

PG DEPARTMENT OF CHEMISTRY

SYLLABUS

2023-2025 Batch



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NGM COLLEGE (Autonomous)

Affiliated to Bharathiar University

Re-Accredited by NAAC & ISO 9001:2015 certified

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PREAMBLE

NALLAMUTHU GOUNDER MAHALINGAM COLLEGE, POLLACHI

Our dream is to make the college an institution of excellence at the national level by imparting quality education of global standards to make students academically superior, socially committed, ethically strong, spiritually evolved and culturally rich citizens to contribute to the holistic development of the self and society. Training students to become role models in academic arena by strengthening infrastructure, upgrading curriculum, developing faculty, augmenting extension services and imparting quality education through an enlightened management, committed faculty who ensure knowledge transfer, instill research aptitude and infuse ethical, cultural values to transform students into disciplined citizens in order to improve quality of life.

PG DEPARTMENT OF CHEMISTRY

Department of M.Sc. Chemistry was established in July, 2015 with following Vision and Mission. It offers a wide range of courses including Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Medicinal Chemistry, Green Chemistry, Nano Chemistry and Analytical Chemistry etc. Experts from Pure and Applied Chemistry domain will teach the courses and students will develop a thorough understanding of fundamentals and experimental concepts of Chemistry. There will be an opportunity for the students to participate in an extensive and varied seminar, workshop, conferences, association, research club activities, extension and internship programmes and gain experience in a large variety of projects. The outcome based education is established in the year 2019.

VISION

Establish a center of excellence for leading-edge Chemistry education. The main goal will be to produce highly skilled graduates capable of working in the rapidly changing scenario in the field of chemical science and technology during their lifetime.

MISSION

Impart quality education through up-to-date knowledge and information in the field of Chemistry related to science and technology and enable them to take up the challenge of the world to come.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC guidelines to be followed.

CORE COURSE

A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core Course.

ELECTIVE COURSE

Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

PROJECT WORK/DISSERTATION

It is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. Project/Dissertation work would be of 5 credits.

OUTCOME BASED EDUCATION (OBE)

It is the educational approach which focuses on student centric education in the context of development of personal, social, professional and knowledge (KSA) requirements in one's career and life. Outcome Based Education is an approach that focuses on outcomes such as the achievements of students that are measurable, proven and can be improved. It is simply the establishment of expected goals or outcomes for different levels of graduate and a commitment to ensure that every student achieves at least those minimum proficiencies before being allowed to post graduate.

The authorities of Nallamuthu Gounder Mahalingam College, Pollachi in lieu of accreditation standards of National Assessment and Accreditation Council, decided to opt for Outcomes Based Education (OBE). As the part of the decision in Academic council meeting

was held at the campus. The detailed document is designed and the existing curriculum of the department is transformed in to the framework of OBE. This is the first step towards the implementation of OBE in the department. The document will serve all stakeholders in the effective implementation of the curriculum. The OBE is continuous process for quality enhancement and it will go a long way in order to enhance the competencies and employability of the Post-graduates of the department.

The M.Sc. Chemistry programme aims that the graduates will become successful professional by demonstrating rational and analytical thinking abilities. The graduates will be mould to communicate efficiently and work in interdisciplinary research and demonstrate scientific leadership in academia and industries.

Programme Educational Outcomes

PEO1	Mastering in concepts and problem solving: To understand major concepts, theoretical principles, experimental findings and the ability to employ them for critical thinking and efficient problem solving skills in different areas of Chemistry.
PEO2	Fostering Academic Ambitions: Be motivated to prepare the students to pursue higher studies and research to meet out academic demands of the country.
PEO3	Exploring Chemistry Techniques: Proficient in diverse chemistry techniques and their applications in scientific and engineering contexts.
PEO4	Stimulating Student Writing: Students will be stimulated to interchange their knowledge and skills for developing independent writing in their field of study.
PEO5	Empowering Responsible Graduates: Graduates will contribute to the growth of the nation and society as ethical and responsible professionals.

Programme Outcomes

After completion of the M.Sc. Chemistry Programme, the students must be able to

PO1	Disciplinary knowledge and skills: Capable of demonstrating (i) comprehensive knowledge and understanding of major concepts, theoretical principles and experimental findings in chemistry and its different subfields (analytical, inorganic, organic and physical), and other related fields of study, including broader interdisciplinary subfields such as life science, environmental science and material sciences; (ii) ability to use modern instrumentation for chemical analysis and separation.
PO2	Skilled communicator: Ability to transmit complex technical information relating to chemistry in a clear and concise manner in writing and orally skills.

PO3	Critical thinker and problem solver: Ability to employ critical thinking and efficient problem solving skills in the four basic areas of chemistry (analytical, inorganic, organic, and physical).
PO4	Sense of inquiry: Capability for asking relevant/appropriate questions relating to issues and problems in the field of chemistry, and planning, executing and reporting the results of an experiment or investigation.
PO5	Team player/ lifelong learners: Capable of working effectively in diverse teams in both classroom, laboratory and in industry and field-based situations as well as Capable of self-paced and self-directed learning aimed at personal development and for improving knowledge/skill development and reskilling.
PO6	Skilled project manager: Capable of identifying/mobilizing appropriate resources required for a project, and manage a project through to completion, while observing responsible and ethical scientific conduct; and safety and chemical hygiene regulations and practices.
PO7	Digital literacy: Capable of using computers for chemical simulation and computation and appropriate software for analysis of data, and employing modern library search tools to locate, retrieve, and evaluate chemistry-related information.
PO8	Ethical awareness/reasoning: Avoiding unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, and appreciate environmental and sustainability issues.

Programme Specific Outcomes

After completion of the M.Sc. Chemistry Programme, the students must be able to

PSO –01	Become Proficient in synthetic, analytical, electrochemistry, Phytochemistry, spectral techniques, characterization to develop interdisciplinary approach.
PSO –02	Develop new innovations in chemical, pharmaceutical and allied chemical industries and successfully implement them at an industrial scale.

Mapping

PEOs POs \ PSOs	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	H	H	H	H	H
PO2	M	H	M	H	H
PO3	H	M	H	H	H
PO4	H	H	H	H	H
PO5	H	H	M	H	H
PO6	H	M	H	H	H
PO7	H	H	H	H	H
PO8	H	H	M	H	H
PSO1	H	M	H	H	H
PSO2	H	M	H	H	H

SCHEME OF SYLLABUS & EXAMINATION



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SEMESTER - I

Semester	Subject Code	Title of the Paper	Hrs /Week			Exam Hrs.	Maximum Marks		Total Marks	Credits
			L	T	P		Internal	External		
I	23PCY101	Core-I -Inorganic Chemistry –I- Solid State and Nuclear Chemistry	4	1	--	3	25	75	100	4
	23PCY102	Core-II -Organic Chemistry – I- Organic Reaction Mechanisms	4	1	--	3	25	75	100	5
	23PCY103	Core-III -Physical Chemistry – I- Group Theory and Chemical Kinetics	4	1	--	3	25	75	100	5
	23PCY207	Core-VII -Inorganic Chemistry Practical-I	--	--	5	--	--	--	--	--
	23PCY208	Core-VIII -Organic Chemistry Practical-I	--	--	5	--	--	--	--	--
	23PCY209	Core-IX - Physical Chemistry Practical –I	--	--	5	--	--	--	--	--
Total			12	3	15	9	75	225	300	14

SEMESTER - II

Semester	Subject Code	Title of the Paper	Hrs /Week			Exam Hrs.	Maximum Marks		Total Marks	Credits
			L	T	P		Internal	External		
II	23PCY204	Core-IV -Inorganic Chemistry – II-Coordination Chemistry	4	1	--	3	25	75	100	4
	23PCY205	Core-V Organic Chemistry-II – Organic Reactions and Stereochemistry	4	1	--	3	25	75	100	5
	23PCY206	Core-VI Physical Chemistry-II – Quantum Chemistry and Nano Chemistry	4	1	--	3	25	75	100	4
	23PCY2E1	*Major Elective –I – Green Chemistry, Research Methodology & Cyber Security	3	--	--	3	25	75	100	3
	23PCY2E2	* Electrochemistry								
	23PCY2E3	* Advanced Polymeric Materials								
	23PCY2N1	*Non Major Elective Chemistry in day to day life	2	--	--	3	--	100	100	2
	23PCY207	Core-VII -Inorganic Chemistry Practical-I	--	--	4	6	40	60	100	4
	23PCY208	Core-VIII -Organic Chemistry Practical-I	--	--	3	6	40	60	100	4
23PCY209	Core-IX - Physical Chemistry Practical –I	--	--	3	6	40	60	100	4	
Total			17	3	10	33	220	580	800	30

SEMESTER - III

Semester	Subject Code	Title of the Paper	Hrs /Week			Exam Hrs.	Maximum Marks		Total Marks	Credits
			L	T	P		Internal	External		
III	23PCY310	Core-X- Organic Chemistry – III– Natural Products and Organic Reagents	4	1	--	3	25	75	100	5
	23PCY311	Core-XI- Physical Chemistry –III – Classical and Statistical Thermodynamics	4	1	--	3	25	75	100	4
	23PCY312	Core-XII- Organic Spectroscopy	4	1	--	3	25	75	100	5
	23PCY3E4	Major Elective -II – *Organometallic Chemistry	3	--	--	3	25	75	100	3
	23PCY3E5	* Material Science								
	23PCY3E6	*Dye Chemistry								
	23PCY415	Core-XV- Inorganic Chemistry Practical-II	--	--	4	--	--	--	--	--
23PCY416	Core-XVI- Organic Chemistry Practical–II	--	--	4	--	--	--	--	--	
23PCY417	Core-XVII- Physical Chemistry Practical–II	--	--	4	--	--	--	--	--	
Total			15	3	12	12	100	300	400	17

SEMESTER - IV

Semester	Subject Code	Title of the Paper	Hrs / Week			Exam Hrs.	Maximum Marks		Total Marks	Credits
			L	T	P		Internal	External		
IV	23PCY413	Core-XIII- Inorganic Chemistry –III- Bioinorganic Chemistry	4	1	--	3	25	75	100	5
	23PCY414	Core-XIV- Instrumental Methods of Chemical Analysis	4	1	--	3	25	75	100	4
	23PCY4E7	*Major Elective –III- Phytochemical Techniques and Health Chemistry	3	--	--	3	25	75	100	3
	23PCY4E8	*Computational Chemistry								
	23PCY4E9	*Green Chemistry								
	23PCY415	Core-XV- Inorganic Chemistry Practical-II	--	--	5	6	40	60	100	4
	23PCY416	Core-XVI- Organic Chemistry Practical–II	--	--	5	6	40	60	100	4
	23PCY 417	Core-XVII- Physical Chemistry Practical–II	--	--	5	6	40	60	100	4
	23PCY 4P1	Core Project Work & Viva Voce	2	--	--	6	25	75	100	5
Total			13	2	15	33	220	480	700	29
Grand Total (Total Marks + Total Credits)									2200	90
* Students can choose any one of the papers as electives										

LIST OF ELECTIVES

SEMESTER	SUBJECT CODE & TITLE
II	MAJOR ELECTIVE-I 23PCY2E1 – Green Chemistry, Research Methodology & Cyber Security 23PCY2E2 - Electrochemistry 23PCY2E3 - Advanced Polymeric Materials
III	MAJOR ELECTIVE-II 23PCY3E4 - Organometallic Chemistry 23PCY3E5 - Material Science 23PCY3E6 - Dye Chemistry
IV	MAJOR ELECTIVE-III 23PCY4E7 - Phytochemical Techniques and Health Chemistry 23PCY4E8 – Computational Chemistry 23PCY4E9 - Green Chemistry

CO-SCHOLASTIC COURSES

ADVANCED LEARNERS (Optional)

S. No	Semester	Course	Hours/ Week	Total Hours	Internal Marks	External Marks	Total Marks	Credits
1	III	23PCY3AL - Applied Chemistry (Optional)	-	-	-	-		2*

ONLINE COURSES

2	I/II	Swayam, MOOC Course etc.	-	-	-	-	-	2*
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VALUE ADDED COURSES

3	II & IV	Value Added Course-I 23PCY2VA- Entrepreneurial Ventures in Chemistry	2	30	25	25	50	2*
4	II & IV	Value Added Course-II 23PCY4VA-Biofuels and Energy Storage Devices	2	30	25	25	50	2*

CERTIFICATE COURSES (Optional)

5	III	Certificate Course-I 23PCYCF01-Fundamentals of Pharmaceutical Chemistry	2	30	50	50	100	2*
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The scholastic courses are only counted for the final grading and ranking. However, for the award of the degree, the completion of Co-scholastic one online course is mandatory. All other Co-scholastic Courses are optional only.

Question Paper Pattern (Based on Bloom's Taxonomy)

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

1. Theory Examinations: 75 Marks

(i) Test- I & II, ESE:

Knowledge Level	Section	Marks	Description	Total
K1 & K2 (Q 1 -10)	A (Q1 – 5 MCQ) (Q6 – 10 Define / Short Answer / MCQ)	10 x 1 = 10	MCQ / Define	75
K3 (Q 11-15)	B (Either or pattern)	5 x 5 = 25	Short Answers	
K4 & K5 (Q 16 – 20)	C (Either or pattern)	5x 8 = 40	Descriptive/ Detailed	

2. Theory Examinations: 100 Marks (NME)

Knowledge Level	Section	Marks	Description	Total
K3 (Q 1 -8)	A (Q 1 – 8) Answer any Five	5 x 5 = 25	Short Answers	100
K4 & K5 (Q 9-16)	B (Q 9 – 16) Answer any Five	5 x 15 = 75	Descriptive/ Detailed	

3. Practical Examinations: 100 Marks

Knowledge Level	Criterion	External/Internal Marks	Total
K3	Record work & Practical	60/40	100
K4			
K5			

Components of Continuous Assessment THEORY

Maximum Marks: 100; CIA Mark: 25; CEE Mark: 75

Components		Calculation	CIA Total
Test 1	75	$(75+75+15+10)/7$	25
Test 2 / Model	75		
Assignment / Digital Assignment	15		
Others [#]	10		
# Others may include class participation, case study presentation, field work, field survey, group discussion, term paper, workshop/conference participation, presentation of papers in conferences, quiz, report/content writing, seminars.			

PRACTICAL

Maximum Marks: 100; CIA Mark: 40; CEE Mark: 60

Components		Calculation	CIA Total
Test / Model	30	$30+5+5$	40
Observation Note	5		
Record	5		

PROJECT

Maximum Marks: 100; CIA Mark: 25; CEE Mark: 75

Components		Calculation	CIA Total
Review I (Introduction)	5	$05+05+05+10$	25
Review II (Literature Survey)	5		
Review III (Results and Discussion)	5		
Report Submission	10		

PROJECT EXTERNAL

External

Total – 75 marks

Project	Total – 50 marks
Relevance of the topic to the academic / society	10 Marks
Objectives	10 Marks
Experimental design	15 Marks
Results and discussion	15 Marks
Viva Voce	Total – 25 marks
Presentation	15 Marks
Discussion	10 Marks

STUDENT SEMINAR EVALUATION RUBRIC

Grading Scale:

A	B	C	D
8-10	5-7	3-4	0-2

CRITERIA	A - Excellent	B – Good	C - Average	D - Inadequate
Organization of presentation	Information presented as interesting story in logical, easy to follow sequence	Information presented in logical sequence; easy to follow	Most of information presented in sequence	Hard to follow; sequence of information jumpy
Knowledge of subject & References	Demonstrated full knowledge; answered all questions with elaboration & Material sufficient for clear understanding AND exceptionally presented	At ease; answered all questions but failed to elaborate & Material sufficient for clear understanding AND effectively presented	At ease with information; answered most questions & Material sufficient for clear understanding but not clearly presented	Does not have grasp of information; answered only rudimentary Questions & Material not clearly related to topic OR background dominated seminar
Presentation Skills using ICT Tools	Uses graphics that explain and reinforce text and presentation	Uses graphics that explain text and presentation	Uses graphics that relate to text and presentation	Uses graphics that rarely support text and presentation
Eye Contact	Refers to slides to make points; engaged with audience	Refers to slides to make points; eye contact majority of time	Refers to slides to make points; occasional eye contact	Reads most slides; no or just occasional eye contact
Elocution – (Ability to speak English language)	Correct, precise pronunciation of all terms Voice is clear and steady; audience can hear well at all times	Incorrectly pronounces few terms Voice is clear with few fluctuations; audience can hear well most of the time	Incorrectly pronounces some terms Voice fluctuates from low to clear; difficult to hear at times	Mumbles and/or Incorrectly pronounces some terms Voice is low; difficult to hear

WRITTEN ASSIGNMENT GRADING RUBRIC

Grading Scale:

A	B	C	D	F
13-15	10-12	7-9	4-6	0-3

CRITERION	A – Excellent	B – Good	C - Average	D - Below Average	F - Inadequate
Content & Focus	Hits on almost all content exceptionally clear	Hits on most key points and writing is interesting	Hits in basic content and writing is understandable	Hits on a portion of content and/or digressions and errors	Completely off track or did not submit
Sentence Structure & Style	<ul style="list-style-type: none"> * Word choice is rich and varies * Writing style is consistently strong * Students own formal language 	<ul style="list-style-type: none"> * Word choice is clear and reasonably precise * Writing language is appropriate to topic * Words convey intended message 	<ul style="list-style-type: none"> * Word choice is basic * Most writing language is appropriate to topic * Informal language 	<ul style="list-style-type: none"> * Word choice is vague * Writing language is not appropriate to topic * Message is unclear 	* Not adequate
Sources	Sources are cited and are used critically	Sources are cited and some are used critically	Some sources are missing	Sources are not cited	Sources are not at all cited
Neatness	Typed; Clean; Neatly bound in a report cover; illustrations provided	Legible writing, well-formed characters; Clean and neatly bound in a report cover	Legible writing, some ill-formed letters, print too small or too large; papers stapled together	Illegible writing; loose pages	Same as below standard
Timeliness	Report on time	Report one class period late	Report two class periods late	Report more than one week late	Report more than 10 days late

Programme Code:	M.Sc		Programme Title:		Master of Chemistry		
Course Code:	23PCY101		Inorganic Chemistry –I- Solid State and Nuclear Chemistry		Batch:	2023 - 2025	
					Semester:	I	
Lecture Hrs./Week	4	Tutorial	1	Total Hrs/ Sem	75	Credits:	4
Course Objectives							
* To gain knowledge in solid state Chemistry.							
* To emphasize the significance of crystallographic properties and description of crystal structures.							
* To acquire awareness about the defects in crystal structure and its effect in electrical properties							
* Ability to know the principle of nuclear model, application of radioactive counting techniques and radioactive isotopes.							

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcomes (CO)	Knowledge Level
CO1	Student will know through knowledge about the structural properties of chains, cages and metal clusters.	K2
CO2	Student will understand the various types of close packing arrangements of different solid structures.	K2
CO3	Distinguish the types of solids, their defects and electrical properties of solids.	K4
CO4	Evaluate n/p ratio, binding energy and Q-value of nuclear reactions.	K4
CO5	Apply the nuclear chemistry principles and its application in various fields.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	<p>Chains – Catenation, heterocatenation, isopolyanions, heteropolyanions (explanation with examples).</p> <p>Cages –Structure and bonding of phosphorus compounds, boranes, carboranes and metallocene carboranes.</p> <p>Metal clusters - Structure and bonding of dinuclear, trinuclear, tetra nuclear and hexa nuclear clusters - polyatomic zintl anions and cations - chevrel phases - fullerenes and their applications.</p> <p>Rings - Structure and bonding of borazines - phosphonitrilic compounds- sulphur - nitrogen ring compounds (S₄N₄).</p>	15

Unit II	Solid State Chemistry –I Types of solids - close packing of atoms and ions - bcc , fcc and hcp voids - radius ratio - derivation - its influence on structures - structures of rock salt - cesium chloride - wurtzite – zinc blende - rutile - fluorite - antiferite - diamond and graphite - spinel - normal and inverse spinels and perovskite - lattice energy of ionic crystals - Madelung constant - Born-Haber cycle and its applications.	15
Unit III	Solid State Chemistry –II Metallic state - free electron theory and band theory - non - stoichiometry - point defects in solids - Schottky and Frenkel defects - linear defects - dislocations - effects due to dislocations - electrical properties of solids - insulators - intrinsic semiconductors - impurity semiconductors (n and p- type) and superconductors - elementary study of liquid crystals.	15
Unit IV	Nuclear Chemistry –I Nucleus: nuclear structure - stability of nuclei - packing fraction - even - odd nature of nucleons - n/p ratio - nuclear potential - binding energy and exchange forces - shell model and liquid drop model. Radioactive isotopes - Decay of radio nuclei- rate of decay - determination of half-life period - secular equilibrium and decay series. Particle acceleration and counting techniques: linear accelerator - cyclotron and synchrotron - betatron - G. M. counter - proportional and scintillation counters.	15
Unit V	Nuclear Chemistry – II Modes of decay: alpha, beta, gamma and orbital electron capture - nuclear isomerism - internal conversions - Q value - nuclear cross section - threshold energy and excitation functions. Type of nuclear reactions with natural and accelerated particles - transmutation - stripping and pick-up - spallation - fragmentation, etc. - fission - characteristics of fission reaction - product distribution and theories of fission - fissile and fertile isotopes - U235, U238, Th232 and Pu239 - atom bomb - nuclear fusion - stellar energy - synthesis of new elements - principles underlying the usage of radioisotopes in analysis - agriculture - industry and medicine - mechanism of chemical reactions - uses of radioisotopes in analytical chemistry - isotopic dilution analysis - neutron activation analysis and dating methods. Hot-atom chemistry-Safety measures, Disposal of Nuclear Wastes.	15
Total contact Hrs		75

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

23PCY101

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1.	Puri. B. R, Sharma. L. R and Madan S. Pathania	Principles of Inorganic Chemistry	Vishal Publishing Co, 41 st Edition	2006
2.	Gurdeep Raj	Advanced Inorganic Chemistry, Vol-I	Geol Publishing House, 12 th Edition	2014
3.	Madan. R.D	Advanced Inorganic Chemistry, Vol-I	S. Chand & company, New Delhi, 3 rd Edition	2012
4.	Arnikar, H.J	Essentials of Nuclear Chemistry	New Age International, 4 th Edition	2000

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1.	James E. Huheey Ellen A. Keiter	Inorganic chemistry	Pearson India Limited, 4 th Edition	2006
2.	Albert Cotton. F and Geoffrey Wilkinson	Advanced Inorganic Chemistry	Wiley & Sons, 6 th Edition	2014
3.	Anthony R. West	Solid State Chemistry and its Application	Wiley India	2011
4.	Lee J. D.	Concise Inorganic Chemistry	Wiley India	2010 Reprint
5.	Keith F. Purcell and John, C. Kotz	Inorganic chemistry	Holt- Saunders International Edition	1980
6.	Bodie E. Douglas, Darl H. McDaniel John J. Alexander	Concepts and Models of Inorganic Chemistry	Wiley & Sons, 3 rd Edition	1970
7.	Gary L. Miessler and Tarr D. A.	Inorganic Chemistry	Pearson Publication, 3 rd Edition	2004

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

Lecture 4 - Crystal Structure - 5 (Miller-Bravais Indices, Linear and Planar Density) - Bing video
Calculation of X-ray Density for Cubic crystal system using Lattice parameter and Bragg's Law - YouTube
XII- 1 # 8, Formula of a Compound and Number of Voids - Bing video
https://nptel.ac.in/courses/104/103/104103069/
https://nptel.ac.in/courses/104/104/104104101/
https://nptel.ac.in/courses/112/103/112103243/

Mapping

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	M	H	H	H	M	L	M	M	H	M
CO2	M	H	M	H	M	-	L	M	H	H
CO3	H	M	H	M	H	M	H	H	H	M
CO4	H	M	H	H	M	-	M	H	M	M
CO5	H	H	M	M	M	-	M	M	H	-

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.V. Prabhu Dr. M. Velayutham Pillai	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY102			Organic Chemistry–I- Organic Reaction Mechanisms	Batch:	2023 – 2025	
					Semester:	I	
Lecture Hrs./Week	4	Tutorial	1	Total Hrs/Sem	75	Credits:	5
Course Objectives							
* To understand the aromaticity of organic molecules and reaction mechanisms.							
* To provide knowledge about electrophilic, nucleophilic substitution and elimination reactions.							
* To learn about the basic concept about organic reaction intermediates.							

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcomes (CO)	Knowledge Level
CO1	Understand the aromaticity of compounds and develop skills for identifying the kinetics of reactions.	K2
CO2	Explain the mechanism of different types of substitution, addition and elimination reactions for synthesizing organic compounds.	K3
CO3	Apply the mechanisms in solving chemical reactions.	K3
CO4	Inspect the different types of reactions involved in chemical synthesis and various naming reactions.	K4 & K5
CO5	Evaluate the various types of reaction mechanisms.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	<p>Aromaticity: Aromatic character – Huckel’s Molecular orbital theory for aromaticity (HMO), concept of aromaticity and anti aromaticity – Criteria for aromaticity, Non-benzenoid aromatic compounds-Monocyclic and bicyclic non-benzenoid neutral compounds (Annulenes and azulenes). Antiaromatic and Homoaromatic compounds- Alternant and non-alternant hydrocarbons.</p> <p>Kinetic and Non-kinetic Methods of Determination of Reaction Mechanisms: Guidelines for proposing reasonable mechanism – Energetics and energy profile diagrams - Reaction Mechanism: Non kinetic methods- Product analysis, intermediate criteria (isolation, trapping and detection) - Isotopic labeling and cross over experiments, Stereochemical evidence.</p>	15

	Kinetic methods- Primary and secondary kinetic isotopic effects. Mechanistic implications of rate law- Isotope effects. Kinetic and thermodynamic control of reactions - Hammonds postulates, linear free energy relationship - Hammett and Taft equations.	
Unit II	<p>Electrophilic substitution reactions:</p> <p>Aromatic Electrophilic Substitution Reactions: Arenium ion mechanism - orientation and reactivity in mono substituted benzene rings – steric effects and ortho/para ratios - <i>ipso</i> attack, orientation in di-substituted benzene rings. Typical reactions - Friedel Crafts alkylation & acylation, Vilsmeier-Haack reaction, Gattermann-Koch reaction, Hofmann-Martius, Jacobsons reaction, Houben-Hoesch reaction, Diazonium coupling, Stork enamine reactions and Bischler-Napieralski reaction.</p> <p>Aliphatic Electrophilic Substitution Reactions – Mechanisms: SE1, SE2, and SEi mechanism. Factors affecting reactivity in SE reactions - Typical reactions –hydrogen exchange and migration of double bond, halogenation of carbonyl compounds.</p>	15
Unit III	<p>Nucleophilic Substitution Reactions:</p> <p>Aliphatic Nucleophilic Substitution: S_N1, S_N2 and S_Ni reactions and mechanisms - factors affecting nucleophilic substitution reaction - ambident nucleophiles and ambident substrates. Substitution at vinyl carbon and allylic carbon - hydrolysis of esters (A_{Ac}1, A_{Ac}2 and B_{Ac}2 only). Neighbouring group participation.</p> <p>Aromatic Nucleophilic Substitution: S_NAr - benzyne mechanism - Zeigler alkylation - Chichibabin reaction - Rosendmund Reactions - von Braun reaction - Cine substitution.</p>	15
Unit IV	<p>Addition Reactions: Electrophilic, nucleophilic and free radical addition to double and triple bonds- hydration, hydroxylation, Michael addition, hydroboration and epoxidation. Addition reactions to carbonyl compounds – Mannich reaction, Meerwein-Ponndorf-Verley reduction, Grignard, Claisen, Dieckmann, Stobbe, Knoevenagel, Darzen, Wittig, Thorpe and Benzoin reactions.</p>	15
Unit V	<p>Elimination Reactions: E1, E2, E1cB - stereochemistry of elimination, Hofmann and Saytzeff's rules - elimination versus substitution - pyrolytic <i>cis</i> elimination - Chugaev reaction – dehydration of alcohols, dehydro halogenation of vicinal dihalides, Hofmann degradation, Cope elimination.</p> <p>Reactive Intermediates: Carbenes and nitrenes-structure, generation and reactions.</p>	15
	Total Contact Hrs	75

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Tasks.

Text Book**23PCY102**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Finar, I.L.	Organic Chemistry 1: The Fundamental Principles	Pearson Education Ltd, Volume I, 6 th Edition.	2014
2	Jerry March	Advanced Organic Chemistry	Wiley Publications Ltd, 4 th Edition.	2008
3	Mukherjee, S.M and Singh, S.P.	Reaction Mechanism in Organic Chemistry	New Age International Publishers, 10 th Edition.	2004
4	Ahluwalia, V.K. Rakesh K. Parashar	Organic Reaction Mechanisms	Narosa Publishing House, 4 th Edition.	2010
5	Jagadamba Singh and Yadav, L.D.S	Advanced Organic Chemistry	Pragati Prakashan Publishers, 20 th Edition.	2014

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1.	Agarwal, O.P.	Reactions and Reagents in Organic Chemistry	Goel publishing House, 49 th Edition.	2014
2.	Tewari, Vishnoi, K.S.	Text book of Organic Chemistry	Vikas Publishing House, 3 rd Edition.	2006
3.	Morrison, R.T, Boyd, R.N	Organic Chemistry	Pearson India Ltd, 7 th Edition.	2013
4.	Peter Sykes	Guide Book to Mechanism in Organic Chemistry	Pearson Education, 6 th Edition.	2014
5.	Ahluwalia, V.K.	Organic Chemistry: Fundamental Concepts	Narosa Publishing House	2013

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=T1ePwEQ4Fa0
https://www.youtube.com/watch?v=QkQUJhJYPA0
https://www.youtube.com/watch?v=hsBn-BxuN0M
https://www.youtube.com/watch?v=RtV_JxzZoss
https://www.youtube.com/watch?v=-D8tYR3LTsI
https://nptel.ac.in/courses/104/101/104101115/
https://nptel.ac.in/courses/104/103/104103110/
https://nptel.ac.in/courses/104/101/104101005/

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	-	H	H	H	-	H	H	M	M
CO2	H	H	M	H	H	H	H	H	H	H
CO3	M	H	H	H	M	H	H	M	H	H
CO4	H	H	M	H	H	M	H	H	M	H
CO5	H	-	H	H	H	H	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY103			Physical Chemistry –I – Group Theory and Chemical Kinetics	Batch:	2023 - 2025	
					Semester:	I	
Lecture Hrs./Week	4	Tutorial	1	Total Hrs/Sem	75	Credits:	5
Course Objective							
* To gain knowledge on basic and applications of group theory.							
* To learn about rate and order of the various reactions.							
* To understand the concepts of catalysis, adsorption and its mechanisms.							

Course Outcomes (CO)

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

#	Course Outcomes (CO)	Knowledge Level
CO1	Summarize the fundamentals of group theory and the fundamental concepts on kinetics and reaction rate.	K2
CO2	Develop knowledge on applications of group theory and various theories of chemical kinetics.	K3
CO3	Predict the IR and Raman active vibration modes for molecules and type of hybridization in nonlinear molecules based on group theory.	K3
CO4	Analyze the use of the kinetics and theories of surface chemistry.	K4
CO5	Examine hybridization scheme for orbital in simple molecules.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	<p>Group theory-I</p> <p>Symmetry elements and symmetry operations - identity element - centre of symmetry- reflection symmetry planes - proper and improper rotation axes of symmetry. Group definition, properties-order of group- types of groups- Abelian group, Non - abelian group, sub group, isomorphic group - similarity transformation and classes. Point group classification- identification of point groups of simple molecules - group multiplication table (C_{2v} and C_{3v} point group) – Definition of matrix, square, diagonal, null, unit, row, column, symmetric matrices - Matrix multiplication (Commutative and non-Commutative) determination of inverse of a matrix, block multiplication of matrices –</p>	15

	Addition Matrix representation of symmetry operations and subtraction of matrices – Matrix notations for symmetry operations of C_{2v} and C_{3v} point groups (use of vectors) construction of character tables for C_{2v} and C_{3v} point groups.	
Unit II	<p>Group theory-II</p> <p>Reducible and Irreducible representations – The Great Orthogonality Theorem and its consequences (statement only, proof not needed)- Determination of the characters for irreducible representation of C_{2v} and C_{3v} point groups – using the orthogonality theorem-direct product representation - wave function as bases for irreducible representation - spectral transition probabilities - projection operators - Huckel approximation -concept of hybridization - secular determinant - symmetry factoring of secular equations.</p> <p>Symmetry selection rule for IR, Raman spectra, rotational spectroscopy and Mutual Exclusion Principle - infrared spectral activity of vibrational modes in NH_3 and H_2O molecules - classification of vibrational modes - application of group theory to bonding: hybridization scheme for orbital in simple molecules - AB_4 (T_d, CH_4), AB_5 (D_{3h} $Fe(CO)_5$) and AB_6 (O_h [$Co(NH_3)_6$]$^{3+}$).</p>	15
Unit III	<p>Chemical Kinetics-I</p> <p>Simultaneous reactions - opposing, parallel and consecutive reactions - theories of reaction rates - Arrhenius theory - collision theory - classical collision theory-modified collision theory - causes of weaknesses of the collision theory - absolute reaction rate or transition state theory - Statistical mechanical derivation of the rate equation - thermodynamical formulation of reaction rate, Lindeman's theory of unimolecular reactions.</p> <p>Kinetics in liquid solution - Salt effect - primary salt effect and secondary salt effect - significance of salt effect - effect of pressure on rates of reactions in solutions.</p>	15
Unit IV	<p>Chemical Kinetics-II</p> <p>Chain Reactions - general characteristics - Experimental methods of fast reactions - shock tubes and pulse radiolysis techniques - kinetics of decomposition of N_2O_5, H_2-Cl_2. Photochemical reactions and H_2-Br_2 thermal reaction - non-stationary chainreaction - H_2-O_2 reaction and explosion limits. Effect of temperature, relative permittivity, ionic strength and solvent (Grunwald-Winstein equation) on reaction rates.</p>	15
Unit V	<p>Surface Chemistry</p> <p>Basic concepts of Micelles and Reverse Micelles - Physisorption and Chemisorption – adsorption isotherm – derivation of Langmuir and Freundlich, derivation of B.E.T equation of multilayer adsorption – application of BET equation to surface area determination, derivation of Gibbs adsorption isotherm. Heterogeneous catalysis and their kinetics – chemical reactions on solid surfaces - Mechanism & Kinetics of unimolecular and bimolecular surface reactions – Langmuir –Hinshelwood, Langmuir –Ridel mechanism, ARRT of surface reactions.</p>	15
	Total Contact Hrs	75

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

23PCY103**Text Book**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1.	Cotton, F.A	Chemical applications of group theory	A Wiley Interscience Publication, 3 rd Edition.	2008
2.	Laidler. K. J	Chemical Kinetics	Pearson Education India, 3 rd Edition.	2003
3.	Gopinathan, M. S. and Ramakrishnan, V	Group Theory in Chemistry	Vishal Publishers, 2 nd Edition	2013
4.	Gurudeep Raj	Chemical Kinetics	Krishna Educational Publishers.	2014
5.	Bajpai, D.N.	Advanced Physical Chemistry	S. Chand Publishing Limited, revised edition	2001

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Adamson A.M.	Physical Chemistry of Surfaces	John Willey, UK, 5 th Edition	2002
2	Raman, K.V.	Group Theory and its Applications to Chemistry	Tata McGraw Hill Publishing company Ltd, 3 rd Reprint.	2000
3	Bhattacharya, P.K.	Group Theory and its Chemical Applications, Second Edition.	Himalaya Publishing House, 2 nd edition	2020

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=-we7yTR7exI
https://www.youtube.com/watch?v=Av9f25sqLG0
https://www.youtube.com/watch?v=5m8ubFNFJUU
https://nptel.ac.in/courses/104/104/104104080/
https://onlinecourses.nptel.ac.in/noc21_cy16/preview
https://onlinecourses.nptel.ac.in/noc20_cy13/preview
https://onlinecourses.nptel.ac.in/noc21_cy17/preview
https://nptel.ac.in/noc/courses/noc21/SEM1/noc21-cy17/

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	M	-	-	-	-	H	H	-	-
CO2	H	H	M	M	M	-	-	-	M	L
CO3	H	H	H	H	H	M	L	M	M	L
CO4	H	H	M	M	H	L	M	M	H	M
CO5	H	H	M	M	M	L	M	L	M	-

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Mrs. K.Vimaladevi Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

Programme code:	M.Sc			Programme Title :	Master of Chemistry		
Course Code:	23PCY204			Inorganic Chemistry - II Coordination Chemistry	Batch :	2023-2025	
					Semester	II	
Lecture Hrs./Week	4	Tutorial	1	Total Hrs/ Sem	75	Credits:	4
Course Objectives							
* Acquire knowledge about theories of complexes, basics of electronic spectroscopy of transition metal complexes, mode of coordination with various geometries.							
* To apply the knowledge of coordination chemistry to research and analyze the term symbols.							
* Realize the importance of the important inorganic polymers and their applications.							

Course Outcomes (CO)

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

#	Course Outcomes (CO)	Knowledge Level
CO1	Understand the various concepts of coordination chemistry and realize the importance of electronic spectroscopy and magnetic properties of coordination compounds.	K2
CO2	Gaining the knowledge on various types of inorganic reaction mechanism in different geometries.	K2
CO3	Acquiring knowledge on various types of electron transfer mechanism of metalcomplexes and their importance.	K3
CO4	Inferring various symmetries/geometries of coordination complexes and their isomerism and important applications of some inorganic polymers.	K4
CO5	Prepare some important coordination complexes as catalyst for reactions.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate		

Units	Content	Hrs
Unit I	Coordination Chemistry - I Crystal field theory - splitting of d orbitals in octahedral, tetrahedral and square planar symmetries - measurement of $10Dq$ - factors affecting $10Dq$ - spectrochemical series - crystal field stabilisation energy for high spin and low spin complexes-evidences for crystal field splitting - site selections in spinels and antispinel - Jahn Teller distortions and its consequences. Molecular Orbital Theory and energy level diagrams concept of Weak and strong fields, Sigma and pi bonding in octahedral, square planar and tetrahedral complexes.	15

Unit II	Coordination Chemistry - II Term states for d ions - characteristics of d-d transitions - charge transfer spectra - selection rules for electronic spectra - Orgel correlation diagrams - Sugano-Tanabe energy level diagrams - nephelauxetic series - Racha parameter and calculation of inter-electronic repulsion parameter	15
Unit III	Coordination Chemistry - III Stability of complexes: Factors affecting stability of complexes, Thermodynamic aspects of complex formation, Stepwise and overall formation constants, Stability correlations, statistical factors and chelate effect, Determination of stability constant and composition of the complexes: Formation curves and Bjerrum's half method, Potentiometric method, Spectrophotometric method, Ion exchange method, Polarographic method and Continuous variation method (Job's method) Magnetic property of complexes: Spin-orbit coupling, effect of spin-orbit coupling on magnetic moments, quenching of orbital magnetic moments.	15
Unit IV	Coordination Chemistry - IV Inert and Labile complexes; Associative, Dissociative and SN ₁ CB mechanistic pathways for substitution reactions; acid and base hydrolysis of octahedral complexes; Classification of metal ions based on the rate of water replacement reaction and their correlation to Crystal Field Activation Energy; Substitution reactions in square planar complexes: Trans effect, theories of trans effect and applications of trans effect in synthesis of square planar compounds; Kurnakov test.	15
Unit V	Coordination Chemistry - V Electron Transfer reactions in octahedral complexes: Outer sphere electron transfer reactions and Marcus-Hush theory; inner sphere electron transfer reactions; nature of the bridging ligand in inner sphere electron transfer reactions. Photo-redox, photo-substitution and photo-isomerisation reactions in complexes and their applications.	15
Total Contact Hrs		75

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book**23PCY204**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	J. E. Huheey, E. A. Keiter and R. L. Keiter	Inorganic Chemistry - Principles of Structure And Reactivity	Addison Wesley Publishing Co, New York, Fourth Edition	1993
2	Malik, U.K., Tuli, G.D., and Madan, R.D	Selected Topics in Inorganic Chemistry	S. Chand Publication	2010
3	Cotton. F. A And Wilkinson.G	Advanced Inorganic Chemistry	Wiley Interscience, 6 th Edition	999

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Lee. J.D	Concise Inorganic Chemistry	Wiley India, 4 th Edition	2010
2	Gurdeep Raj	Advanced Inorganic Chemistry. 12 th Edition	Geol Publishing House.	2014
3	R. Gopalan, V. Ramalingam	Concise Coordination Chemistry, 3 rd Edition	VikasPublishing house Pvt. Ltd.	2001

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=z9CmSAV1wcY
https://www.youtube.com/watch?v=JjidYZYb_ck
https://www.youtube.com/watch?v=oCEAN6PR3Tg
https://www.youtube.com/watch?v=1V-Bu04LKM4
https://www.youtube.com/watch?v=FrdfyICk49o
https://www.youtube.com/watch?v=4pJqBEOy_OM
https://www.youtube.com/watch?v=A6NeTLwKvbk
https://www.youtube.com/watch?v=SzfQ-DBHAec
https://www.youtube.com/watch?v=A32k0JAFVC4
https://nptel.ac.in/courses/104/101/104101121/
https://nptel.ac.in/courses/104/101/104101090/
https://nptel.ac.in/courses/104/106/104106064/

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PS01	PS02
CO1	H	-	H	H	H	-	H	H	M	M
CO2	H	H	M	H	H	H	H	H	H	H
CO3	M	H	H	H	M	H	H	M	H	H
CO4	H	H	M	H	H	M	H	H	M	H
CO5	H	-	H	H	H	H	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezian Signature:

Programme Code:	M.Sc		Programme Title:	Master of Chemistry			
Course Code:	23PCY205		Organic Chemistry –II – Organic Reactions and Stereochemistry	Batch:	2023 - 2025		
				Semester:	II		
Lecture Hrs./Week	4	Tutorial	1	Total Hrs/Sem	75	Credits:	5

Course Objective

- * To give a thorough introduction to the study of Oxidation, Reduction and alkaloids.
- * To know the concept of Organic Photochemistry.
- * To enable a comprehensive knowledge on conformational Stereochemistry and Pericyclic reactions.

Course Outcomes

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

#	CO Statement	Knowledge Level
CO1	Comprehend the basic of oxidation and reduction reactions and photochemistry.	K2
CO2	Outline the importance of pericyclic reactions, to figure out isomerism and conformational analysis of stereochemistry and to understand the structural elucidation of alkaloids.	K2
CO3	Implement the basic values and analyze the functions of the natural product such as alkaloids.	K3
CO4	Analyze the reagents in chemical reactions, to execute photochemical and pericyclic reactions.	K4
CO5	Evaluate the stereo chemical isomerization, configuration and conformations of molecules.	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate

Units	Content	Hrs
Unit I	<p>Oxidation, Reduction</p> <p>Oxidation - Chromyl chloride, ozone, DDQ, dioxiranes, lead tetraacetate, selenium dioxide, DMSO with either Ac₂O or oxalyl chloride, Dess-Martin reagent. Synthesis involving phase transfer catalysis (PTC), use of crown ethers, Merrifield resin, Baker's yeast, Oppanauer oxidation, Jones oxidation.</p> <p>Reduction - Catalytic hydrogenation - Wilkinson catalyst, dehydrogenation, reduction with LiAlH₄, aluminium tertiary butoxide, NaBH₄, NaCNBH₃, tributyl tin hydride, alkali metals for reduction, reductions involving hydrazines, Clemmensen and Wolffkishner reduction. DIBAL and hydroboration.</p>	15

Unit II	<p>Organic photochemistry Laws of photochemistry - Beer-Lambert, Grothus-Draper law, Stark-Einstein law – Electronic excitation - energy transfer - quantum efficiency, Jablonski diagram - chemical actinometry - photosensitization - quenching. Photochemistry of carbonyl compounds - photoreduction - Norrish type I and type II reactions, Photoadditions - – Barton reaction - Paterno-Buchi reaction. Photochemistry of olefins - cis and trans isomerization - dimerization reactions - cycloaddition reactions - 1, 2 cycloadditions – photooxidation - Photo substitution reactions of benzene derivatives. Chemiluminescence and bioluminescence.</p>	15
Unit III	<p>Pericyclic reactions Conservation of molecular orbital symmetry - symmetry properties of molecular orbitals. Electrocyclic reactions - 1,3-diene and 1,3,5-triene systems, correlation diagram and FMO method, Woodward-Hoffman selection rule for electrocyclic reactions - con rotatory and dis rotatory motions $4n\pi$ and $(4n+ 2)\pi$ systems. Cycloadditions reactions - correlation diagram and FMO approach, $p2s + p2s$, $p2s + p4s$ (Diels-Alder reaction) systems. Woodward-Hoffman selection rule for cycloaddition reactions. Sigmatropic rearrangements - analysis of sigmatropic rearrangements by FMO method - 1,3 & 1,5 sigmatropic rearrangements, other sigmatropic shifts - Cope and Claisen rearrangements, Di pi methane rearrangement, ene reaction.</p>	15
Unit IV	<p>Stereochemistry Optical isomerism – concept of chirality- concept of prochirality – axial chirality – (optical isomerism of biphenyls, allenes and spiranes) – planar chirality (optical isomerism of ansa compounds and cyclophanes) – helicity (optical isomerism of over – crowded molecules) - R, S – nomenclature of compounds having one and more than one chiral centres - enantiotopic and diastereotopic ligands & faces - stereo selective and stereo specific reactions – stereochemistry of sulfur and nitrogen compounds. Geometrical Isomerism E,Z –notation – Determination of configuration of geometrical isomers. Stereoisomerism of cyclic compounds (up to six membered ring) – aldoximes & ketoximes. Conformational Analysis Configuration and conformation – Conformation of acyclic compounds –ethane, butane, cyclohexane, decalins - stability and reactivity in relation to conformation – perhydro phenanthrenes.</p>	15
Unit V	<p>Alkaloids General methods for determination of structure of alkaloids - Structural elucidation and synthesis of morphine, reserpine, quinine, atropine, lysergic acid and nicotine.</p>	15
Total Contact Hrs		75

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

23PCY205**Text Book**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Mukerjee S.M. & Singh, S.P.	Reaction Mechanism in Organic Chemistry	McMillan India Ltd, 3 rd Edition	2013
2	Ahluwalia, V.K. Rakesh K. Parashar	Organic Reaction Mechanisms	Narosa Publishing House, 4 th Edition.	2010
3	Kalsi. P.S	Stereochemistry, Conformation and Mechanism	John Wiley Sons, 3 rd edition.	1995
4	Nasipuri, M	Stereochemistry of Organic Compounds	New Age International, New Delhi, 3 rd Edition.	2007
5	Agarwal O. P	Natural Product Chemistry	Goel Publishing house, 20 th Edition	2001
6	Jagadambal Singh	Advanced Organic Chemistry	Pragati Prakashan Publishers, 20 th Edition.	2014
7	Viswanathan, B. & Aulice Scibioh, M	Photoelectrochemistry – Principles and Practices	Narosa Publishing House, New Delhi	2014
8	Finar. I.L	Organic Chemistry, Volume I & II, The Fundamental Principles	Pearson Education Ltd, 6 th Edition.	2014

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Depuy, C.H. & Chapman. O.S	Molecular Reactions and Photochemistry	Prentice Hall	1972
2	Eliel. E.L, Wilen. S.H	Stereochemistry of Organic Compounds	Wiley International	1994
3	Potapov, V.M. Beknazarov. A	Stereochemistry	Mir Publications, Russia	1980
4	Jerry March	Advanced Organic Chemistry	A Wiley-Interscience, 4 th Edition.	2007
5	Eliel, E.L	Stereochemistry of Carbon Compounds	McGraw Hill, New Delhi, 1 st Edition.	2013

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=uwia3_Her8s
https://www.youtube.com/watch?v=qB9V2uMaxA8
https://www.youtube.com/watch?v=Pp0LeL0SkRg
https://www.youtube.com/watch?v=J_b1Y4QhhZc
https://www.youtube.com/watch?v=BBljnB-6420
https://www.youtube.com/watch?v=JROZc-9DayM
https://www.youtube.com/watch?v=wNyijTBpOrI

Mapping

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	M	M	H	H	M	M	M	M	M	M
CO2	H	H	H	H	H	M	M	H	H	H
CO3	H	H	H	H	H	M	M	H	H	M
CO4	M	H	H	H	H	H	H	H	M	H
CO5	H	H	H	M	H	M	M	H	M	M

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.V.Prabhu	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme Code:	M.Sc		Programme Title:	Master of Chemistry			
Course Code:	23PCY206		Physical Chemistry –II - Quantum Chemistry and Nano Chemistry	Batch:	2023 – 2025		
				Semester:	II		
Lecture Hrs./Week	4	Tutorial	1	Total Hrs/Sem	75	Credits:	4
Course Objective							
* To motivate the students to comprehend knowledge in quantum mechanics.							
* To apply the quantum mechanical concept to simple molecules and experiment approximation methods.							
* To appraise the practical applications of nano material synthesis techniques.							

Course Outcomes (CO)

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

#	CO Statement	Knowledge Level
CO1	Understand the failure of classical mechanics and formulation of quantum mechanics.	K2
CO2	Solve the Schrödinger wave equation for simple systems	K4
CO3	Comprehend the approximate methods in quantum mechanics and apply it to simple molecules	K5
CO4	To understand and analyze nano material synthetic strategy for various applications.	K3
CO5	Realize the practical applications of designing and synthesizing nano materials.	K3
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	Quantum Chemistry-I Success of quantum theory and the failure of classical mechanics - black body radiation, photo electric effect and Compton effect. The need for quantum mechanics- time dependent and time independent Schrodinger equation - operator concept as applied to quantum mechanics (basic ideas) - Eigen functions and Eigen values - postulates of quantum mechanics - application of Schrodinger equation to the particle in a box (1-D& 3-D Boxes) - particle in a ring & particle in spherical orientation. Harmonic oscillator and rigid rotator.	15

Unit II	<p>Quantum Chemistry-II</p> <p>Central force problem - H-atom - method of separation of variables - final solution - the energy and wave function for the problem.</p> <p>Approximation Methods: Approximate methods in quantum mechanics and need for approximation methods. Approximation methods applicable to multi electron systems - perturbation method applicable to H atom in ground state - He atom in the ground state. Variation methods applicable to H atom in ground state - He atom in the ground state. Shapes of the wave functions and Quantum numbers.</p>	15
Unit III	<p>Quantum Chemistry-III</p> <p>Construction of anti-symmetric wave functions- Slater determinant – LCAO-MO treatment of diatomic molecules- HMO treatment of simple and conjugated π-electron systems - ethylene, allyl, butadiene and benzene systems - charge distributions and bond orders from the coefficients of HMO. Delocalization energy-construction and use of hybrid orbitals. Determination of bond order</p>	15
Unit IV	<p>Nano Chemistry - I</p> <p>Introduction- definition – types- nanoparticles, nano cluster, nano rod, nanotube (CNT) and nano wire. Properties of nano materials, Bottom up and Top down approaches - methods of preparation of nano materials – Laser ablation, chemical vapour deposition, electrodeposition, precipitation, thermolysis. Application of nanomaterials. Catalysis, environmental and biomedical (drug delivery) applications. Nano materials- Environmental hazards.</p>	15
Unit V	<p>Nano Chemistry - II</p> <p>Experimental Techniques for the characterization of nanomaterials - UV-Visible spectroscopy (UV-DRS), FT-IR spectroscopy, Instrumentation, principle and applications of scanning electron microscopy (SEM), transmission electron microscopy (TEM), atomic force microscopy (AFM), scanning tunnelling microscopy (STM) , ESCA, BET and Photoluminescence study.</p>	15
Total Contact Hrs		75

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

TEXT BOOK

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Prasad, R. K	Quantum Chemistry	New age international(P) Limited Publishers, New Delhi, 4 th Edition	2010
2	Chandra, A.K.	Introductory Quantum Chemistry	Tata-McGraw Hill Publication Co. Ltd., NewDelhi, 4 th Edition	2012
3	Ira N. Levine.	Quantum Chemistry	PHI learning Pvt. Ltd, 7 th Edition	2014
4	Puri, B.R & Sharma. L. R.	Advanced Physical Chemistry	Milestone Publishers & Distributors, 2 nd Edition	2009
5	Atkins, P. and De Paula, J.	Physical Chemistry	Oxford University Press, New Delhi, 9 th Edition	2012
6	Cao.G	Nanostructures and Nanomaterials: Synthesis, Properties and Applications,	Imperial College Press	2004
7	Pradeep.T	Nano: The Essentials in Understanding Nanoscience and Nanotechnology	Tata McGraw Hill, New York, 1st Edition	2007
8	Köhler, M. Fritzsche, W	Nanotechnology: An Introduction to Nanostructuring Techniques	WILEY-VCH Verlag GmbH & Co.	2004
9	Bhagyaraj, S.M.Oluwafemi, O.S.Kalarikkal, N Thomas,S	Synthesis of Inorganic Nanomaterials: Advances and Key Technologies	Woodhead Publishers, Elsevier	2018

Reference Books**23PCY206**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Melvin W. Hanna.	Quantum Mechanics in Chemistry	Addison Wesley Longman, 2 nd Edition.	1969
2	Mc Quarrie. D.A	Quantum Chemistry	University Science Books, 2 nd Edition	2008
3	Thomas Engel	Quantum Chemistry & Spectroscopy	Pearson Education, 2 nd Edition	2006

4	Atkins. P.W and Friedman. R.S	Molecular Quantum Mechanics	Oxford University Press/4 th Edition	2005
5	Mc Quarrie, D.A. and Simon, J.D.	Physical Chemistry - A Molecular Approach	Viva Books Pvt. Ltd., New Delhi/ 1 st South Asian Edition	2015
6	Charles P. Poole, Jr. Frank J. Owens	Introduction to Nanoscience and Nanotechnology	Wiley India Pvt. Ltd, New Delhi/ Indian Edition	2021
7	Jain P C and Monika Jain	Engineering Chemistry	Dhanpat Rai Publishing Co, 16 th Edition	2015

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=LnmCsNQsR68
https://www.youtube.com/watch?v=uPvWlwOhCTo
https://www.youtube.com/watch?v=p82enyv3XA0
https://www.youtube.com/watch?v=gLesbQ8MPIU
https://www.youtube.com/watch?v=ASPuNKrCzDE
https://onlinecourses.nptel.ac.in/noc20_cy27/preview
https://onlinecourses.swayam2.ac.in/arp19_ap51/preview

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	H	M	-	M	M	H	H
CO2	H	H	H	L	H	-	L	M	L	H
CO3	H	H	H	H	M	M	H	H	H	M
CO4	H	H	H	M	H	-	H	M	-	-
CO5	H	H	H	M	H	M	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Mrs.M.Anusuya	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme Code:	M.Sc		Programme Title:	Master of Chemistry			
Course Code:	23PCY2E1		Major Elective –I: Green Chemistry, Research methodology and Cyber Security	Batch:	2023 - 2025		
				Semester:	II		
Lecture Hrs./Week	3	Tutorial	-	Total Hrs/Sem	45	Credits:	3
Course Objective							
* To stimulate students to have in-depth knowledge in green chemistry.							
* To acquire a clear idea about various synthesis of Nanomaterials and techniques.							
* To gain knowledge about the significance of research and scientific writing.							
* To apply the principles of Cyber Security and its attack.							

Course Outcomes

On the completion of the course the student will be able to

#	CO Statement	Knowledge Level
CO1	Understand the principles and tools of green chemistry.	K2, K3
CO2	Recollect the hazardous effect of chemicals and solvents used in laboratory.	K3
CO3	Ability to write a good research report.	K5
CO4	Get the idea about cyber security.	K3
CO5	Apply the ideas of legal and ethical issues for cybercrime and plagiarism.	K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate		

Units	Content	Hrs
Unit I	Green Chemistry Principles Definition, need of green chemistry, twelve basic principles of green chemistry- planning a green synthesis in a chemical laboratory- solvent-less reactions, selection of appropriate solvent, use of microwaves-fundamentals of closed-vessel heating and sonication. Atom efficient processes and atom efficiency, atom economy (with specific reaction).	9
Unit II	Greener Reactions Water as greener solvent- reactions in ionic-liquid, solvent free reaction- solid supported organic synthesis, phase transfer catalyst (PTC), use of microwaves and sonication (any four specific reactions with mechanism).	9

Unit III	<p>Research Methodology</p> <p>Concepts of Research - Importance of research in science, Criteria of good research, Sources of a research problem. Types of research - Basic, applied, action, experimental, diagnostic and exploratory. Primary and secondary sources-N-list-journals, plagiarism, Intellectual property rights, patent, trade mark, Copyrights, Plagiarism. Web of science, Scopus, citations-Science citation index- H – Index, I-10 Index.</p> <p>Scientific Writing</p> <p>Nature and purpose, the components of dissertation and Research paper, Writing techniques. Types of scientific publications-magazines, journals, reviews, news, letters, Structure of Scientific paper. Various reference styles.</p>	13
Unit IV	<p>Over view of cyber security: Confidentiality, integrity and availability Threats: Malicious software (viruses, Trojans, root kits, worms, and botnets), Memory exploits (buffer overflow, heap overflow, integer overflow, format string).</p> <p>Cryptography- Authentication, password system- windows security.</p>	7
Unit V	<p>Network security: Network intrusion detection and prevention system, firewalls. Software security: Vulnerability auditing, penetration testing, sandboxing, control flow integrity – web security: user authentication- Legal and ethical issues: trade secret, hacking and intrusion, privacy, identity theft- Legal and ethical issues and Cybercrime.</p>	7
Total Contact Hrs		45

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

23PCY2E1

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Ahluwalia. V.K.	Green Chemistry (Environmental Benign Reactions)	Ane Books Pvt. Ltd	2006
2	Asim K. Das	Environmental Chemistry with Green Chemistry	Arunabha Sen books and allied Pvt. Limited.	2012
3	Kothari. C.R.	Research Methodology	New Age International (P) Limited.	2011

4	Biju Dharmapalan	Scientific Research Methodology.	Narosa Publications, New Delhi	2012
5	Hans F. Ebel, Claus Bliefert	The Art of Scientific Writing	Wiley Publishing, 2 nd Edition	2005
6	Arthur. W.M. Conklin Greg White	Principles of Computer Security	McGraw-Hill Education; 4 th Edition	2016

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Rashmi Sanghi & M. M. Srivastava	Green Chemistry – Environment Friendly Alternatives	Narora Publishing House,	2003
2	Singh, Y.K, Nath, R.	Research Methodology	APH Publishing Corporation, 1 st Edition	2005
3	Chwan- Hwa (John) Wu, J. David Irwin	Computer Networks & Cybersecurity	CRC Press	2016
4	Mike O’Leary	Cyber O	A Press Publications	2016
5	Jeff Kramer, Nicolas Burrus, Florian Editler, Matt Parker	Hacking the Kinect (Technology in Action)	Apress; 1 st Edition	2016

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://youtu.be/ooJSgsB5fIE
https://youtu.be/iy_h0tr_CMc
https://youtu.be/E03gh1huvW4
https://www.youtube.com/watch?v=Yzfl3rtF0SM
https://www.youtube.com/watch?v=zL356VB1cDA
https://www.youtube.com/watch?v=C2pN3l2BGc4
https://www.youtube.com/watch?v=-emrdVazBN8
https://www.youtube.com/watch?v=ooJSgsB5fIE
https://nptel.ac.in/courses/118/102/118102003/
https://nptel.ac.in/courses/121/106/121106007/

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	M	H	H	H	M	H	M	M	H	M
CO2	M	H	M	H	M	H	M	M	H	H
CO3	H	M	H	M	H	H	H	H	H	M
CO4	H	M	H	H	M	H	M	H	M	M
CO5	H	H	M	M	M	H	M	M	H	M

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi Mrs.K.Vimaladevi Dr.V.Prabhu Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY2E2			*Major Elective–I: Electrochemistry	Batch:	2023 - 2025	
					Semester:	II	
Lecture Hrs./Week	3	Tutorial	-	Total Hrs/Sem	45	Credits:	3
Course Objective							
* Enable the students to understand the electrochemical principles.							
* To comprehend the various electrode reactions in electrode systems.							
* To learn about different batteries and fuel cells.							

Course Outcomes (CO)

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

#	Course Outcomes (CO)	Knowledge Level
CO1	Understand the behavior of electrolytes in terms of conductance, ionic atmosphere, interactions.	K1
CO2	Familiarize the structure of the electrical double layer of different models.	K2
CO3	Compare electrodes between current density and over potential.	K3
CO4	Discuss the mechanism of electrochemical reactions.	K4
CO5	Highlight the different types of over voltages and its applications in electroanalytical techniques.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	Ionics: Arrhenius theory -limitations, van't Hoff factor and its relation to colligative properties. Deviation from ideal behavior. Ionic activity, mean ionic activity and mean ionic activity coefficient-concept of ionic strength, Debye Huckel theory of strong electrolytes, activity coefficient of strong electrolytes Determination of activity coefficient ion solvent and ion-ion interactions. Born equation. Debye-Huckel Bjerrum model. Derivation of Debye-Huckel limiting law at appreciable concentration of electrolytes modifications and applications. Electrolytic conduction-Debye-Huckel Onsager treatment of strong electrolyte-qualitative and quantitative verification and limitations.	9
Unit II	Electrode-electrolyte interface: Interfacial phenomena -Evidences for electrical double layer, polarizable and non-polarizable interfaces, Electrocapillary phenomena - Lippmann equation electro capillary curves. Electro-kinetic phenomena electro-osmosis, electrophoresis, streaming and sedimentation potentials, colloidal and poly electrolytes. Structure of double layer: Helmholtz -Perrin, Guoy- Chapman and Stern models of electrical double layer. Zeta potential and potential at zero charge. Applications and limitations.	9

Unit III	Electrodics of Elementary Electrode Reactions: Nernst equation, polarizable and non-polarizable electrodes. Rate of electro chemical reactions: Rates of simple elementary reactions. Butler-Volmer equation-significance of exchange current density, net current density and symmetry factor. Low and high field approximations. Symmetry factor and transfer coefficient Tafel equations and Tafel plots.	9
Unit IV	Electrodics of Multistep Multi Electron System: Rates of multi-step electrode reactions, Butler - Volmer equation for a multi-step reaction. Rate determining step, electrode polarization and depolarization. Transfer coefficients, its significance and determination, Stoichiometric number. Electro-chemical reaction mechanisms-rate expressions, order, and surface coverage. Reduction of I^3^- , Fe^{2+} , and dissolution of Fe to Fe^{2+} . Overvoltage - Chemical and electro chemical, Phase, activation and concentration over potentials. Evolution of oxygen and hydrogen at different pH. Pourbiax and Evan's diagrams.	9
Unit V	Concentration Polarization, Batteries and Fuel cells: Modes of Transport of electro active species - Diffusion, migration and hydrodynamic modes. Role of supporting electrolytes. Polarography-principle and applications. Principle of square wave polarography. Cyclic voltammetry- anodic and cathodic stripping voltammetry and differential pulse voltammetry. Sodium and lithium-ion batteries and redox flow batteries. Mechanism of charge storage: conversion and alloying. Capacitors- mechanism of energy storage, charging at constant current and constant voltage. Energy production systems: Fuel Cells: classification, alkaline fuel cells, phosphoric acid fuel cells, high temperature fuel cells.	9
Total Contact Hrs		45

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book**23PCY2E2**

S.No.	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	D. R. Crow	Principles and Applications of Electrochemistry	Chapman & Hall/CRC, 4 th Edition,	2014
2	J. Rajaram and J.C. Kuriakose	Kinetics and Mechanism of Chemical Transformations, Macmillan India Ltd.	New Delhi	2011
3	S. Glasstone	Electro Chemistry	Affiliated East West Press, Pvt. Ltd., New Delhi.	2008
4	B. Viswanathan, S. Sundaram, R. Venkataraman, K. Rengarajan	Electrochemistry- Principles and Applications	S.Viswanathan Printers, Chennai	2007
5	Joseph Wang	Analytical Electrochemistry	Wiley, 2 nd Edition	2004

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	J.O.M. Bockris and A.K.N. Reddy	Modern Electrochemistry	Vol.1 and 2B, Springer, Plenum Press, New York	2008
2	J.O.M. Bockris, A.K.N. Reddy and M.G. Aldeco	Morden Electrochemistry	Vol. 2A, Springer, Plenum Press, New York	2008
3	Philip H. Rieger	Electrochemistry	2 nd Edition, Springer, New York	2010
4	L.I. Antropov	Theoretical Electrochemistry	Mir Publishers	1977
5	K.L. Kapoor	Text Book of Physical Chemistry	Volume-3, Macmillan	2001

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY2E3			Major Elective I – Advanced Polymeric Materials	Batch:	2023 – 2025	
					Semester:	II	
Lecture Hrs./Week	3	Tutorial	-	Total Hrs/Sem	45	Credits:	3
Course Objectives							
* To choose any research work related to the advanced polymeric materials.							
* To gain Knowledge about polymeric composites.							
* To learn the conducting and biomedical polymers and its applications.							

Course Outcomes

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

#	CO Statement	Knowledge Level
CO1	Acquire the knowledge about dendrimers, hyper-branched polymers and polymer nanocomposites.	K4
CO2	Recognize the importance of synthetic biomedical polymers for drug delivery and conducting polymers.	K5
CO3	Understand the synthetic route, structure, properties and uses of engineering plastics.	K2
CO4	Analyze the properties of new polymeric materials.	K4
CO5	Synthesize the new conducting and biomedical polymers	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 –Evaluate

Units	Content	Hrs
Unit I	Dendrimers and hyper branched polymers: Dendrimers and hyper branched polymers Properties of Dendrimers and Hyper branched Polymers and their Blends: Dendrimers and their structure, synthesis of Dendrimers, Hyper branched Polymers and their structure. Synthesis of hyper branched polymers, branching and poly dispersity, conformation, general concepts of polymer blends. Blends of Dendritic polymers with thermoplastics.	9
Unit II	Polymer nano composites: Polymer nano composites, Polyamide/clay nano composites - Synthesis, characterization and properties of Nylon6 – clay hybrid. Polystyrene/clay nano composites– Surface initiated polymerization, syndiotactic polystyrene/ clay nanocomposites, properties. Poly butylene sterephthalate (PBT) based nanocomposites, Epoxy nanocomposites on layered silicates. Polypropylene layered silicate nano composites.	9

Unit III	Biomedical polymers: Synthesis Biomedical polymers for drug delivery Polymers as biomaterials, biomedical applications of synthetic polymers, synthetic polymers for biomedical applications, poly(α -hydroxyesters), poly(lacticacid), poly(anhydrides), poly(phosphazenes), controlled drug delivery, methods of drug delivery.	9
Unit IV	Conducting polymers: Conducting polymers, Correlation of chemical structure and electrical conductivity. Structure of conducting polymers, Poly(acetylene), poly(pyrrole)s, poly(thiophene)s, polyanilines, poly(p- phenylenesulphide), poly(p-phenylenevinylene)s. Different methods of synthesis of polyaniline: solution polymerization, interfacial polymerization, electrochemical synthesis, enzyme synthesis and photo induced polymerization of aniline. Applications of conducting polymers: Membranes and ion exchanger, corrosion protection, gas sensors, biosensors, electrocatalysis.	9
Unit V	Engineering plastics: Engineering plastics, Acrylonitrile, butadiene, styrene(ABS), Polycarbonates(PC), Polyamides(PA), Polybutylene terephthalate (PBT), Polyethylene terephthalate (PET), Polyphenylene oxide (PPO), Polysulphone (PSU), Polyether ether ketone (PEEK). Polyimides, Poly phenylene Sulphide (PPS), Synthetic route, structure, properties and uses.	9
Total Contact Hrs		45

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book**22PCY2E3**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Gabriel O. Shonaike & Suresh G. Advani	Advance Polymeric Materials	CRC press	2003

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	F. Scholz	Monographs in Electrochemistry Conducting Polymers – A New Era in Electrochemistry	Springer – Verlag, Germany	2012

2	Y-W Mai	Polymer Nanocomposites	Wood head Publishing Ltd	2006
3	S Bhadra	Progress in Preparation, Processing and Applications of Polyaniline	Progress in Polymer Science, 34, 783 – 810	2009

Related Online Contents [MOOC, SWAYAM, NPTEL, and Websites]

https://nptel.ac.in/courses/104/105/104105124/
https://www.youtube.com/watch?v=UjMbwS0LOkU
https://www.youtube.com/watch?v=Sqz_QLAo7-c

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	H	H	M	H	M	H	H
CO2	H	M	H	H	H	H	M	H	H	H
CO3	M	H	H	H	H	H	H	H	H	H
CO4	H	M	H	H	-	H	H	-	M	L
CO5	H	H	H	H	H	M	H	H	L	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi Mrs. M.Anusuya Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY2N1			* Non Major Elective Chemistry in Day to Day Life	Batch:	2023 - 2025	
					Semester:	II	
Lecture Hrs./Week	2	Tutorial	-	Total Hrs/Sem	30	Credits:	2
Course Objective							
* To understand industrial preparations and materials of application in day today life.							
* To get an awareness about eco-friendly products to lead sustainable life.							
* To enable the student to understand about the manufacture of commercial products.							

Course Outcomes (CO)

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

#	Course Outcomes (CO)	Knowledge Level
CO1	Remember fundamental concepts of applied chemistry	K1
CO2	Understand the drugs used in day to day life.	K2
CO3	Test the various forms of drugs, cosmetics and milk products in day to day life.	K3
CO4	Predict the knowledge about the paints and cleansing agents.	K4
CO5	Analyze the composition of fertilizers, pesticides and milk products.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	Food and Medicines: Medicines - Antacid - Tranquilizers (Psychotherapeutic Drugs) – Analgesics – Antipyretics – Antimicrobials – Antibiotics – Antiseptics – Disinfectants. Chemistry in Food and Cosmetics - Artificial Sweetening Agents - Food Preservatives.	7
Unit II	Fertilizer and Pesticides: Fertilizer type- need for fertilizers- essential requirements-NPK ratio-sources of fertilizers. Effect of nitrogen, potassium and phosphorous on plant growth. Pesticides -classification of insecticides, fungicides, herbicides as organic and inorganic - general methods of application and toxicity, Identification of pesticides in food.	8

Unit III	Paints: Paints, varnish and lacquers- ingredients, characteristics and their uses. Chemistry in Colouring Matter - Classification of Dyes on the Basis of Constitution- Classification of Dyes on the Basis of Application.	5
Unit IV	Cleansing agents: Cleansing agents - importance of cleansing- Soaps - classification, manufacture, dry cleaning-properties.	5
Unit V	Milk and Milk products: Milk and Milk products-composition of Milk; Flavour and aroma of Milk; Effect of heat on Milk; pasteurization; Homogenization- Physical properties of Milk; milk products; Cream; butter; ice Cream; milk powder.	5
Total Contact Hrs		30

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book**23PCY2N1**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Jayashree Ghosh. S	Fundamental Concepts of Applied Chemistry	Chand, Publications.	2005
2	Sharma, B.K.	Instrumental Methods of Chemical Analysis, 18 th Edition.	Krishna Prakashan Media Pvt.. Ltd	2011

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Ronald Bailey, Herbert Clark, James Ferris, Sonja Krause, Robert Strong	Chemistry of the Environment	Elsevier Publications, 2 nd Edition	2001
2	Jain and Jain	Engineering Chemistry.	Dhanpat Rai Publishing Company, 15 th Edition.	2013

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=kyjYsKfEz88
https://www.youtube.com/watch?v=2sHILNzTpUU
https://www.youtube.com/watch?v=vppFkXW7Dt8
https://www.youtube.com/watch?v=e8X6RNFcMVc

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	-	-	H	H	-	H
CO2	H	H	M	M	M	-	-	-	M	H
CO3	H	H	H	M	H	M	H	M	M	H
CO4	H	M	H	-	H	M	H	M	-	H
CO5	H	M	H	-	H	M	H	M	-	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr. M. Velayutham Pillai Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

Programme Code:		M.Sc		Programme Title:			Master of Chemistry		
Course Code:		23PCY207		Inorganic Chemistry Practical –I			Batch:	2023 – 2025	
							Semester:	I & II	
Lecture Hrs/Week	I Sem	5	Tutorial	-	Total Hrs/Sem	I	75	Credits:	4
	II Sem	4				II	60		
Course Objectives									
* To equip the students with analytical skills by analyzing the given inorganic salt mixture containing two common cations and two rare cations.									
* To perform systematic qualitative analysis with the strong theoretical back ground.									
* To enable the students to prepare simple complexes by using published reactions.									

Course Outcomes

On the completion of the course the student will be able to

#	CO Statement	Knowledge Level
CO1	Separate common and rare cations.	K3
CO2	Analyze and report cations in a mixture.	K4
CO3	Analysis of synthesized compounds by UV Spectroscopy.	K4
CO4	Prepare and report coordination compounds.	K5
CO5	Develop skills in the synthesis of inorganic complexes.	K6

	Content	Hrs
A	<p>Semi Micro Qualitative Analysis: Qualitative Analysis employing semi micro methods & spot tests of mixtures of common cations & ions of the following less familiar elements.</p> <p>Less Familiar Cations: Molybdenum, Uranium, Thorium, Tungsten, Selenium, Cerium, Titanium, Zirconium, Vanadium & Lithium.</p> <p>Familiar Cations: Lead, Copper, Bismuth, Cadmium, Nickel, Manganese, Zinc, Barium, Strontium, Calcium, Ammonium, Magnesium</p>	
B	<p>Preparation of Inorganic Complexes Any Six preparations selected from the following list:</p> <ol style="list-style-type: none"> Hydroxylamine hydrochloride, Chrome alum Copper(I)Chloride, Trithiourea copper(I), Potassium trioxalato chromate(III), 	

	d) Potassium trioxalatoferate(III), Hexamine cobalt(III)chloride, Chloropentammine chromium(III)chloride, e) Tetrammine copper(II) Sulphate, Ammonium hexachloro stannate (IV).	
C	Demonstration (NOT FOR ESE EXAMINATION) * UV Spectroscopic analysis of Synthesized compounds.	
	Total Contact Hrs	75 +60Hrs

Pedagogy: Demonstration and hands on practical

Reference Books

23PCY207

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Ramanajum V.V	Semimicro Qualitative Inorganic Analysis.	National Publishing Company	1985
2	VenkateswaranV, Veeraswamy R and Kulandaivelu A.R,	Principles of Practical Chemistry	Sultan Chand & Sons. 2 nd Edition	1997
3	Arthur I.Vogel	Macro & Semimicro Qualitative Inorganic Analysis	Orient Long man's Ltd, 1 st Edition	1968

Mapping

PO /PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	M	H	H	H	H	H	H	M
CO2	H	H	M	H	H	M	H	H	H	M
CO3	H	H	M	H	H	H	H	H	H	H
CO4	H	H	M	H	H	M	H	H	H	M
CO5	H	H	M	H	H	-	H	H	H	M

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr. M. Velayutham Pillai Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

Programme Code:		M.Sc		Programme Title:			Master of Chemistry		
Course Code:		23PCY208		Organic Chemistry Practical –I			Batch:	2023 – 2025	
							Semester:	I & II	
Lecture Hrs./Week	I Sem	5	Tutorial	-	Total Hrs/Sem	I	75	Credits:	4
	II Sem	3				II	45		
Course Objective									
* To enable the students to separate two components in an organic mixture.									
* To identify the separated components by qualitative tests.									
* To prepare organic compounds and identify the organic compounds from the given spectral data.									
* Handle UV-Vis. spectrophotometer effectively.									
* Apply different chromatographic techniques for separating organic compounds.									

Course Outcomes

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

#	CO Statement	Knowledge Level
CO1	Remember the analysis of organic compounds and aromatic substitution reactions.	K1
CO2	Separate organic mixtures by solvent extraction and chromatographic techniques.	K4
CO3	Analyze organic compounds by IR, NMR and UV visible spectra.	K4
CO4	Develop skills in the synthesis of organic compounds.	K6
CO5	Determine boiling point /melting point.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

	Content	Hrs
A	Analysis of two component organic mixtures. (Separation and analysis of individual compounds)	
B	Single stage Preparations and Recrystallization 1. Hydrolysis: Preparation of Benzoic acid from Benzamide.	

	<p>2. Acetylation: Preparation of Acetanilide from Aniline.</p> <p>3. Bromination: Preparation of p-Bromoacetanilide from Acetanilide.</p> <p>4. Nitration: Preparation of m-dinitrobenzene from Nitrobenzene.</p> <p>5. Benzoylation: Preparation of Benzanilide from Aniline.</p> <p>6. Oxidation: Preparation of Benzoic acid from Benzaldehyde.</p> <p>7. Preparation of Glucose penta acetate.</p>	
C	<p>Demonstration only General methods of separation and purification of organic compounds such as:</p> <ol style="list-style-type: none"> Solvent extraction Soxhlet extraction Fractional crystallization TLC and Column Chromatography Melting point of synthesized compounds 	
D	<p>Class work only</p> <ol style="list-style-type: none"> Drawing the structures of organic molecules and reaction schemes by ChemDraw, Symyx Draw. Chemsketch. Draw the structures and generate the IR and NMR spectra of the substrates and products of synthesized compounds. Identification of structural pattern of organic compounds (Flavone, Isoflavone and Quinone) by taking UV spectrum (class work only). 	
Total Contact Hrs		75 +45 Hrs

Pedagogy: Demonstration and hands on practical.

Reference Book

23PCY208

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Gnana prakasam and Ramamurthy	Organic Chemistry Laboratory Manual	Ananda Book Depot, Chennai.	1998
2	Vishnoi N.K	Advanced Practical Organic Chemistry	Vikas Publishing House	2001
3	Jagmohan. R	Advanced Practical Organic Chemistry, Vol. I & II.		2002

4	Ahluwalia, V.K., and Dhingra, S	Comprehensive Practical Organic Chemistry (Qualitative Analysis)	University Press, First Edition, Hyderabad	2012
5	Dey, B.B. and Sitharaman, M.V	Laboratory Manual of Organic Chemistry	Fourth Edition, Allied Publishers, New Delhi	1992
6	Silverstein, R.M., Bassler, G.C. and Morrill, T.C	Spectroscopic Identification of Organic Compounds	Sixth Edition, Wiley India Ltd., New Delhi	2006
7	Willard, H.H., Jr. Merritt, L.L., Dean. J.A. and Jr. Settle, F.A	Instrumental Methods of Analysis	Seventh Edition, CBS Publishers & Distributors, New Delhi	2008
8	Mann. F.G, Saunders. B.C	Practical Organic Chemistry	4th Edn., Pearson Education India	2009

Mapping

PO /PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	M	H	M	M	H	H	H
CO2	H	H	H	M	H	M	M	H	H	H
CO3	H	H	H	M	H	M	M	H	H	H
CO4	H	H	H	M	H	M	M	H	H	H
CO5	H	H	H	M	H	M	M	H	H	H

H –High; M-Medium; L-Low

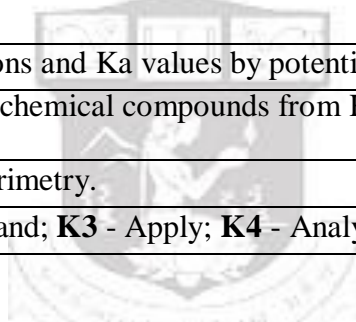
Course Designed by Name and Signature	Head of the Department Name and Signature	Curriculum Development Cell Name and Signature	Controller of the Examination Name and Signature
Name: Dr. V. Prabhu Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

Programme Code:		M.Sc		Programme Title:			Master of Chemistry		
Course Code:		23PCY209		Physical Chemistry Practical –I			Batch:	2023 – 2025	
							Semester:	I & II	
Lecture Hrs./Week	I Sem	5	Tutorial	-	Total Hrs/Sem	I	75	Credits:	4
	II Sem	3				II	45		
Course Objective									
* To make the students to understand the principle and to carry out the potentiometric titrations.									
* To determine the pH and P ^{Ka} values of buffers and acids.									
* To determine the molecular weight of solutes.									
* To construct the Phase diagram of two components systems.									

Course Outcomes (CO)

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

#	Course Outcomes (CO)	Knowledge Level
CO1	Recollect the concept of potentiometric titration.	K3
CO2	Understand the simple eutectic system, molecular weight determination by Rast method, partition coefficient and estimation of metal ions using colorimetry.	K4
CO3	Examine the strength of the solutions and Ka values by potentiometry.	K4
CO4	Calculate the molecular weight of chemical compounds from K _f values by Rast micro method.	K4
CO5	Estimate the metal ions using colorimetry.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		



	Content	Hrs
A	<p><u>Non Electrical Experiments</u></p> <ol style="list-style-type: none"> 1. Simple Eutectic System- determination of unknown compositions. 2. Determination of Critical Solution Temperature- Phenol –Water system. 3. Determination of effect of added electrolyte on CST of Phenol- Water system 4. Determination of the concentration of the electrolyte using CST of Phenol-Water system 5. Determination of Molecular weight by Rast's micro method. 6. Determination of Partition Coefficient of Iodine. 	

B	Electrical Experiments -Potentiometric Titrations: Acid-Base titrations (using quinhydrone electrode) 7. Titration of Strong acid against Strong base 8. Titration of Weak acid against Strong base 9. Titration of mixture of (strong & weak) acids against Strong base 10. Determination of P ^H (acidic solutions) 11. Determination of P ^{Ka} of weak acid	
C	Redox titrations 10. Titration of Ferrous Ammonium Sulphate against Potassium Permanganate 11. Titration of Ferrous Ammonium Sulphate against Potassium dichromate	
D	Precipitation titrations (using silver electrode) 12. Titration of Potassium chloride against Silver nitrate 13. Titration of mixture of halides (chloride and iodide) against silver nitrate	
	Total Contact Hrs	75+45 Hrs

Pedagogy: Demonstration and hands on practical.

23PCY209

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Palit S. R and De S.K	Practical Physical Chemistry	Science Book Agency, Calcutta.	2003
2	Sharma. P.C and Agarwal	Practical Chemistry	Goel Publishing House, Meerut.	1996
3	Venkateswaran.V and Kulaindaivelu. A. R	Practical Physical Chemistry	S.Chand & Co.	1987

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	M	H	H	H	H	-	-
CO2	H	H	M	M	M	H	H	H	M	-
CO3	H	H	H	H	H	M	H	H	M	-
CO4	H	H	H	H	H	M	M	H	H	-
CO5	H	H	M	H	M	M	M	H	M	-

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Mrs.K.Vimaladevi	Name: Dr.K.Poonkodi	Name: Mr. K. Srinivasan	Name: Dr. R. Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY310			Organic Chemistry –III – Natural Products and Organic Reagents	Batch:	2023 – 2025	
					Semester:	III	
Lecture Hrs./Week	4	Tutorial	4	Total Hrs/Sem	75	Credits:	5
Course Objective							
* To promote an awareness in the student about natural products and their synthesis.							
* To introduce new reagents available in organic synthesis.							
* To synthesize eco-friendly reagents and chemical pathways for the development of green chemistry.							

Course Outcomes

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

#	CO Statement	Knowledge Level
CO1	Comprehend the classes of natural products and the fundamental of condensation and molecular rearrangement reactions.	K2
CO2	Understand isolation, classification and structural elucidation of terpenoids, steroids and naming reactions which includes condensation, molecular rearrangements.	K2
CO3	Implement the biosynthetic idea of proteins and polypeptides.	K3
CO4	Apply the reagents inorganic synthesis.	K3
CO5	Predict the reagents involved inorganic synthesis and evaluate the structure and synthesis of heterocyclic compounds.	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate

Units	Content	Hrs
Unit I	Terpenoids Introduction –isolation and classification of terpenoids – isoprene rule, gem-dialkyl rule. Structural elucidation and synthesis of zingiberene, eudesmol, abietic acid and caryophyllene, α -pinene, α -santonin, Linalool.	15
Unit II	Steroids Introduction- Structural elucidation of cholesterol (synthesis not required), ergosterol, Vitamin-D, Bile acid, testosterone and progesterone.	15

Unit III	<p>Retrosynthetic analysis, protection and deprotection</p> <p>An introduction to retrosynthesis – synthon – synthetic equivalent – target molecule, functional group interconversion. Retro synthetic analysis and Synthesis of simple organic molecules such as 1,2, 1,3, 1,4 and 1,5 – dicarbonyl compounds both acyclic and cyclic. Formation of 3,4,5 and 6 membered cyclic compounds. Protection and deprotection of functional groups – R-OH, RCHO, R-CO-R, R-NH₂ and R-COOH.</p>	15
Unit IV	<p>Molecular rearrangements</p> <p>Introduction- Wagner Meerwein rearrangements, dienonephenol, Wolf, Favorski, Neber rearrangement, Baeyer- Villiger rearrangement, Stevens, Chapman, Benzidine, Fries, Arndt Eister synthesis, Lossen and Wallac rearrangements, Curtius, Hoffmann-Lofller- Freytag, Demjanov, Von-Richter rearrangement, Sommelet-Hauser rearrangement, Smiles rearrangement.</p>	15
Unit V	<p>Reagents in organic synthesis</p> <p>Gilman's reagent, lithium diisopropyl amide (LDA), trimethyl silyl iodide, Peterson's synthesis, Vilsmeier reaction. Preparations and synthetic applications of DBU(1,8-diazabicyclo[5.4.0] undecene-7-ene), DCC (dicyclohexyl carbodiimide), NBS, PCC, PDC, Wilkinson's catalyst, Tri-n-butyl tin hydride.</p> <p>Heterocyclic compounds: Structure, synthesis and reactions of flavones, isoflavones, purines (adenine and guanine) and anthocyanins (cyanin and pelargonin).</p>	15
Total Contact Hrs		75

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book**23PCY310**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Finar. I. L	Organic Chemistry Vol. II	Longman Publishing Group	1998
2	Agarwal O. P	Natural product Chemistry	Goel Publishing house, 20 th Edition.	2001

3	Gurdeep Chatwal	Organic Chemistry of Natural Products Vol I & II	Himalaya Publishing House.	2001
4	Ahluwalia. V.K. Rakesh K. Parashar	Organic Reaction Mechanisms	Narosa Publishing House, 4 th Edition	2010
5	Stuart Warren	Designing Organic Syntheses	John Wiley and sons, 1 st Edition.	1994
6	Bansal, R.K	Organic Reaction mechanism	Tata McGraw-Hill, 11 th Edition.	2006
7	Bansal, K	Heterocyclic Chemistry	New Age International, New Delhi, 5 th Edition.	2012
8	Joule, J.A. and Mills, K	Heterocyclic Chemistry	Blackwell Publishing Company, New York, 4 th Edition.	2004
9	Carruthers. W	Some Modern Methods in Organic Synthesis	Cambridge University Press, New York, 3 rd Edition.	2009
10	Khan, M.A	Chemistry of Natural products	Omega Publications, New Delhi, 1 st Edition.	2011
11	Mackie, R.K., Smith, M.M., and Aitken, R.A.	Guide Book to Organic Synthesis	Longman Scientific and Technical, Singapore, 2 nd Edition.	1990

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Jerry March	Advanced organic chemistry	4 th Edition, A Wiley-Inter science	2007
2	Newman, A. A	Chemistry of Terpenes and Terpenoids	Academic press publishers	1972

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://youtu.be/sdN9LgeKLAo
https://youtu.be/diksW7rHXms
https://youtu.be/baAaUzf_psy
https://youtu.be/nm0rkDiobvc
https://youtu.be/AYB_E9gdzx0
https://youtu.be/2DyeKE5q8Go
https://youtu.be/pel8P2atSEg

Mapping

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	M	M	H	M	H	L	L	L	H	H
CO2	M	M	H	M	L	L	L	M	H	H
CO3	M	H	H	H	H	M	M	M	H	M
CO4	H	H	H	H	H	M	H	M	M	H
CO5	H	H	H	M	H	M	M	M	M	M

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.V.Prabhu Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

Programme Code:	M.Sc.			Programme Title:		Master of Chemistry	
Course Code:	23PCY311			Physical Chemistry –III - Classical and Statistical Thermodynamics		Batch:	2023 – 2025
						Semester:	III
Lecture Hrs./Week	4	Tutorial	1	Total Hrs/Sem	75	Credits:	4
Course Objective							
* To understand and apply the concept of fugacity, activity and chemical potential.							
* To acquire knowledge on third law of thermodynamics and probability and ensembles.							
* To gain knowledge about the distribution laws (classical and statistical) and their applications.							

Course Outcome

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

#	CO Statement	Knowledge Level
CO1	Interpret the physical significance of chemical potential.	K2
CO2	Apply probability to molecular energy levels.	K3
CO3	Apply thermodynamic concepts to evaluate the relationship between thermodynamic properties.	K3
CO4	Comprehend the quantum statistics and partition function.	K4
CO5	Evaluate statistical thermodynamics to the properties of identical indistinguishable particles like electrons.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	<p>Thermodynamics and Non-ideal systems</p> <p>Chemical potential – Fugacity- determination of fugacity of gases by graphical method, from equation of state, approximate calculation method and generalized method-variation of fugacity with temperature and pressure. Fugacity and the standard state for non-ideal gases - Fugacity coefficient, fugacity of mixture of non- ideal gases – Lewis Randal rule.</p> <p>Definition of activity - Standard states - activity coefficient of a gas - relation between fugacity and activity coefficient of gas - variation of activity of a gas with temperature and pressure. Activity and activity coefficient of solutions-mean activity and mean activity coefficient.</p>	15

Unit II	<p>Third Law of Thermodynamics</p> <p>Laws of thermodynamics - need for third law - probability and third law - Nernst heat theorem, thermodynamic quantities at absolute zero - entropy of gases - entropy at absolute zero - entropy and probability (Boltzmann Expression) - Boltzmann - Planck equation - significance of thermodynamic probability - Entropy of expansion of ideal gas.</p> <p>Probability and Ensembles</p> <p>Theorems of permutations, combinations and probability. Thermodynamic probability to molecular systems- States of maximum thermodynamic probability of systems involving energy levels. Distinguishable and indistinguishable particles. Microstates and macro states. Ensembles – definition- micro canonical, canonical and grand canonical ensembles.</p>	15
Unit III	<p>Statistical Thermodynamics</p> <p>Maxwell - Boltzmann statistics – Fermi-Dirac statistics-Bose-Einstein statistics-thermodynamic probability- Boltzmann expression for entropy - Stirling's approximation - States of maximum thermodynamics probability - thermodynamic probabilities of systems in equilibrium - LAGRANGIAN multipliers - Maxwell - Boltzmann distribution law - Evaluation of alpha and beta in M.B. distribution law. Experimental verification of Maxwell's distribution of molecular velocities by Stern method. Limitations of Maxwell Boltzmann distribution law.</p>	15
Unit IV	<p>Partition function</p> <p>Partition function – Relation between molecular partition function and canonical function - Evaluation of translational, rotational, vibrational and electronic partition function – Evaluation of E, Cv and entropy from the partition functions - The relation between partition function and thermodynamic functions (E, H, S, A, G, Cv and Cp) - Effect of molecular symmetry on rotational partition function – Ortho and para Hydrogen - Study of monoatomic and diatomic ideal gas molecule on the basis of partition functions.</p>	15
Unit V	<p>Irreversible Thermodynamics</p> <p>Theories of conservation of mass and energy entropy production in open systems by heat, matter and current flow, force and flux concepts. Onsager theory-validity and verification- Onsager reciprocal relationships. Electro kinetic and thermo mechanical effects-Application of irreversible thermodynamics to biological systems.</p>	15
	Total Contact Hrs	75

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book**23PCY311**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Puri B.R & Sharma. L R	Advanced Physical Chemistry	Milestone Publishers & Distributors, 2 nd Edition	2009
2	Bajpai, D.N.	Advanced Physical Chemistry	S. Chand Publishing Limited., 1 st Edition Reprint	2015
3	Gupta, M.C.	Statistical thermodynamics	Wiley Eastern Limited, 1 st Edition	1990
4	Rajaram Kuriacose	Statistical thermodynamics	Shoban lal & Co, 4 th edition	2006
5	Samuel Glasstone	Thermodynamics for chemists	East West Press, 2 nd Edition	Reprint 2002

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Akins. P. W	Physical Chemistry	Oxford University, 1 st Edition	1978, Reprint 2005
2	Klotz, L. M, Rosenberg R.M. Benjamin, W.A	Chemical thermodynamics	Pearson publications, 3 rd Edition	1974
3	Frederick.T. Wall	Chemical thermodynamics	W.H. Freeman & Company, 3 rd Edition	1974
4	Nash, L.K.	Chemical Thermodynamics	Addison Wesley Publishing, 2 nd Edition	1976

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=NrtZAJtEH3c&list=PLdBDmcnzLC_ZfA9evETgII7NX6N_45M77
https://www.youtube.com/watch?v=ogw0iojLBEQ
https://www.youtube.com/watch?v=UIVJ4JkqjaI
https://www.youtube.com/watch?v=1yf2LBUB39g
https://www.youtube.com/watch?v=i2OE9ljBKD8

Mapping

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	M	H	M	M	M	M	M	M	M
CO2	M	H	M	H	M	M	M	M	M	M
CO3	H	M	H	M	H	H	H	H	M	-
CO4	H	M	H	H	M	H	H	H	H	M
CO5	M	H	M	H	M	H	M	M	H	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr. M. Velayutham Pillai Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY312			Organic Spectroscopy	Batch:	2023 – 2025	
					Semester:	III	
Lecture Hrs./Week	4	Tutorial	1	Total Hrs/Sem	75	Credits:	5
Course Objective							
* To enable the students to understand the principles and instrumentation of various spectroscopic techniques.							
* To acquire knowledge in the structural determination of unknown compounds using various spectroscopic methods.							
* To apply the spectral techniques in research and practical situations.							

Course Outcome

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

#	CO Statement	Knowledge Level
CO1	Apply and evaluate the UV/Vis spectroscopy as a qualitative and quantitative method.	K3,K5
CO2	Analyze the vibrations of molecules and identify the functional group present in it.	K4
CO3	Predict the structure of compound using 1D and 2D NMR techniques.	K5
CO4	Assess the mass to charge ratio for the sample under test and to propose the fragmentation pattern.	K5
CO5	Able to identify an unknown organic compound using the spectroscopic principles.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	UV Visible Spectroscopy Introduction to spectroscopy - Electromagnetic spectrum- Properties of electromagnetic radiation. Electronic excitation, Theory of electronic , Franck – Condon Principle - Origin of different bands - Intensity of bands - Selection rules, Instrumentation, Correlation of electronic absorption with molecular structure, Simple chromophoric groups- auxochromes - effects of conjugation - Woodward - Fischer rules - aromatic system and systems with extended conjugation – λ_{\max} calculation of butadiene and carbonyl compounds- applications to organic compounds.	15

Unit II	<p>IR Spectroscopy and Raman spectra</p> <p>Principles and theory of IR spectra- vibrations of polyatomic molecules - the influence of rotation on the spectrum of polyatomic molecules - factors influencing vibrational frequencies - characteristic group absorptions of organic molecules- finger print region - identification of functional groups - applications to simple organic molecules -medical diagnosis (cancer)- instrumentation- FT- IR-NIR.</p> <p>Raman spectra – introduction – characteristic properties of Raman lines – differences between Raman spectra and IR spectra – mechanism of Raman Effect – Intensity of Raman lines and applications of Raman spectroscopy.</p>	15
Unit III	<p>Mass Spectrometry</p> <p>Theory - instrumentation - isotopic abundance - determination of molecular weights and formula, ionisation techniques (CI, FD, FAB & ESI, APCI) - nitrogen rule -metastable ions and peaks - ion fragmentation mechanisms - Retro Diels-Alder rearrangement - McLafferty rearrangement -elimination due to ortho groups. Fragmentation associated with functional groups - benzyl alcohol, phenol, methyl phenyl ether, benzaldehyde, 2-hexanone, benzoic acid, n-propyl ethanoate, and benzamide. LC-MS and GC-MS.</p>	15
Unit IV	<p>Nuclear Magnetic Resonance Spectroscopy -¹H NMR</p> <p>Magnetic properties of nuclei - theory of nuclear resonance - chemical shift and its measurement - factors influencing chemical shift - chemical equivalence and magnetic equivalence - solvents and NMR spectra - spin-spin coupling, spin-spin splitting systems - proton exchange reactions – hetero nuclear coupling - deuterium exchange - double resonances - chemical shift reagents - applications to organic compounds - FT NMR.</p>	15
Unit V	<p>¹³C NMR and 2D NMR Techniques</p> <p>Magnetic moment and natural abundance- broad band decoupling - Off-resonance decoupling - deuterium coupling - NOE effect- peak assignments using DEPT spectrum - structural applications of simple organic molecules.</p> <p>2D NMR Techniques: Theory - ¹H-¹H COSY, ¹H-¹³C COSY: HETCOR, Proton detected HETCOR: HMQC, HMBC, NOESY. Solving problems using IR, UV, NMR and mass spectra for simple molecules.</p>	15
	Total Contact Hrs	75

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book**23PCY312**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Sharma. Y. R	Elementary Organic Spectroscopy	S. Chand Publications, 4 th Edition	2012
2	Kemp, W.	Organic Spectroscopy	Replica Press Pvt. Ltd., New Delhi, 3 rd Edition	2008
3	Kalsi. P.S	Spectroscopy of Organic Compounds	New Age International (P) Ltd, 6 th Edition	2014
4	Jag Mohan	Organic Spectroscopy	Narosa Publishing House	2013
5	Banwell. C.N. McCash. E.M.	Fundamentals of molecular spectroscopy	Tata McGraw Hill Publishing Company Ltd, 4 th Edition	2016

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Thomas Engel	Quantum Chemistry & Spectroscopy	Pearson Education	2006
2	Pavia. D. L. Lampman. G.M. Kriz. G.S. and James R. Vyvyan	Spectroscopy	Brooks/Cole Publications, 5 th Edition	2011
3	Yadav. M. S	Molecular Spectroscopy	Arise Publishers & Distributors, 1 st Edition	2011
4	Kaur. H	Spectroscopy	Pragati Prakashan Publications, 10 th Edition	2015
5	Silverstein, R.M., Webster. F.X, Kiemle. D.J, Bryce. D.L	Spectrometric Identification of Organic Compounds	John Wiley Publications, 8 th Edition	2015

RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/results?search_query=https%3A%2F%2Fwww.khanacademy.org%2Fscience%2Forganic-chemistry%2Fspectroscopy-jay
https://www.youtube.com/watch?time_continue=1153&v=bEzITtaEfDU
https://onlinecourses.nptel.ac.in/noc20_cy08/preview
https://onlinecourses.nptel.ac.in/noc19_cy29/preview

https://onlinecourses.swayam2.ac.in/cec20_ma16/preview

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	M	H	-	-	M	H	H
CO2	M	H	H	H	H	L	M	-	H	H
CO3	H	H	H	H	H	-	-	M	H	H
CO4	H	H	H	H	M	-	-	L	M	H
CO5	H	H	H	H	H	L	L	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Mrs.M.Anusuya	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme Code:	M.Sc			Programme Title:		Master of Chemistry	
Course Code:	23PCY3E4			*Major Elective –II - Organometallic Chemistry		Batch:	2023 – 2025
						Semester:	III
Lecture Hrs./Week	3	Tutorial	-	Total Hrs/Sem	45	Credits:	3
Course Objective							
<ul style="list-style-type: none"> Learn about the development of organometallic chemistry and types of bonds in organometallic complexes Learn about the important organometallic complexes and their applications in various organic transformations as homogeneous/ heterogeneous catalysts Recognition of organometallic chemistry in Noble Prize for chemistry in 2001, 2005 and 2010 To apply organometallic chemistry principles to research for new compound synthesis 							

Course Outcomes (CO)

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

#	Course Outcomes (CO)	Knowledge Level
CO1	Understand the historical development of Organometallic chemistry and uniqueness in various bonding behaviour of organometallic compounds.	K2
CO2	Gaining the knowledge on metal carbonyl compounds, various types of insertion reactions in carbonyl chemistry and their applications	K4,K2
CO3	Organometallic alkyl, alkylidene and alkylidyne, alkene and alkyne chemistry and application of them in insertion, double carbonylation, olefin metathesis, hydrogenation, hydrosilation, oxidation and polymerisation reactions.	K4,K2
CO4	Synthesis and understand metallocenes, half-sandwich complexes, arene complexes and multidecker complexes.	K4
CO5	Inferring the importance of metallocene chemistry and the applications of metallocenes in stereospecific polymerisation of 1-alkenes and fluxional behaviour of π -electron systems and importance of organometallic chemistry in catalysis and recognition of Noble prizes 2001, 2005 and 2010.	K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	Organometallic Chemistry - I Definition of organometallic compound - 18 electron rule - effective atomic number rule - classification of organometallic compounds - the metal carbon bond types - ionic bond – sigma covalent bond - electron deficient bond - delocalised bond - dative bond - metal carbonyl complexes - synthesis - structure and reactions of metal carbonyls - the nature of M- CO bonding-binding mode of CO and IR spectra of metal carbonyls - metal carbonyls-	13

	metal carbonyl anions - metal carbonyl hydrides - metal carbonyl halides - metal carbonyl clusters – Wade’s rule and isolobal relationship - metal nitrosyls - dinitrogen complexes - dioxygen complexes.	
Unit II	Organometallic Chemistry - II Metal alkyl complexes - stability and structure - synthesis by alkylation of metal halides - by oxidative addition - by nucleophilic attack on coordinated ligands - metal alkyl and 18 electron rule - reactivity of metal alkyls - M-C bond cleavage reactions - insertion of CO to M-C bonds - double carbonylation - insertions of alkenes and alkynes - insertions of metals with C-H bonds.	8
Unit III	Organometallic Chemistry - III Alkene complexes - synthesis of alkene complexes by ligand substitution - by reduction and by metal atom synthesis - bonding of alkenes to transition metals - bonding in diene complexes - reactivity of alkene complexes - alkyne complexes - bonding in alkyne complexes - reactivity of alkynes - alkyne complexes in synthesis – cobalt catalysed alkyne cycloaddition	8
Unit IV	Organometallic Chemistry - IV Cyclopentadienyl complexes - metallocenes - synthesis of metallocenes - bonding in metallocenes- reactions of metallocenes - metallocene halides and hydrides - synthesis and structures of allyl complexes -arene complexes - synthesis - structure and reactivity of arene complexes - multidecker complexes.	8
Unit V	Organometallic Chemistry - V Organometallic compounds in homogeneous catalytic reactions - coordinative unsaturation - acid-base behaviour reaction - migration of atoms or groups from metal to ligand - insertion reaction -hydrogenation - hydroformylation and hydrosilation of alkenes - alkene polymerisation and oligomerisation - fluxional molecules.	8
	Total Contact Hrs	45

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

23PCY3E4

S.NO	AUTHOR	TITLE OF THE	PUBLISH	YEAR OF
1	J. E. Huheey, E. A. Keiter and R. L. Keiter	Inorganic Chemistry - Principles of structure and reactivity	Addition Wesley Publishing Co, NY, Fourth Edition	1993
2	Cotton. F. A And Wilkinson.G	Advanced Inorganic Chemistry	Wiley Inter science 6 th edition	1999

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \	YEAR OF
1	Manfred Bochmann	Organometallics 1,	Oxford science publications, Oxford	1994
2	Manfred Bochmann	Organometallics 2, Complexes with transition	Oxford science publications,	1994

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=0V8BBxfg0Xg
https://www.youtube.com/watch?v=zYSl4OVv8E
https://www.youtube.com/watch?v=plhLipR8yYQ
https://www.youtube.com/watch?v=xzyR8Nxsloc
https://www.youtube.com/watch?v=CsdaDja4WvM
cobalt catalysed alkyne cycloaddition
https://www.youtube.com/watch?v=HvwsWg8FmqE
https://www.youtube.com/watch?v=ZjDqdJKdUrk
https://www.youtube.com/watch?v=xzyR8Nxsloc

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	M	H	M	H	H	H	-
CO2	H	H	H	M	M	M	H	L	H	M
CO3	H	H	H	H	H	M	H	H	M	-
CO4	H	H	H	H	H	L	H	H	H	-
CO5	H	H	H	H	M	M	M	M	M	-

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi Mrs.K.Vimaladevi Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

Programme code:	M.Sc			Programme Title :	Master of Chemistry		
Course Code:	23PCY3E5			*Major Elective –II – Material Science		Batch :	2023 – 2025
						Semester:	III
Lecture Hrs./Week	3	Tutorial Hrs./Sem.	-	Total Hrs./Sem	45	Credits:	3
Course Objective							
* Origin and the basics of crystal structure and application to structure determination.							
* The various methods available for preparation of crystalline materials and their applications.							
* The role of nanomaterials and their properties in advancing different areas of science.							

Course Outcomes

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

#	Course Outcomes (CO)	Knowledge Level
CO1	Understand the crystal structure, growth methods and X-ray scattering.	K1
CO2	Explain the optical, dielectric and diffusion properties of crystals.	K2
CO3	Recognize the basis of semiconductors, superconductivity materials and magnets.	K3
CO4	Study the synthesis, classification and applications of nanomaterials	K4
CO5	Learn about the importance of materials used for renewable energy conversion.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	Crystallography: symmetry - unit cell and Miller indices -crystal systems - Bravais lattices - point groups and space groups - X-ray diffraction-Laue equations-Bragg's law-reciprocal lattice and its application to geometrical crystallography. Crystal structure–powder and single crystal applications. Electron charge density maps, neutron diffraction-method and applications.	9

Unit II	Crystal growth methods: Nucleation–equilibrium stability and metastable state. Single crystal –Low and high temperature, solution growth– Gel and sol-gel. Crystal growth methods- nucleation– equilibrium stability and metastable state. Single crystal–Low and high temperature, solution growth– Gel and sol-gel. Melt growth - Bridgeman-Stockbarger, Czochralski methods. Flux technique, physical and chemical vapour transport. Lorentz and polarization factor - primary and secondary extinctions.	9
Unit III	Properties of crystals: Optical studies - Electromagnetic spectrum (qualitative) refractive index – reflectance – transparency, translucency and opacity. Types of luminescence – photo-, electro-, and injection luminescence, LEDs – organic, Inorganic and polymer LED materials - Applications. Dielectric studies- Polarisation - electronic, ionic, orientation, and space charge polarisation. Effect of temperature. dielectric constant, dielectric loss. Types of dielectric breakdown–intrinsic, thermal, discharge, electrochemical and defect breakdown.	9
Unit IV	Special Materials: Superconductivity: Meissner effect, Critical temperature and critical magnetic Field, Type I and II superconductors, BCS theory-Cooper pair, Applications. Soft and hard magnets – Domain theory Hysteresis Loop-Applications. Magneto and giant magneto resistance. Ferro, ferri and antiferromagnetic materials-applications, magnetic parameters for recording applications. Ferro-, Piezo-, and pyro electric materials – properties and applications. Shape memory Alloys-characteristics and applications, Non-linear optics-Second Harmonic Generators, mixing of Laser wavelengths by quartz, ruby and LiNbO ₃ .	9
Unit V	Materials for Renewable Energy Conversion: Solar Cells: Organic, bilayer, bulk heterojunction, polymer, perovskite based. Solar energy conversion: lamellar solids and thin films, dye-sensitized photo voltaic cells, coordination compounds anchored onto semiconductor surfaces - Ru(II) and Os(II) polypyridyl complexes. Photochemical activation and splitting of water, CO ₂ and N ₂ . Manganese based photo systems for water-splitting. Complexes of Rh, Ru, Pd and Pt - photochemical generation of hydrogen from alcohol.	9
Total Contact Hrs		45

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book**23PCY3E5**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	S. Mohan and V. Arjunan	Principles of Materials Science	MJP Publishers	2016
2	Arumugam	Materials Science	Anuradha Publications	2007
3	Giacavazzo <i>et. al.</i>	Fundamentals of Crystallography	International Union of Crystallography. Oxford Science Publications	2010
4	Woolfson	An Introduction to Crystallography	Cambridge University Press	2012

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Suggested Readings M.G. Arora	Solid State Chemistry	Anmol Publications, New Delhi	2001
2	R.K. Puri and V.K. Babbar	Solid State Physics	S Chand and Company Ltd	2001
3	C. Kittel	Solid State Physics	John-Wiley and sons, NY	1966
4	H.P. Meyers	Introductory Solid State Physics	Viva Books Private Limited	1998
5	A.R. West	Solid State Chemistry and Applications	John-Wiley and sons	1987

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=I-m-FZy1oAA
https://www.youtube.com/watch?v=O9nUNkIHqT8
https://www.youtube.com/watch?v=t-m-NwJa4IY
https://www.youtube.com/watch?v=7ozWJbbFuV8
https://www.youtube.com/watch?v=xnOqahYA6NU
https://www.youtube.com/watch?v=FQzUrbKTLVU
https://www.youtube.com/watch?v=_UMmjgXKcOQ
https://www.youtube.com/watch?v=xAS4NS9RuI4

https://nptel.ac.in/courses/118/104/118104008/
https://nptel.ac.in/courses/118/107/118107015/
https://nptel.ac.in/courses/118/102/118102003/

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	M	H	M	H	H	H	H
CO2	H	H	H	M	M	M	H	M	H	H
CO3	H	H	H	H	H	M	H	H	M	H
CO4	H	H	M	H	H	M	H	H	H	H
CO5	H	H	M	H	M	M	M	M	M	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Mrs.K.Vimaladevi	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme Code:	M.Sc		Programme Title:	Master of Chemistry			
Course Code:	23PCY3E6		Major Elective –II: Dye Chemistry	Batch:	2023 – 2025		
				Semester:	III		
Lecture Hrs./Week	3	Tutorial Hrs./	-	Total Hrs/Sem	45	Credits:	3
Course Objective							
* To understand the chemistry of dyes.							
* To interpret the various types of dyes, synthesis, reactions and applications.							
* To recognize the pigments, cosmetics and coloring agents.							

Course Outcomes

On the completion of the course the student will be able to

#	CO Statement	Knowledge Level
CO1	Learn the chemistry of dyes.	K3
CO2	Study the organic intermediate in the dye chemistry.	K4
CO3	Interpret the various types of dyes, synthesis, reactions and applications.	K5
CO4	Expertise in the pigments, cosmetics and colouring agents.	K5
CO5	Synthesize new variety of Dyes.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	Colour and Constitution: Relationship of colour observed to wavelength of light absorbed – Terms used in colour chemistry – chromophores, Auxochromes, Bathochromic shift, Hypsochromic shift. Quinonoid theory and modern theories: Valence bond theory, molecular orbital theory.	9
Unit II	Chemistry of organic intermediates used in dye manufacture. Benzene, Naphthalene and Anthroquinone intermediates. Nitro dyes, Nitrosodyes, Azo dyes – principles governing azo coupling– mechanism of diazotization coupling	9

	with amines, coupling with phenols. Classification according to the number of azo groups and application – Tautomerism in azo dyes.	
Unit III	Synthesis of specific dyes and uses Orange IV, Diamond Black F, Metanil yellow, Tartrazines Direct Deep Black, Eriochrome Black T, Eriochrome Red B, Cellitron Scarlet B, Congo Red, Malachite green, methylene blue, Safranin – T, Acid Magenta, Cyanin Green G, Alizarin, Benzanthrone, Indigo, Copper phthalocyanine, Sulphur black – T.	9
Unit IV	Synthesis, reactions and applications of xanthene dyes, Cyanine dyes, acridine dyes, Sulphur dyes, Anthraquinone dyes: Anthraquinone mordant dyes, Anthraquinone acid dyes and Anthraquinone disperse dyes.	9
Unit V	Pigments – Introduction - Requirements of organic pigments Types of Pigments – Applications. Fluorescent. Brightening agents – application of dyes in other areas – Leather, paper, medicine, chemical analysis, cosmetics, colouring agents Food and Beverages	9
Total Contact Hrs		45

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

23PCY3E6

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Finar. I. L	Organic chemistry volume – I	Pearson Education India; 6th edition	2002
2	Venkataraman. K	The chemistry of synthetic dyes volume I, III, III+IV	Elsevier	1971

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Gurdeep R.Chatwal	Synthetic Dyes	Himalaya Publishing House	2009
2	Chawathe.Shah. Ra	An Introduction to synthetic drugs and dyes	Himalaya Publishing House, 14 th edition	2019
3	Sharma, B.K.	Instrumental methods of Chemical analysis, 18th Edition.	Krishna Prakashan Media p Ltd	2011

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://nptel.ac.in/courses/116/104/116104044//
https://www.youtube.com/watch?v=2sHILNzTpUU
https://www.youtube.com/watch?v=71VHFku36Jw

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PS01	PS02
CO1	H	H	M	H	H	M	H	M	H	H
CO2	H	M	H	H	H	H	M	H	H	H
CO3	M	H	H	H	H	H	H	H	H	H
CO4	H	M	H	H	H	H	M	H	H	H
CO5	H	H	H	M	H	M	H	H	H	H

H-High, M-Medium, L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezian
Signature:	Signature:	Signature:	Signature:

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY413			Inorganic Chemistry –III: Bioinorganic Chemistry	Batch:	2023 - 2025	
					Semester:	IV	
Lecture Hrs./Week	4	Tutorial	1	Total Hrs/ Sem	75	Credits:	5

Course Objective

- * To understand the key role of various elements in the living systems.
- * To acquire knowledge in the nature, preparation and properties metal carbonyl complexes, photochemistry of metal complexes.
- * To gain insight into the small molecules binding and transport mechanism involving metalloenzymes.
- * To know about the mechanism of binding interactions of metal complexes with bio-molecules and metal based drug action.

Course Outcomes

On the completion of the course the student will be able to

#	CO Statement	Knowledge Level
CO1	Analyze the various biological roles such as metal ion transport and storage, electron.	K4
CO2	Knowledge about the medically- metal in medicine, interaction of metal ions with biomolecules.	K2
CO3	Acquire intense knowledge about various biological roles such as metal ion transport and storage, electron- and proton transfer, O ₂ transport, hydrolysis, etc. taking place at the active site of metalloproteins.	K4
CO4	Gain knowledge about the medically-important topics such as the toxicity of metal ions, and their uses, Ru and Pt complexes in cancer therapy. This would motivate the students to pursue their research in the field of medicinal chemistry.	K3
CO5	Interpretation of bioinorganic chemistry to crack the competitive examinations.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

Units	Content	Hrs
Unit I	Metals in Biology Metals and Non-metals in biological systems - Essential and trace elements - Role of different metal ions in biological systems - Sodium-Potassium pump – Calcium ATbase pump Ferritin –Hemosiderin- Transferrin- Blue copper proteins - Catecholase - Photosynthesis:Chlorophyll - Photosystem-I (PS-I) & II (PS-II) - Structure-function relationship - in-vivo and in-vitro nitrogen fixation.	15

Unit II	Structure and Function of Various Metalloenzymes Metalloenzymes - Definition - Examples - Active site structure and mechanism of action of- Carboxy peptidase-A and Carbonic anhydrase - Structure and function of Superoxide dismutase(SOD) (Fe-SOD, Mn-SOD, Cu-Zn couple SOD and Ni-SOD), Peroxidase and catalase enzymes - Xanthine oxidase – Nitrogenase, Hydrogenase, Urease.	15
Unit III	Heme and Non-heme Metalloenzymes Phorphyrin system - Structure and functions of Hemoglobin and Myoglobin - Dioxygenbinding, transport and utilization - Hemocyanin - Hemerythrin - Synthetic oxygen carriers -Vitamin B ₁₂ co-enzyme - Non-heme iron-sulphur proteins - Ferridoxins - Rubredoxins – Cytochrome. a,b,c, cytochrome P450, Cytochrome C oxidase,	15
Unit IV	Metals in Medicine Binding of metal ions and complexes to biomolecules, Types of binding - Nucleic acid structures - Fundamental interactions with nucleic acids - Binding interactions of tris-phenanthroline metal complexes with DNA - Techniques to monitor binding (Electronic absorption, Fluorescence and Circular dichroic spectral techniques, electrochemical behaviour, viscosity measurement and polarimetry). Chemotherapy - Radio diagnostic agents - MRI scanning - Chelating Agents (with special reference to EDTA) and therapy based on in vivo chelation of radio nucleotides - Dosage and toxicity.	15
Unit V	Drug Discovery and Design Drug discovery and design - Therapeutic index and chemotherapeutic index - Structure - activity relationship - Factors governing drug design - Computer aided drug design - Bleomycin – Doxorubicin - Cancer chemotherapy - Bioinorganic chemistry of platinum and ruthenium anticancer drugs - Mechanism of action of cisplatin - Clinical trials and their significance - Applications of Coordination complexes in medicine.	15
	Total Contact Hrs	75

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book**23PCY413**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Gurdeep Raj	Advanced Inorganic Chemistry	Geol Publishing House, 12 th Edition	2014
2	Madan. R.D	Advanced Inorganic Chemistry 84	S. Chand & company, New Delhi, 3 rd Edition	2011

3	Asim K. Das	Bio-inorganic chemistry	Books and Allied Pvt. Ltd	2015
4	Wolfgang Kaim, Brigitte schwederski, Axel klein	Bioinorganic chemistry: Inorganic Elements in the chemistry of life	Wiley, 2 nd edition	2013

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Keith F. Purcell, John. C. Kotz	Inorganic chemistry	Holt-Saunders International Editions.	1997
2	James E. Huheey	Inorganic chemistry	Pearson India Limited, 4 th Edition	Copyright 2006
3	Basolo, F. & Pearson. R.G.	Mechanisms of Inorganic Reactions: Study of Metal Complexes in Solution	Wiley Eastern Limited	1967
4	Ivano Bertini, Harry B. Gray, Stephen J.Lippard,	Bio-inorganic chemistry	VIVA books private Ltd	1998

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=6fRxAjMdMvE&list=PLRlh4Ip2fLusw2XTKlgOS9c5sGHCDlqW
https://www.youtube.com/watch?v=OgqPPFg4t6s
https://www.youtube.com/watch?v=k7Bf9p4-Kzo
https://www.youtube.com/watch?v=vnVMS_Dp0dU
https://www.youtube.com/watch?v=HkgsP0Jlc_o
https://www.youtube.com/watch?v=darVtuigUJA
https://www.youtube.com/watch?v=xzyR8Nsxloc

Mapping

PO / PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO										
CO1	H	M	H	H	M	H	M	M	H	L
CO2	M	H	M	H	M	-	L	M	M	-
CO3	H	M	H	H	H	M	H	H	L	-
CO4	H	M	H	H	M	-	M	H	H	H
CO5	M	H	M	H	M	-	M	M	H	H

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr. M. Velayutham Pillai Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:



Programme Code:	M.Sc		Programme Title:	Master of Chemistry			
Course Code:	23PCY414		Instrumental Methods of Chemical Analysis		Batch:	2023 – 2025	
					Semester:	IV	
Lecture Hrs./Week	4	Tutorial	1	Total Hrs/ Sem	75	Credits:	4
Course Objective							
* To study the various types of errors and their correlations.							
* To enable the students to attain knowledge on various chromatographic techniques and thermo analytical methods.							
* To gain knowledge in ESR, Mossbauer spectroscopy and AAS, AES, Polarimetry and Photo Electron Spectrometry.							
* To acquire knowledge about the configuration and confirmation of organic molecules by ORD and CD.							

Course Outcomes (CO)

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

#	Course Outcomes (CO)	Knowledge Level
CO1	Classify thermo analytical techniques and to assess the thermal stability of a chemical compound.	K2
CO2	Comprehend the basic principle, instrumentation and applications of various chromatographic techniques, thermal analysis.	K2
CO3	Apply data analysis, various chromatographic techniques to separate the compounds, electron spin resonance and Mossbauer spectroscopy in the field of research.	K3
CO4	Evaluate the basic principle, instrumentation and applications of photoelectron spectroscopy, AAS, FES and Polarimetry.	K5
CO5	Interpret the data in chemical analysis.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate		

Units	Content	Hrs
Unit I	Errors in Chemical Analysis Treatment of analytical data- Accuracy and precision. Absolute and relative errors. Classification and minimization of errors. Significant figures. Statistical treatment- mean and standard deviation, variance, confidence limits, student-t and f tests. Detection of gross errors, rejection of a result-Q test. Least square method, linear regression; covariance and correlation coefficient.	15

<p>Unit II</p>	<p>Chromatographic methods</p> <p>Solvent extraction - Methods of extraction and applications of solvent extraction. Solid phase extraction - methods and applications - chromatography - HPLC - outline study of instrument modules. UPLC, UHPLC and HPLC-Mass spectroscopy, ion exchange chromatography and LC-MS.</p> <p>Gas chromatography - basic instrumental set up - carriers, columns, detectors and comparative study of TCD, FID, ECD and NPD.</p> <p>Self-study: Thin layer chromatography and size exclusion chromatography.</p>	<p>15</p>
<p>Unit III</p>	<p>Thermal analysis</p> <p>Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) and Thermometric titrations - basic principles, Instrumentation and application. Atomic absorption spectroscopy and Flame emission spectroscopy- Basic principles - Instrumentation and applications.</p> <p>Photoelectron Spectroscopy</p> <p>ESCA (XPS): principle, chemical shifts - description of ESCA spectrometer, X-ray sources, samples, analysis, detectors and recording devices, applications.</p> <p>Auger electron spectroscopy (AES) and UV photo electron spectroscopy (UPS) - principles, applications and instrumentation.</p>	<p>15</p>
<p>Unit IV</p>	<p>Electron spin resonance</p> <p>Theory - derivative curves - 'g' values, Kramer's degeneracy - zero field splitting - hyperfine splitting - isotropic and anisotropic systems - identification of free radicals (CH₃ and C₆H₅ radicals, Copper - Iron complex) - applications.</p> <p>Mossbauer spectroscopy</p> <p>Principle and theory- Doppler Effect, Isomer shift - quadruple interactions - magnetic interactions.</p> <p>NQR spectroscopy</p> <p>Theory and Principle of NQR spectroscopy-Nature of electric field gradient, Energy levels and selection rules, Interaction of electric quadrupole with</p>	<p>15</p>

	electromagnetic radiation, nuclear orientations, the asymmetry parameter, quadrupole transitions in spherical, axially symmetric fields and not axially symmetric fields. Applications of NQR spectra. Self-study: Mossbauer spectroscopy – applications.	
Unit V	Polarimetry Circular Dichroism and Optical rotatory dispersion -Basic principles of ORD and CD - Cotton effects - Octant rule - axial halo ketone rules - applications of ORD and CD. Molecular fluorescence and phosphorescence Principles and Applications of Fluorometers -Phosphorometers. Self-study: Fluorescence and phosphorescence–applications.	15
	Total Contact Hrs	75

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

23PCY414**Text Book**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Gurdeep R. Chatwal, Anand, S.K.	Instrumental Methods of Chemical Analysis	Himalaya Publishing House.	2003
2	Sharma, B.K.	Instrumental methods of Chemical analysis.	Krishna Prakashan Media P.Ltd, 18 th Edition	2011
3	Ghosh	Introduction to Photoelectron Spectroscopy	NY, John Wiley & Sons	1983

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Skoog. D.A West. D.M & James Holler. F	Analytical Chemistry – An Introduction	Saunders College publishing	2000

2	Willard, H.H, Merrit L.L & Dean, J.A	Instrumental method of analysis	CBS Publishers & Distributors. 7 th Edition	2002
3	Drago, R.S	Physical methods in Inorganic chemistry	W. B. Saunders Company. 1 st Edition	1992
4	S.M. Khopkar	Basic Concepts of Analytical Chemistry	New Age International Publishers, 3 rd Edn	2008

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=OypCNBPmGBY
https://www.youtube.com/watch?v=a3FOOSOchlo
https://www.youtube.com/watch?v=XMtmSz_9umk
https://www.youtube.com/watch?v=ryo8Kd2Wgks
https://www.youtube.com/watch?v=5FczhvJrYNE
https://www.youtube.com/watch?v=DgA3-UnpSuI
https://www.youtube.com/watch?v=9zimhww51WI
https://www.youtube.com/watch?v=s7zsl9yFOsg
https://www.youtube.com/watch?v=a81cDH26f7A
https://www.youtube.com/watch?v=r55anTcoWvE
https://www.youtube.com/watch?v=X3AHbeZhKhU

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	H	M	M	H	H	-
CO2	H	H	H	M	H	M	-	H	H	-
CO3	H	H	H	H	H	M	L	H	H	-
CO4	H	H	M	M	H	L	M	H	H	-
CO5	H	H	H	H	M	M	H	H	H	-

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Mrs. K. Vimaladevi	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY4E7			*Major Elective –III Phytochemical Techniques and Health Chemistry	Batch:	2023 – 2025	
					Semester:	IV	
Lecture Hrs./Week	3	Tutorial Hrs./Sem.	-	Total Hrs/ Sem	45	Credits:	3

Course Objective

- * To enable post graduate students in Chemistry to gain knowledge on phytochemical techniques.
- * To enable them to be familiar with techniques of extraction, separation and purification and simple identification strategies of drugs/natural products.
- * To acquaint with health and hygiene food system along with carbohydrates and vitamins.
- * To learn the mode of mechanism for common diseases.

Course Outcomes

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

#	CO Statement	Knowledge Level
CO1	Understanding the necessity and role of carbohydrates and vitamins for humans.	K2
CO2	Remember the phytochemical techniques - extraction, separation and purification.	K5
CO3	Implement the basic values and analyze the functions of food, food pyramid and hygiene food system.	K5
CO4	Evaluate the mechanism for biological function of carbohydrates and vitamins.	K4
CO5	Analyze the mechanism and causes of common diseases.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
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Unit I	Extraction strategies of drugs/natural products Extraction Techniques - Cold and hot extraction methods - liquid-liquid extraction techniques - liquid-carbon dioxide extraction - concentration and evaporation techniques – lyophilisation - principles and technique of simple distillation - distillation under reduced pressure - fractional distillation - steam distillation - rotary evaporation and centrifugation.	10
Unit II	Separation Techniques of drugs/natural products Separation Techniques – Simple crystallization - experimental aspects – solvents for crystallization - Special methods – Flavanoids - pigment extraction - GC-MS - LC-MS- identification of phytochemicals by NIST Library.	9
Unit III	Purification Techniques of drugs/natural products Purification Techniques – Preliminary methods of identification of extracts – colour tests – TLC and fluorescent characteristics, proximate methods. Theory of melting and freezing – melting point and vapour pressure - <i>in vitro</i> biological assays- antibacterial, antifungal, antioxidant and anticancer activities.	10
Unit IV	Health: Definition: - Food - Food Pyramid, Health, Hygiene, mal, under and over nutrition –their causes and remedies, sanitation. Carbohydrates: Classification, biological functions. Vitamins: Classification, biological functions.	8
Unit V	Common Diseases: Toxicants in food cancer, types and causes, common diseases- jaundice, vomiting, fever, rickets, scurvy, beriberi, pellagra, gout, goiter, diabetes, anemia, night blindness, ulcer - their causes.	8
Total Contact Hrs		45

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

23PCY4E7**Text Book**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Harborne, J. B.	Phytochemical Methods-A Guide to Modern Techniques of Plant Analysis, 3 rd Edition.	Springer Publications.	2008
2	Ahluwalia & Madhu Chopra. V.K	Medicinal Chemistry	Ane Books India	2008
3	Ashutosh kar	Medicinal Chemistry, 5 th Edition	New Age International Publishers	2010
4	Jayashree Ghosh	A Textbook of Pharmaceutical Chemistry	S. Chand and Co. Ltd.	1999
5	Alex V Ramani	Food Chemistry	MJP Publishers, Chennai.	2009
6	Satake M and Mido Y	Chemistry for the Health Science	Discovery Publishing House, New Delhi.	2003

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Graham L. Patrick	An Introduction to Medicinal Chemistry, 4 th Indian Edition.	Oxford Publishers.	2009
2	Krishnaswamy. N. R	Chemistry of Natural Products, 2 nd Edition.	A Unified Approach Unified Press.	2010
3	Krishnaswamy. N. R	Chemistry of Natural Products A Laboratory Handbook, 1 st Edition.	University Press India Pvt. Ltd.	2003

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=jcgGjSLBA4Q
https://www.youtube.com/watch?v=IIIkq5RW2L0
https://www.youtube.com/watch?v=9KX0dWPxgYM
https://www.youtube.com/watch?v=krIgKr3IC7s
https://www.youtube.com/watch?v=fuNmvm5BvDM

Mapping

PO /PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	M	M	H	M	H	M	H	H	M	M
CO2	H	M	H	M	H	M	M	M	M	H
CO3	H	M	H	M	H	H	H	M	M	H
CO4	H	H	M	H	M	M	M	M	M	H
CO5	H	H	H	H	H	H	H	H	M	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi Dr. V. Prabhu Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY4E8			Major Elective III –Computational Chemistry	Batch:	2023 – 2025	
					Semester:	IV	
Lecture Hrs./Week	3	Tutorial	-	Total Hrs/Sem	45	Credits:	3
Course Objectives							
* To draw chemical structures by Chemdraw and graphs by Origin.							
* To gain knowledge about various computational tools and methods.							
* To learn Gaussian and DFT studies.							

Course Outcome

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

#	CO Statement	Knowledge Level
CO1	Know the available free databases like MOL, SMILES.	K2
CO2	Draw the chemical structure and graphs using Chemdraw and Origin.	K3
CO3	Gain the theoretical knowledge about Slater and Gaussian functions.	K3
CO4	Evaluate the molecular mechanics, <i>abinitio</i> , semi empirical and DFT studies.	K5
CO5	Calculate the optimization studies for various molecules.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	Representation of Chemical Compounds: 1D, 2D, 3D SMILES, InChI, Fingerprints (Daylight), Matrices, Connection Tables, mol & sdf files, Markush structures, Rotatable bonds and conformers, Molecular surfaces. Representation of Reactions: SMARTS, SMIRKS, Matrices. Searching chemical structures: Exact (Canonicalizing SMILES: Morgan, CANGEN), Clustering small molecules: Hierarchical and non-hierarchical methods. 3D pharmacophore based searching: Common Pharmacophore features, building hypotheses and searching databases. Chemical Databases: CSD, Pubchem, other relevant databases. Information content and applications. Data mining.	8

Unit II	<p>Chemdraw Software</p> <p>Opening and saving Chemdraw applications. Menu Commands: File – Edit – Arrange – Options – Font – Size – Style. Drawing the following features: Lewis dot structure - norbornane – center carbonyl oxygens – double bonds with a short line inside the ring – degree symbol in a caption.</p>	5
Unit III	<p>Origin Software</p> <p>Origin software and its applications - graphing - data exploration - exploratory analysis - curve and surface fitting - peak analysis - statistics - signal processing - mathematics - data processing - importing and exporting presentation - batch processing - project and data management - programming and connectivity.</p>	5
Unit IV	<p>Computational Chemistry</p> <p>Introduction: computational chemistry as a tool and its scope. Potential energy surface: stationary point, transition state or saddle point, local and global minima. Molecular mechanics methods: Force fields-bond stretching, angle bending, torsional terms, non-bonded interactions, electrostatic interactions. Important features of commonly used force fields like MM3, MMFF, AMBER, ADMET and CHARMM. <i>Ab initio</i> methods: A review of Hartee-Fock method. Basis set approximation.</p> <p>General Introduction to Semi Empirical Methods: Basic principles and terminology. Introduction to Density Functional Theory (DFT) methods: Hohenberg-Kohn theorems. Kohn-Sham orbitals. Exchange correlation functional. Local density approximation. Generalized gradient approximation. Hybrid functionals (only the basic principles and terms need to be introduced). Model Chemistry-notation, effect on calculation time (cost). Comparison of molecular mechanics, <i>ab initio</i>, semi empirical and DFT methods.</p>	18
Unit V	<p>Computational Chemistry Calculations</p> <p>Molecular geometry input- Cartesian coordinates and internal coordinates, Z-matrix. Z-matrix of: single atom, diatomic molecule, non-linear triatomic molecule, linear triatomic molecule, polyatomic molecules like ammonia, methane, ethane and butane. General format of GAMESS / Firefly input file. GAMESS / Firefly key word for: basis set selection, method selection, charge, multiplicity, single point energy calculation, geometry optimization, constrained optimization and frequency calculation.</p>	9
Total Contact Hrs		45

Softwares

Molecular Mechanics:

1. **Argus lab** available from www.arguslab.com/
2. **Tinker** available from www.dasher.wustl.edu/ffe/
Ab initio, semi empirical and DFT:

1. **Firefly / PC GAMESS** available from <http://classic.chem.msu.su/gran/games/>
2. **WINGAMESS** available from [http://www.msg.ameslab.gov/games/Graphical User Interface \(GUI\)](http://www.msg.ameslab.gov/games/Graphical%20User%20Interface):
1. **Gabedit** available from <http://gabedit.sourceforge.net/>
2. **wxMacMolPlt** available from <http://www.scl.ameslab.gov/MacMolPlt/>
3. **Avogadro** from http://avogadro.openmolecules.net/wiki/Get_Avogadr

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

23PCY4E8

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Lewars E.G	Computational Chemistry: Introduction to the Theory and Applications of Molecular and Quantum Mechanics	Springer, 2 nd Edition	2011
2	Jensen J.H	Molecular Modelling Basics	CRC Press	2010
3	Leach A.	Molecular Modelling: Principles and Applications	Longman, 2nd Edition	2001
4	Jr. Fackler J.P. Falvello L.R. (Eds.)	Techniques in Inorganic Chemistry: Chapter-4	CRC Press	2011
5	Ramachandran K.I. Deepa G, Namboori K	Computational Chemistry and Molecular Modelling: Principles and Applications	Springer	2008

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Hinchliffe A.	Molecular Modelling for Beginners	John Wiley & Sons, 2 nd Edition	2008
2	Cramer C.J.	Essentials of Computational Chemistry: Theories and Models	John Wiley & Sons, 2 nd Edition	2004
3	Young D.C.	Computational Chemistry: A Practical Guide for Applying Techniques to Real-World Problems	John Wiley & Sons	2001

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=c0y5KJXH6zw
https://www.youtube.com/watch?v=c0y5KJXH6zw
http://www.digimat.in/nptel/courses/video/104101095/L12.html
https://youtu.be/zVIZxHKP1e0
https://youtu.be/nKYrzrwaRmc
https://youtu.be/HCpjAViYbAI

Mapping

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	M	H	H	M	H	M	H
CO2	H	H	H	H	H	H	M	M	H	H
CO3	H	H	H	M	-	H	H	M	M	M
CO4	H	M	M	H	-	M	-	M	M	M
CO5	H	H	H	H	H	H	H	H	M	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY4E9			*Major Elective –III Green Chemistry	Batch:	2023 - 2025	
					Semester:	IV	
Lecture Hrs./Week	3	Tutorial	-	Total Hrs/Sem	45	Credits:	3
Course Objective							
* To understand the basic principles and importance of green chemistry for industrial applications.							
* To acquire knowledge about the microwave and ultra sound assisted synthesis.							
* To understand the concept of phase-transfer catalysis.							
* To gain knowledge about ionic liquids, Crown ethers and their applications.							

Course Outcomes (CO)

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

#	Course Outcomes (CO)	Knowledge Level
CO1	Define green chemistry and explain basic principles.	K2
CO2	Discuss and appraise green reagents, microwave and ultrasound assisted Synthesis.	K2
CO3	Analyse the synthetic applications and advantages of ionic liquids.	K4
CO4	Appraise the advantages and the applications of phase transfer catalyst in organic synthesis.	K5
CO5	Propose Crown ethers for various reactions.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	Green Chemistry: Definition, need for green chemistry, basic principles, planning a green synthesis in the laboratory- atom efficiency process & atom economy- rearrangement, addition, substitution, elimination. Synthesis involving basic principles of green chemistry – synthesis of styrene, adipic acid. Green chemistry in day-today life - dry cleaning of clothes, versatile bleaching agents.	9
Unit II	Green Reagents: Dimethyl carbamate, polymer supported reagents, green catalysts - acidic, basic, oxidation and polymer supported catalysts.	9

	Microwave Induced Green Synthesis: Introduction- microwave assisted reactions in water – Hoffmann elimination, hydrolysis, oxidation, inorganic solvents- esterification, chalcone synthesis, Diel’s Alder reaction, decarboxylation and Fries rearrangement.	
Unit III	Ultrasound Assisted Green Synthesis: Introduction- esterification, saponification, oxidation, reduction, hydroboration, coupling reaction, Diels Alder reaction, Cannizaro reaction, Strecker synthesis, Reformatsky reactions. Ionic Liquids: Introduction, applications in organic synthesis - Diels Alder reaction, advantages & disadvantages of ionic liquids.	9
Unit IV	Phase Transfer Catalysts: Introduction, definition, mechanism of phase transfer catalysed reaction, types and advantages of phase transfer catalysts, types of phase transfer catalysed reactions, preparation of phase transfer catalysts, applications of phase transfer catalysis in organic synthesis- alcohols from alkyl halides and addition to olefins.	9
Unit V	Crown ethers: Introduction, nomenclature, special features, nature of donor site, general synthesis of Crown ethers -synthesis of [12] Crown-4, [18] Crown-6 and cryptates. Synthetic applications – esterification, saponification and KMnO ₄ oxidation.	9
Total Contact Hrs		45

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book**23PCY4E9**

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Ahluwalia V. K.	Environmentally Benign Reactions	Ane Books Pvt Ltd, 2 nd Edition.	2012
2	Ahluwalia V. K. Kidwai M.	New Trends in Green Chemistry	Anamaya Publishers, Reprint	2012

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Rashmi Sanghi, Srivastava M. M.	Green Chemistry: Environment Friendly Alternatives	Narosa Publishing House, Reprint 4 th Edition.	2012

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=E2ohFKSYhg0
https://www.youtube.com/watch?v=7VHII7Sk7NY
https://www.youtube.com/watch?v=wjFc_Tj20oA
https://www.youtube.com/watch?v=5mBv_bJ7v8Q
https://www.youtube.com/watch?v=3oIQGJ4xdmg

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	M	H	M	H	H	H	H
CO2	H	H	H	M	M	M	H	L	H	M
CO3	H	H	H	H	-	M	H	H	M	H
CO4	H	H	H	H	H	L	H	H	H	H
CO5	H	H	H	H	-	M	M	M	M	M

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr. M. Velayutham Pillai	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme Code:		M.Sc		Programme Title:			Master of Chemistry		
Course Code:		23PCY415		Inorganic Chemistry Practical –II			Batch:	2023 - 2025	
							Semester:	III & IV	
Lecture Hrs./Week	III Sem	4	Tutorial	-	Total Hrs/Sem	III	60	Credits:	4
	IV Sem	5				IV	75		
Course Objective									
* To analyse quantitatively the metal ions such as Cu, Ni, Fe, Zn, Ca and Ba in a mixture.									
* To estimate quantitatively Magnesium, Calcium and Zinc by complexometry.									
* To separate the components in ink and flowers by Chromatography.									

Course Outcomes

On the completion of the course the student will be able to

#	CO Outcomes	Knowledge Level
CO1	Separate and estimate the metal ions in a mixture.	K5
CO2	Estimate the metal ions in complexes.	K4
CO3	Separate the components in natural and commercial products.	K4
CO4	Estimation of various inorganic ions.	K5
CO5	Distinguish the chromatographic techniques.	K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content
A	Titrimetry Complexometric titrations using EDTA - Estimations of Magnesium, Calcium & Zinc.
B	Gravimetric Determination of Metal Ions in Mixture 1. Determination of Copper & Nickel 2. Determination of Iron & Nickel 3. Determination of Copper & Zinc 4. Determination of Calcium & Barium 5. Determination of Copper & Iron

C	Colorimetric Estimations (using photoelectric colorimeter) –(Not for ESE) Estimation of Copper, Iron, Nickel, Manganese and Chromium
	Total Contact Hrs
	75 + 60 Hrs

Pedagogy: Demonstration and hands-on experience

Reference Books

23PCY415

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Vogel A.I.	A Text Book of Quantitative Inorganic Analysis	ELBS & Longmann, Green & Co. Ltd., 9 th Edition.	2011
2	Venkateswaran, V. Veeraswamy. R and Kulandaivelu, A.R.	Principles of Practical Chemistry	Sultan Chand & Sons, 2 nd Edition.	1997
3	Giri S, Bajpai D.N. and Panday O.P.	Practical Chemistry Vol. I & II	S.Chand & Co	1997
4	Bassart J. Dennay R.C. Jeffery G.H. and Mendham	Vogel's text Book of qualitative Inorganic Analysis	The ELBS & Longman, 4 th Edition.	2004

Mapping

PO / PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	M	H	H	M	-	M	M	H	M
CO2	H	H	H	M	H	-	M	M	H	M
CO3	H	H	H	H	H	-	H	M	H	H

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Mrs.M.Anusuya	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezian
Signature:	Signature:	Signature:	Signature:

Programme Code:		M.Sc		Programme Title:			Master of Chemistry		
Course Code:		23PCY416		Organic Chemistry Practical –II			Batch:	2023 – 2025	
							Semester:	III & IV	
Lecture Hrs./Week	III Sem	4	Tutorial	-	Total Hrs/ Sem	III	60	Credits:	4
	IV Sem	5				IV	75		
Course Objective									
* To estimate organic compounds quantitatively.									
* To learn and practice the methods of preparation of some organic compounds.									
* To understand some chromatographic techniques.									

Course Outcomes

On the completion of the student will be able to

#	Course Outcomes	Knowledge Level
CO1	Remember and practice aromatic substitution reactions and the basic principles of various chromatographic techniques.	K2, K4
CO2	Understand and evaluate the estimation of phenol, aniline, ketone and glucose.	K4
CO3	Estimate certain natural products and separate the compounds using chromatographic technique.	K5
CO4	Test the different types of chemical constituents in plant extracts.	K4
CO5	Furnish the pupil to estimate the adulteration level in the oil.	K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content
A	Quantitative Estimations: 1. Estimation of phenol, aniline, ethyl methyl ketone, Glucose (Iodimetry method and Bertrand's method). 2. Citric acid or ascorbic acid from a tablet or from a natural source.
B	Two Stage Preparations: 1. Benzanilide from benzophenone. 2. Acetyl salicylic acid from methyl salicylate.

	3. Preparation of <i>m</i> - nitrobenzoic acid from methyl benzoate. 4. Preparation of <i>p</i> - nitroaniline from acetanilide. 5. Preparation of <i>p</i> -bromo acetanilide from aniline.
C	Extraction: (Not for ESE examination) 6. Lactose from milk. 7. Caffeine from tea. 8. Curcumin from <i>Curcuma longa</i> . 9. Nicotine from tobacco extract.
D	Analysis of oil: (Not for ESE examination) 10. Reichart - Meisel value, saponification value and acetyl value.
Total Contact Hrs	
60+75 Hrs	

Pedagogy: Demonstration and hands on Experience

Reference Books

23PCY416

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Gnanprakasam and Ramamurthy	Organic Chemistry Laboratory Manual	Ananda Book Depot, Chennai.	2000
2	Arthur I. Vogel	Elementary Practical Organic Chemistry (Part-2) Qualitative Organic Analysis	Pearson Education, 2 nd Edition.	2011

Mapping

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO										
CO1	H	H	H	H	H	H	M	H	H	H
CO2	H	M	H	H	M	H	M	H	H	H
CO3	M	M	H	H	L	-	-	-	H	H
CO4	H	H	H	H	H	H	H	H	H	H
CO5	M	M	H	H	L	-	M	-	H	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr. M. Velayutham Pillai	Name: Dr.K.Poonkodi	Name: Mr .K. Srinivasan	Name: Dr. R. Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme code:		M.Sc		Programme Title :			Master of Chemistry	
Course Code:		23PCY417		Physical Chemistry Practical –II			Batch :	2023-2025
Lecture Hrs/Week:		III Sem	4	Tutorial :	-	Total Hrs/Sem:	III	60
		IV Sem	5				IV	75
Course Objective								
* To equip the future chemist with the knowledge of electrical conductance measurement, kinetics, UV visible spectrometer and conductometric titrations.								
* To learn maintain the record observations on conductometric titrations and chemical kinetics and ability to use various instruments.								

Course Outcomes (CO)

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

#	Course Outcomes (CO)	Knowledge Level
CO1	Acquire knowledge about conductometric titration, fundamentals of adsorption, metal ligand ratio and the acid hydrolysis of ester.	K2
CO2	Understand various laws of electrochemistry and applications of electrical conductance measurements and the applications of chemical kinetics.	K3
CO3	Determine the cell constant and verify the Debye-Huckel Onsager equation and Kohlrausch's law.	K5
CO4	Determine the relative strength of acids and rate of reaction.	K5
CO5	Estimate the amount of ions conductometrically and evaluate the amount of oxalic acid adsorbed using charcoal as adsorbent.	K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

	Content	Hrs
A	Electrical Conductance Measurements: 1. Verification of Debye-Huckel Onsager equation 2. Ostwald's dilution law 3. Verification of Kohlrausch's law 4. Determination of Solubility Product of sparingly soluble salt	
B	Conductometric Titrations: Acid-Base Titrations 5. Strong Base Vs Weak Acid, Strong Acid Vs Strong Base 6. Strong Base Vs Mixture of (weak and strong) Acids 7. Determination of <i>pH</i> of Buffer	
C	Precipitation titrations 8. AgNO ₃ Vs mixture of halides (KCl & KI) 9. BaCl ₂ Vs MgSO ₄	

D	Chemical Kinetics 10. Acid hydrolysis of an ester - Relative strength of acids 11. Reaction kinetics of KI and K ₂ S ₂ O ₈ 12. Iodination of acetone	
E	Adsorption 13. Adsorption of oxalic acid on charcoal 14. Study of adsorption of acetic acid on activated carbon	
Total Contact Hrs		75+60 Hrs

Pedagogy: Demonstration and hands on practicals

Reference Books

23PCY417

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Palit S.R. and De S.K.	Practical Physical Chemistry	Science Book Agency, Calcutta	2003
2	Sharma P.C. and Agarwal	Practical Chemistry	Goel Publishing House, Meerut.	1998
3	Venkateswaran and Kulaindaivelu	Practical Physical Chemistry	S. Chand & Co.	2005
4	Sundaram S and Raghavan K	Practical Chemistry.	S. Viswanathan Co.	1996
5	Yadav J. B	Advanced Practical Physical Chemistry	Goel Publishing House	2001
6	Gurthu J. N. Kapoor R	Advanced Experimental Chemistry	S. Chand and Co.	1987

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	M	H	H	M	H	H	H	H	M
CO3	H	H	M	H	H	M	H	M	M	H
CO4	M	H	H	M	H	H	H	H	H	H
CO5	H	H	M	H	H	M	-	-	M	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme code:	M.Sc		Programme Title :		Master of Chemistry		
Course Code:	23PCY4P1		Project Work & Viva-Voce		Batch	2023-2025	
					Semester	IV	
Lecture Hrs/Week:	2	Tutorial	-	Total Hrs/Sem	30	Credits:	5
Course Objective							
* Make the students to understand the importance of experimental analysis, scientific approach in solving problems related to the environment and society.							
* Educate and train the students to write scientific papers.							

Course Outcomes (CO)

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

#	Course Outcomes (CO)	Knowledge Level
CO1	Apply the various preliminary skills in laboratory.	K3
CO2	Analyze the various sources of literature review.	K4
CO3	Evaluate the various techniques from the previous studies.	K5
CO4	Apply the suitable parameters in the project work.	K5
CO5	Synthesis the various organic, nano and co-ordination compounds	K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Individual Project and Viva Voce

- Each faculty will be allotted 4/5 students.
- The topic/area of work will be finalized at the end of third semester, allowing scope for the students to gather relevant literature during the vacation.
- The research work can be carried out in the college or at any other organization approved by the College.
- Viva Voce/Power point presentation will be conducted by a panel comprising of HOD, internal / external examiners.

Research Areas

Synthetic Organic Chemistry, Coordination Chemistry, Phytochemistry, Surface Chemistry and Nanochemistry, etc.

Methodology

Each project should contain Introduction, Review of Literature, Materials and Methods, Results and Discussions – evidences in the form of figures, tables and photographs, Summary and Bibliography.

Evaluation - Total - 100 Marks (Internal – 25 marks, External – 75 marks)

Internal

Total – 25 marks

Review		Marks
I	Selection of the field of study, Topic & Literature collection	25
II	Research Design and Data Collection	
III	Analysis & Conclusion, Preparation of rough draft	
IV	Paper Presentation in National / International Conference (Or) Paper Publication in UGC Care list Journals	

RULES GOVERNING THE EVALUATION OF PROJECT REPORT AND VIVA

VOCE

SELECTION OF TOPIC:

- Each student shall select a topic for his / her project in consultation with his / her Guide and the Head of the Department.
- The project report should contain a minimum of 50 pages in A4 format excluding bibliography and appendices.
- Each student should submit two copies of his / her project report for evaluation.
- Last date for the submission of Project Report:
- The project report should be submitted to Department (P.G. Courses) through the Guide **on or before the last working day** for the students of the College for the academic year.
- If a student fails to submit the project report on or before the last working day, he / she will not be eligible for getting rank.

FIRST EXTENSION :

- If the student fails to submit the project report within the stipulated time, he / she may be permitted to submit the same one day prior to the date of *viva voce*.

SECOND EXTENSION :

- If the student fails to submit the project report one day prior to the date of *viva voce* then, he / she may apply for a second extension of three months duration.
- The above two extensions may be granted by the Principal based on the written recommendations from the Guide and the Head of the Department.
- Any other unforeseen problems / situations, not mentioned above if arise regarding the project report and *viva voce*, will be placed in the College Council and suitably resolved.

External

Total – 75 marks

Project	Total – 50 marks
1. Relevance of the topic to the academic / society	10 Marks
2. Objectives	10 Marks
3. Experimental design	15 Marks
4. Results and discussion	15 Marks
Viva Voce	Total – 25 marks
5. Presentation	15 Marks
6. Discussion	10 Marks

Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	H	H	M	H	H	H
CO2	H	M	H	H	M	H	M	H	H	H
CO3	M	M	H	H	L	-	-	-	H	H
CO4	H	H	H	H	H	H	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi Mrs. K. Vimaladevi Dr. M. Velayutham Pillai Dr.V.Prabhu Mrs.M.Anusuya	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

**ADVANCED
LEARNERS
COURSE**

Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	23PCY3AL			Applied Chemistry (Optional)	Batch:	2023 – 2025	
					Semester:	III	
Lecture Hrs./Week	-	Tutorial	-	Total Hrs/Sem	-	Credits:	Grade
Course Objective							
* To understand the chemistry of dairy and leather processing.							
* To acquire knowledge about ceramic products and lubricants.							
* To learn about explosives and rocket fuels.							

Course Outcomes

On the completion of the course the student will be able to

#	CO Statement	Knowledge Level
CO1	List the properties of milk & predict the quality	K1
CO2	Explain the different steps in leather processing and analyze the effluent problems in tanneries	K3
CO3	Use your understanding for the production of manufacturing of ceramic products	K4
CO4	Design and synthesis lubricants with enhanced properties and performance	K4
CO5	Utilize your skills to assess the quality of milk, create leather, and produce the essential raw materials for the ceramics industry.	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content
Unit I	Dairy Chemistry: Composition of Milk, factors affecting the composition of milk, micro flora of raw milk, milk fat/ proteins/sugar flavour and aroma, physical properties, effect of heat, milk processing – clarification, pasteurization, homogenization. Milk products- Cream, Butter, Ice cream and milk powder. Adulteration of milk.
Unit II	Leather Chemistry: Introduction, Structure of hides and skin, Leather Processing – Process before tanning- flaying and curing (drying, salt curing and brine curing and pickling), Soaking, Liming, Fleshing, Unhairing, Deliming and Bathing. Tanning Processes – Vegetable, Synthetic,

	Chrome and Aldehyde tanning. Tannery effluents and Byproducts – primary and secondary treatments.
Unit III	Ceramic Industries Basic raw materials- Chemical conversions including basic ceramic chemistry, Whitewares, Structural clay products, Refractories – specialized ceramic products, vitreous enamel, kilns.
Unit IV	Lubricants Introduction, functions, requirements, mechanism of lubrication, classification of lubricants, properties of lubricating oil – viscosity, viscosity index, oiliness, flash and fire points, cloud and pour points, carbon residue, aniline point, volatility, corrosion and decomposition stabilities.
Unit V	Explosives and rocket fuels Introduction, characteristics, classification – primary, high and low, requirements of explosives, rocket propellants, characteristics, classification – solid and liquid propellants with examples.

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

23PCY3AL

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Durga Nath Dhar	Applied Chemistry –II	Vayu Education of India. 1 st Edition.	2010
2	B. Srilakshmi	Food Science	New Age International Publishers. 7 th Edition.	2014
3	Jayashree Ghosh	Fundamental Concepts of Applied Chemistry	S. Chand &Co. 1 st Edition.	2006
4	M. R. Adams & Maurice O. Moss	Food Microbiology	RSC Publishers, 3 rd Edition.	2007

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	George T. Austin	Shreve's Chemical Process Industries	McGraw – Hill Book Co, 5 th Edition.	1984
2	M. Karunanithi, T. Ramachandran, H.Venkataraman, N. Ayyaswamy	Applied Chemistry	Anuradha Agencies, Reprint	2006

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

https://www.youtube.com/watch?v=DQ7GmVYD7n0
https://www.youtube.com/watch?v=GQngqnmkIDM
https://www.youtube.com/watch?v=9PgjtJPIakY
https://www.youtube.com/watch?v=RTQ_J8yLw9k
https://www.youtube.com/watch?v=YFGLs7iAkaw

Mapping

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	M	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H	H	H
CO4	H	H	M	H	M	H	H	H	H	H
CO5	H	H	H	M	M	H	H	H	H	M

H-High; M-Medium; L-Low

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Manicka Chezhan Signature:

**VALUE ADDED
COURSES**



Programme code:	M.Sc	Programme Title :		Master of Chemistry	
Course Code:	23PCY2VA	Value Added Course: Entrepreneurial Ventures in Chemistry		Batch	2023-2025
				Semester	II / IV
Lecture Hrs/Week:	2	Total Hrs/Sem	30	Credits:	2

Course Objectives

- * To provide knowledge of household products to address the needs of chemical industry.
- * Able to synthesize house hold Cleaning agents, formulation of cosmeceuticals and hygiene products.
- * To enhance student sense of enthusiasm for chemistry and to involve them in an intellectually stimulating experience of learning in a supportive environment.
- * To impart knowledge on marketing approaches on studying consumer need, need gaps and global markets.

Employability

- * To provide worldwide opportunity to study household products.
- * Students have the opportunity to undertake an optional placement and enhance their entrepreneur skill by offering valuable experience.

Advantages

Students will be familiar with the different exposure of chemicals used in day to day life such as Cleaning agents, surfactants and Insect repellent one can design and practice ecofriendly cosmetics of their own.

Course Outcomes

- * To acquire basic information about the possibilities and limitations of household products, their importance and marketing.
- * To familiarize the authorized ingredients for household products, their origin, chemical nature and importance.
- * Develop new innovations in Chemical, pharmaceutical, cosmetics and allied chemical industries and successfully implement them at an industrial scale.
- * Hands on experience for manufacturing industries.

Units	Content	Hrs
Unit I	Cleaning agents: Soaps and detergents: Types (cationic and anionic), physical and chemical characteristics, advantages and disadvantages. Examples of Commercially available cleaning agents (shampoo, hand wash, face-wash)	6
Unit II	Disinfectants: Introduction, types, physical and chemical properties, classification (acids, alcohols, aldehydes, alkalis, halogens, phenols) Sanitizers: Sanitizers-Introduction, types, raw material used in making professional hand sanitizer with properties, WHO recommendations for hand sanitizers.	6
Unit III	Cosmetics: Oils, fats, and waxes - Introduction, physical and chemical properties, their use in cosmetics, Preservatives-Introduction, properties, types and their significance. Transition to Greener approach: Importance and Principles of Green Chemistry, bio-enzymes as disinfectants, green cosmetics-make up, shampoo, face pack, face mask, lipsticks.	12
	Practicals 1. Preparation of Soaps. 2. Preparation of liquid detergent using animal fat. 3. Preparation of Hand-Sanitizers. 4. Preparation of Disinfectants. 5. Preparation of cleaning agents using bio-enzymes.	6
	Total Contact Hrs	30

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

23PCYV01

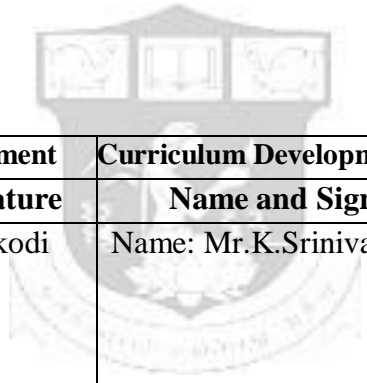
Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Takeo Mitsui	New Cosmetic Science	Elsevier Science Ltd.	1997
2	Sargin C.B	Cosmetic Science and Technology	Wiley India Pvt Ltd; 2 nd Edition	2008
3	Linda D.Rhein, Anthony O'Lenick.	Surfactants in personal care products and decorative cosmetics	CRC Press, 3 rd Edition.	2020

4	B.P. Sen	Handbook on Synthetic detergents	Das Gupta & Company (P) Ltd. 1st edition	2004
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Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Kuo-Yann Lai	Liquid Detergents	CRC Press, 2 nd Edition	2020
2	Mylene Stedmen	Soap-Making Manual A Practical Handbook on the Raw Materials, Their Manipulation, Analysis and Control in the Modern Soap Plant(E-Book)	Dhanpat Rai Publishing Company, 15 th Edition	2018



Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi Mrs. M.Anusuya	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Manicka Chezhan
Signature:	Signature:	Signature:	Signature:

Programme code:	M.Sc	Programme Title :		Master of Chemistry	
Course Code:	23PCY4VA	Value added course Biofuels and Energy Storage Devices		Batch	2023-2025
				Semester	II / IV
Lecture Hrs/Week:	2	Total Hrs/Sem	30	Credits:	2
Scope					
* This course will train participants with the knowledge and skills required for energy storage devices.					
* This course is designed to expertise in current trends in batteries and energy storage devices.					

Course Objectives
Upon completion, the participant should be able to:
* To enable the students to attain knowledge on different types of batteries.
* To gain knowledge in biofuels and fuel cells.
Course Outcomes
* Graduates will be qualified to work in energy sector.
* To apply the various recent trends in battery research.
* Students have the opportunity to undertake an optional placement and enhance their entrepreneur skill by offering valuable experience.

Units	Content	Hrs
Unit I	Energy storage and conversion devices Charge storage mechanism, lead-acid batteries, metal ion batteries, metal sulfur batteries, metal air batteries, super capacitors, pseudo capacitors, advanced Li-ion and beyond Li-ion battery systems (multivalent battery systems), redox-flow batteries, solid state thin film batteries, solid state micro super capacitors.	7
Unit II	Fuel cells Classification - chemistry of fuel cells - detailed description of hydrogen/oxygen fuel cells - methanol - molten carbonate solid polymer electrolyte and biochemical fuel cells.	8
Unit III	Solar energy conversion devices - photovoltaic cells - photo electrochemical cells - semiconductor electrolyte junctions photo catalytic modes for fuel conversion process - photo biochemical options. Hydrogen as a fuel - production (thermal, electrolysis, photolysis and photo electrochemical) storage and applications of hydrogen storage. Other methods of energy conversion: processes especially in the form of storage as chemical energy.	15
Total Contact Hrs		30

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	A. S. J. Appleby and F. K. Foulkes,	Fuel cell Hand Book	Von Nostrand Reinhold	1989
2	D. Linden	Hand book of batteries and Fuel cells	McGraw Hill Book Company	1984

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	T. Ohta	Solar Hydrogen energy systems	Peragamon Press	1979
2	M. Gratzel	Energy Resources through photochemistry and catalysis	Academic Press	1983
3	T. Ohta	Energy Technology, Sources, Systems and Frontiers conversions	Pergamon	1994
4	J. G. Speight	The chemistry and technology of petroleum	Marcel Dekker Inc.	1980



Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Ms. K.Vimaladevi Dr.V.Prabhu Dr. M. Velayutham Pillai	Name: Dr.K.Poonkodi	Name: Mr.K.Srinivasan	Name: Dr.R.Muthukumaran
Signature:	Signature:	Signature:	Signature:



Programme code:	M.Sc			Programme Title :	M.Sc Chemistry
Course Code:	CERTIFICATE COURSE-I			Batch	2023-2025
23PCYCFC01	Fundamentals of Pharmaceutical Chemistry			Semester:	III
				Credits:	2
Lecture Hrs/Week	2	Tutorial	-	Total Hrs/Sem:	30
Course Objectives:					
* To compete during their search for jobs in the pharmaceutical companies.					
* To acquire the knowledge about medicinal plants and medicinally important compounds.					
* To recognize the importance of Antibiotics, sulphadugs, Analgesics.					
* To analyze the Antipyretics, Antihypertensive, hypotensive and antineoplastic drugs.					

Course Outcomes (CO)

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

#	CO Outcomes	Knowledge Level
CO1	Acquire knowledge about the important terminologies used in pharmaceutical chemistry, naming of drugs and mechanism of drug action.	K2
CO2	Learn about medicinal plants and medicinally important compounds.	K4
CO3	Recognize the importance of Blood, receptor and drug design.	K5
CO4	Analyze the Antipyretics, Antihypertensive, hypotensive and antineoplastic drugs.	K4
CO5	Explain receptors and drug design	K5
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate		

Units	Content	Hrs
Unit I	Introduction to Pharmaceutical Chemistry Introduction Important terminologies used in pharmaceutical chemistry – pharmacology – drug – pharmacophore – antimetabolites – mutation – Grams test – actinomycetes – immunological agents – vaccines – toxoids – immune – human sera – primary immunization – routes of drug administration – additive effect – synergism – antagonism – placebo – important drugs which cause dependence – dosage – mechanism of drug action – factors influencing the metabolism of drugs – principles of bio assay – encapsulation – naming of drugs.	8

Unit II	Medicinal Plants Medicinal plants and medicinally important compounds Indian medicinal plants – medicinal plants in cure of diseases – spices as medicines – medicinal plants in the kitchen garden – plant poisoning –medicinally important compounds of Mg, Al, P, As, Hg and Fe-testing cholesterol in serum-estimation of bilirubin in serum– estimation of urea in serum and estimation of inorganic chlorides in blood serum.	8
Unit III	Clinical Chemistry Blood: Composition of blood – estimation of hemoglobin – red cell count. Diagnostic tests in Serum: Na and K salts, chlorides and cholesterol. Estimation Methods: Determination of sugar (glucose) in serum – Folin and Wu’s method, Determination of serum cholesterol – Sackett’s method for total cholesterol. Estimation of glucose in urine – Benedict’s test.	8
Unit IV	Analgesics and Antipyretics Analgesics and Antipyretics Introduction to pharmaceutical chemistry analgesics – Morphine analogues and its modification – Codeine – Synthetic narcotic analgesics – Pethidine and methadone – Narcotic antagonists – Nalorphine – Antipyretic analgesics – pyrazoles – salicylic acid – paraaminophenol derivatives -Aspirin and salol hypnotics and sedatives – Barbiturates –Benzodiazepines.	8
Unit V	Receptors and Drug Design Receptor: Nature of receptors, criteria for receptor identity, types of drug-receptor binding interactions. Drug design: introduction – identification of lead compound by serendipity, endogenous sources, exogenous sources, rational drug design, screening. Optimization of lead compound: analog synthesis.	8
Total Contact Hrs		40

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

23PCYCFC01

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Berger	Medicinal Chemistry	A, Wiley Interscience, New York, Volume I and II,	1990.
2	AsutoshKar	Medicinal Chemistry	Wiley Eastern Ltd, Chennai,	1992

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Bentley Driver's	Textbook of Pharmaceutical Chemistry		1985
2	Wilson, O. Giswold George.F	Textbook of Organic medicinal and pharmaceutical chemistry,	Philadelphia,	1991

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites]

<https://nptel.ac.in/courses/104/106/104106106/>

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Name: Dr.K.Poonkodi	Name: Dr. K. Poonkodi	Name: Mr. K. Srinivasan	Name: Dr. R. Manicka Chezhan
Signature:	Signature:	Signature:	Signature: