangements.	K1, K2
CO2	Interpret the reaction mechanism in various organic reactions.	K3
CO3	Classify the different types of intermediates involving in organic rearrangement reactions.	K4
CO4	Recognize the technique of identifying reaction mechanism in various naming reactions.	K5
CO5	Predict the mechanism and product of molecular rearrangement reactions.	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	3

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Molecular Rearrangements –** Introduction, intermolecular and intra molecular rearrangement, intermediates, classification based on migration origin and migration terminus. Rearrangement to electron-deficient carbon - Wagner-Meerwein rearrangement, pinacol rearrangement, Wolff rearrangement, benzil-benzilic acid rearrangement-Allylic rearrangement-Sommelet-Hauser rearrangement-Tiffeneau-Demjanov Rearrangement.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
II	**Rearrangement to electron-deficient nitrogen:** Beckmann rearrangement- Schmidt rearrangement, Hofmann rearrangement-Curtius rearrangement- Lossen rearrangement-Neber rearrangement- Stieglitz Rearrangement- Rearrangements with acyl carbenes-Arndt-Eistert Reaction- Diazo Ketone Reactions	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
III	**Rearrangement to electron-deficient oxygen:** Baeyer-Villiger oxidation, cumene hydroperoxide rearrangement-phenol rearrangement-Dakin reaction- free radical rearrangements. Sigmatropic rearrangement – classification, [1,2] shift, [1,3] shift and [3,3] shift - Claisen rearrangement, cope rearrangement	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
IV	**Migration from N- to ring carbon rearrangement:** Hoffmann Martius rearrangement- Orton rearrangement – Benzidine -semidine rearrangement – Bamberger rearrangement- Migration to electron rich carbon center – Fries rearrangement – Favorski rearrangement.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5

V	**Aromatic and Photochemical rearrangement** Stevens rearrangement-Wittig rearrangement–Photochemical rearrangement – di -pi methane rearrangement	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
VI	**Self-Study for Enrichment** **(Not to be included for External Examination)** Aldol condensation-allylic rearrangement-ullmann reaction-sandmeyer reaction-perkin reaction.	-	CO1 CO2	K1 K2 K3

Text Books

1. Tewari, .K.S, Vishil, N.K, &Mehotra N.S (2001), A text book of org. chem – 1st edition, Vikas Publishing House Pvt Ltd., New Delhi.
2. Soni P.L (2005), Text Book of Organic chemistry, Sultans Chand, 1991, New Delhi,
3. Bahl& Arun Bahl (2005), Organic Chemistry, S. Chand and Sons, New Delhi.
4. Agarwal O.P (2002), Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub. House.
5. Gurdeep Chatwal (2002), Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub. House..

Reference Books

1. Sharma, Y.R &Vig O.P (1997), Elementary organic absorption spectroscopy – 1st edition, Goel Pulishers, Meerut.
2. Morrison R.T & Boyd R.N (1992), Organic Chemistry, 6th edition, PHI Limited, New Delhi.
3. Jerry March (1992), Advanced Organic Chemistry, 4th edition, John Wiley and Sons, New York.
4. Pine S.H (1987), Organic Chemistry, 5th edition, McGraw Hill International Edition, Chemistry Series, New York.

Web References

1. https://www.masterorganicchemistry.com/2012/08/15/rearrangement-reactions-1-hydride-shifts
2. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/rearrang.htm
3. https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Book%3A_Virtual_Textbook_of_OChem
4. https://www.organic-chemistry.org/namedreactions/claisen-rearrangement.shtm

Pedagogy

Chalk and talk, PPT, E-content, Discussion, Assignment, Demo ,Quiz, Seminar

Course Designers

1. Dr. K. UmaSivakami

Semester II	InternalMarks:40		ExternalMarks:60	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
22PCH2CC3P	**INORGANIC CHEMISTRY -I (P)**	**CORE PRACTICAL**	**6**	**5**

Course Objectives

1. To perform the semi-micro qualitative analysis and to estimate the metal ions using photoelectric colorimeter.

Prerequisites

Eperation of cations and anions, quantitave analysis

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	Explain the quantitative estimation and estimation of inorganic compounds.	K2
CO2	Apply the methods, identify the components and interpret results, while observing responsible and scientific conduct.	K3
CO3	Analyze quantitatively organic components in the environment by hands-on experience with latest technical instrumentation	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	2	2	2	1	1	1	2	1

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

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

Syllabus

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,) and two less common cations (W, Tl, Se, Te, Mo, Ce, Th, Zr, Ti, V, U, Li).

2. Quantitative Estimation of copper,iron, nickel, chromium and manganese ions using photoelectric colorimeter

Text Books

1. Vogel.A.I (2000), Text Book of Quantitative Inorganic Analysis, Longman.
2. RamanujamV.V (1988), Inorganic Semimicro Qualitative Analysis, National Pubs.
3. Svehla.G. (1987), Text Book of Macro and Semimicro Qualitative Inorganic analysis, Longman.

Reference Books

1. Vogel.A.IT atchell. A.R, Furniss B.S, Hannaford.A. J &SmithP.W. G, (1989), Vogel's Textbook of Practical Organic Chemistry, 5th Ed., Prentice Hall.

Web References

1. https://iscnagpur.ac.in/study_material/dept_chemistry/4.1_MIS_and_NJS_Manual_for_Inorganic_semi-micro_qualitative_analysis
2. https://byjus.com/chemistry/systematic-analysis-of-cations
3. https://www.uou.ac.in/sites/default/files/slm/MSCCH-505L.pdf

Pedagogy

E-content, Demo, Hands on training

Course Designers

1. Dr. K. Shenbagam

Semester II	Internal Marks:25		External Marks:75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
22PCH2DSE2A	**GREEN CHEMISTRY**	**DISCIPLINE SPECIFIC ELECTIVE**	**6**	**3**

Course Objectives

- To know about twelve principles of green chemistry, eco-friendly synthesis using microwave, ionic liquid and phase transfer catalyst.
- To know the synthesis of organic compounds in greener way.
- To gain knowledge about the use of environmentally friendly practices in reducing pollution.

Prerequisites

Pollution, hazardous chemicals, toxic chemicals. Catalyst, condensation, substitution, elimination, oxidation, reduction.

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	Describe the basics of green chemistry and introduction of organic synthesis.	K1
CO2	Understand the importance and role of solvents, solid-state reactions, phase transfer catalyst and alternative energy sources.	K2
CO3	Apply green synthesis for synthesizing different organic compounds.	K3
CO4	Analyze the applications of green synthesis.	K4
CO5	Create a new route for the synthesis of organic compounds from the knowledge gained throughout the course.	K5

Mapping of CO with PO and PSO

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

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Introduction to Green Chemistry:** Need of Green Chemistry- twelve principles of green chemistry. Planning a green synthesis- percentage atom utilization - Evaluating the type of the reaction - selection of solvents-selection of starting materials- use of catalyst. International organisations promoting green chemistry.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
II	**Organic Synthesis in Green Solvents:** Reactions in water - pericyclic reactions, Wittig-Horner reaction, Knoevenagel reactions, Pinacol coupling, Aldol condensation, Benzoin condensation, Heck reaction, Wurtz reaction and Mannich reactions. Organic synthesis in supercritical carbon dioxide -Diels-Alder reaction and Kolbe-schmitt synthesis. Reaction in ionic liquids – types, preparations and synthetic applications.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
III	**Organic Synthesis in Solid State:** Introduction, room temperature solid state reactions - Grignard reaction, Reformatsky reaction. Solid state reactions on heating – oxidations of hydroxylated aldehydes, ketones, nitriles, sulfides and nitrogen heterocycles. Solid state reactions using solid support – oxidation, reduction, rearrangement, isomerization and condensation reactions.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
IV	**Alternate Energy Processes in Chemical Synthesis:** Microwave assisted organic synthesis - hydrolysis of benzyl chloride and benzamide and coupling reactions - Baylis - Hillman reaction, Esterification, synthesis of chalcones. Ultrasound assisted organic synthesis - homogenous sonochemical reactions - Curtius rearrangement, organometallic reactions- Heterogenous	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5

	liquid-liquid reactions and solid-liquid reactions.			
V	**Phase Transfer Catalysts:** Mechanism of phase transfer reaction, types and advantages of phase transfer catalyst. Applications of phase transfer catalyst in organic synthesis - Darzen reaction, Michael addition, oxidation reactions using permanganate, chromate, hypochloride, osmium tetraoxide, potassium ferricyanide and peroxides and reduction reactions	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
VI	**Self-Study for Enrichment** **(Not to be included for External Examination)** Properties of CO_2 - Phase diagram for CO_2 - uses of CO_2 in dry cleaning. Synthesis of quinoxaline derivatives and β-keto sulfones from ketones using green synthesis. Instrumentation and types of sonochemical reaction in ultrasound assisted green synthesis.	-	CO1 CO2	K1 K2

Text Books

1. Kumar, V. (2007) An Introduction to Green Chemistry. Vishal Publishing Co. Jalandhar.
2. Ahluwalia. V. K. An Introduction to Green Chemistry. Narosa Publishing.
3. Anastas. P. T., and Warner, J. C. (2008). Green Chemistry. Oxford University Press.

Reference Books

1. Ahluwalia. V. K., and Kidwai, M. (2007). New Trends in Chemistry. Anamaya Publishers. 2nd Edition.
2. Ahluwalia. V. K., and Varma, R. S. (2009). Green Solvents. Narosa Publishing. 1st Edition.

Web References

1. https://www.epa.gov/greenchemistry/basics-green-chemistry.
2. https://pubs.rsc.org/en/content/articlelanding/2005/gc/b418069k.
3. https://www.scielo.br/j/jbchs/a/Fzh57FB7TrhBWRLnzkCCfDs/?lang=en#:~:text=The%20solid%2Dphase%20organic%20synthesis%20(SPOS)%20has%20emerged%20as,chemistry%20to%20discover%20new%20hits.&text=In%20SPOS%2C3%20the%20solid,to%20drive%20reactions%20to%20completion.

4. https://www.organic-chemistry.org/topics/sonochemistry.shtm.
5. https://www.sciencedirect.com/topics/chemistry/phase-transfer-catalyst.

Pedagogy

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

Course Designers

Dr. S.Devi,

Semester II	Internal Marks:25		External Marks:75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
22PCH2DSE2B	**FORENSIC CHEMISTRY**	**DISCIPLINE SPECIFIC ELECTIVE**	**6**	**3**

Course Objectives

- To know about the history and principles involved in Forensic science
- To demonstrate proficiency in accurately conveying scientific datas for crime cases.
- To develop testable hypothesis, designing and analysis of collected sample to solve criminal justice system.

Prerequisites

Finger print analysis, Crime detection in Gold, Food and soil

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 know thefundamentalprinciples, technological methods andfunctionsofforensicscience	K1 &K2
CO2	Applythe principles ofSpectroscopy in physical evidences and beverages	K3
CO3	Illustrate themechanism persisting in identification of evidences, finger prints and explosives	K4
CO4	Appraisetheroleofchemistry in detection of corrupted jewels, explosives and consumed liquors	K5
CO5	Design the role of handwriting examplars, alcoholic beverages, marked currency notes and hidden explosives	K6

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	3	3	2
CO2	2	3	3	3	2	3	3	2	3	3
CO3	2	3	3	3	2	3	2	3	3	3
CO4	2	2	2	3	3	2	3	2	3	2
CO5	3	3	3	3	3	3	3	3	3	3

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	CONGNITIVE LEVEL
I	**INTRODUCTION OF FORENSICSCIENCE:** Functions of forensic science-Historical aspects - definitions and concepts inforensic science-scope of forensic science-need of forensic science-basic principles of forensicscience-branchesofforensicscience-forensic sciencein internationalperspectives.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
II	**CHEMISTRYOFFORENSIC INVESTIGATIONS:** Definition, Classification -physicalevidence- Glass and soil - physical properties - comparing glass fragments - collection andpreservation of glass evidence - forensic characteristics of soil - collection and preservation ofsoilevidence.Fingerprints-fundamentalprinciples -classificationofmethods of detecting fingerprints - preservation of developed prints. Document and voiceexamination - collection of handwriting exemplars – typescript comparisons - inks and papers - alterations,erasures,andobliterations.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
III	**TECHNOLOGICALMETHODSINFORENSICSCIENCE:** Chromatographic methods-Fundamental principles and forensic applications of thin layerchromatography-gaschromatographyandliquidchromatography. Spectroscopicmethods-Fundamental principles and forensic applications of Ultraviolet- visible spectroscopy, infraredspectroscopy,atomicabsorptionspectroscopy,atomicemissionspectroscopyandmassspectroscopy.X-rayspectrometry. Colorimetric analysis andLambert-Beerlaw.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
IV	**FORGERYANDCOUNTERFEITING:** Detecting forgery in bank cheques / drafts and educational	18	CO1 CO2	K1 K2

	records (mark lists, certificates) usingUV-light. Alloy analysis using AAS to detect counterfeit coins. Checking Silverline water mark incurrency notes. Jewellery: detection of gold, purity in 22 carat ornaments, detecting gold platedjewels,authenticityof diamonds, (natural, synthetic, glassy).		CO3 CO4 CO5	K3 K4 K5 K6
V	**STUDY OFBEVERAGES ANDEXPLOSIVES:** Definition-classification of liquors based on origin(Indian made foreign products, Country made)- Methods-Fermentation and Distillation process- Characterization of Beer, wines, Congeners in alcoholic beverages. Explosives-Definition and chemistry of explosives- characteristics of high and low explosion, dust explosion- Gas/vapour explosion- Detection of hidden explosives- Examination of explosives and explosion residues using chemical and instrumental techniques.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6
VI	**Self-Study for Enrichment** **(Not to be included for External Examination)** Case studies on crime cases related to documentation, money and mobile data hacking	-	CO1 CO2	K1 K2 K3

Text Books

1.Jay.A.Seigel (2015), Forensic Chemistry: Fundamentals and Applications, Wiley Pulications.

2. Suzanne Bell, (2022), Forensic Chemistry, CRC Press

3. Syed Aftab Iqbal (2021), Textbook of Forensic chemistry, Discovery Publishers Ltd

Reference Books

1. Kenyon Evans Nguyen (2021), Forensic Chemistry, American chemical society.

2. Anthony J.Bertino (2019), Forensic Science: Fundamentals and Investigations, Cenage Publishers

Web References

1. https://www.pdfdrive.com/introduction-to-forensic-chemistry-e189712545.html
2. https://www.degruyter.com/document/doi/10.1515/9783110718812/html?lang=en

Pedagogy

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

Course Designers

1. Dr. R.Subha

Semester II	InternalMarks:25		ExternalMarks:75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs /Week	CREDITS
22PCH2DSE2C	ANALYTICAL CHEMISTRY	DISCIPLINE SPECIFIC ELECTIVE	6	3

Course Objectives

- To acquire the knowledge of basic principles and theory behind analytical techniques.
- To know the separation of chemical compounds from mixtures.
- To gain knowledge about the application of analytical techniques to analysis chemical compounds.

Prerequisites

Adsorption, elution, solubility, Electromagnetic radiation.

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	Describe the basic concepts of data analysis, chromatography, electroanalytical methods, thermal methods and flame photometry.	K1
CO2	Understand the theory of various analytical techniques.	K2
CO3	Illustrates the instrumentation and experimental details of analytical techniques.	K3
CO4	Compare various analytical techniques based on their principles and applications.	K4
CO5	Evaluate the applications of data analysis, chromatography, electroanalytical methods, thermal methods and flame photometry.	K5

Mapping of CO with PO and PSO

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

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Introduction To Analytical Chemistry:** Analytical chemistry - role of analytical chemistry, classification, advantages and limitations of analytical methods - Safety in laboratory. Errors - Types, definitions of relative error, absolute error, significant figures, mean, median, standard deviation, sensitivity, detection limits, precision and accuracy. Confidence limit, test of significance - Q - test, F - test and T - test. Linear least squares methods. Minimisation of errors. Sampling, standardisation and calibration in analytical methods.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
II	**Chromatography I:** Chromatography -Introduction, definition, types, principles and theories. Principle, experimental details, theory, advantages, limitations and applications of paper chromatography, thin layer chromatography, liquid - liquid partition chromatography, column chromatography.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
III	**Chromatography II:** Introduction, principle, instrumentation, advantages, limitations and applications of gas chromatography, gel permeation chromatography, ion exchange chromatography. Principle, instrumentation and applications of high performance liquid chromatography, gas chromatography - mass spectroscopy and liquid chromatography - mass spectroscopy techniques.	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
IV	**Electroanalytical Methods:** Definitions and terminology involved in electrochemistry. Types of	18	CO1 CO2	K1 K2

	electrodes - ion selective electrode, glass membrane electrode, solid and liquid membrane electrodes. Principle, instrumentation, titrations, advantages and application of potentiometry, conductometry and coulometry. Principle, instrumentation, advantages and applications of polarography, cyclic voltammetry and amperometric titrations.		CO3 CO4 CO5	K3 K4 K5
V	**Thermal Methods and Flame Photometry:** Thermogravimetry - Introduction, principle, instrumentation, derivative thermogravimetry analysis, factors affecting TGA and applications of TGA for quantitative analysis of calcium carbonate, copper sulphate pentahydrate and calcium oxalate hydrate.Differential thermal analysis - Introduction, principle of working, factors affecting DTA and applications. Flame photometry - Introduction, principles, instrumentation, advantages, limitations and applications	18	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
VI	**Self-Study for Enrichment** **(Not to be included for External Examination)** Methods of expressing accuracy and precision- Electrogravimetry - Calibration - Thermometric titrations - Interference and effect of solvent in flame photometry - Flame infrared emission.	-	CO1 CO2 CO3	K1 K2 K3

Text Books

1. Skoog. D. A., West. D. M., & Holler. H. J. (1992). Fundamentals of Analytical Chemistry.
2. Chatwal, G. R., and Anand. S. (1999). Instrumental Method of Analysis. Himalya Publishing House, 13th reprint.
3. Srivastava. A. k., and Jain, P. C. Instrumental Approach to Chemical Analysis.
4. Allen J. Bard and Larry R. Faulkner. Electrochemical Methods: Fundamentals and Applications.

Reference Books

1. Skoog, D. A., Holler, F. J., and Crouch, R. (2006). Principles of Instrumental Analysis. 6th Edition.
2. Vogel's Textbook of Quantitative Chemical Analysis, Pearson Education. 6th Edition.
3. Kaur, H. Instrumental Methods of Chemical Analysis. Pragati Edition.

Web References

1. https://www.simplilearn.com/data-analysis-methods-process-types-article
2. https://www.britannica.com/science/chromatography
3. https://microbenotes.com/high-performance-liquid-chromatography-hplc/
4. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Instrumentation_and_Analysis/Cyclic Voltammetry.
5. https://soe.unipune.ac.in/studymaterial/ashwiniWadegaonkarSelf/621%20Unit%202.pdf

Pedagogy

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

Course Designer

1.Dr. S. Devi