MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE

(An Autonomous College)

Affiliated to Periyar University, Salem | Accredited by **NAAC** with '**A**' Grade

Recognized by **UGC** under Section 2(f) & 12 (B)

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE (Autonomous)

A UNIT OF VANETRA GROUP

ESTD-1994

Learn. Lead

DEGREE OF MASTER OF SCIENCE

Learning Outcomes – Based Curriculum Framework

– Choice Based Credit System

Syllabus for M.Sc., Chemistry

(Semester Pattern)

(For Candidates admitted from the academic year 2023-2024 and onwards)

Regulation and Syllabus for
M.Sc., Chemistry
(With effect from the Academic Year 2024-25)

Vision:

To redefine the scope of higher education by infusing into each of our pursuits, initiatives that will encourage intellectual, emotional, social and spiritual growth, thereby nurturing a generation of committed, Knowledgeable and socially responsible citizens.

Mission:

*To Ensure State of the world learning experience

*To Espouse value based Education

*To Empower rural education

*To Instill the sprite of entrepreneurship and enterprise

*To create a resource pool of socially responsible world citizens

QUALITY POLICY

To Seek – To Strive – To Achieve greater heights in Arts and Science, Engineering, Technological and Management Education without compromising on the Quality of Education.

DEPARTMENT OF CHEMISTRY

Vision:

Department is dedicated to provide a high quality education in Chemistry for the students and to create young chemist to survive for social and scientific well-being.

Mission:

- To develop the department as a research ground for rural students
- To ensure that the department is equipped with highly sophisticated instruments

PREAMBLE

Master of Science in Chemistry (M.Sc.,) program is two years of study. Due to the relevance of chemistry in many various businesses and research domains, offer a wide variety of work options across multiple industries. In the end, the M.Sc., in Chemistry gives students a wide range of career options and the ability to work in a variety of industries, including government, research, and academia. With the right information, abilities, and experience, M.Sc., Chemistry graduates can have prosperous and meaningful careers in the fields of their choice. Furthermore, the most popular options for higher education among students are an M.Phil or Ph.D. in Chemistry.

PROGRAMME LEARNING OUTCOME NATURE AND EXTENT OF THE PROGRAMME

The Post-Graduate Programme in Chemistry will impart advanced knowledge of basic and applied chemical sciences to the graduates. It will prepare the students for taking up challenging assignments in academia and industry and also empower them with skill and knowledge for generating employment for their own and others. The Programme introduces the students to advanced developments in chemical sciences as well as in the field of other allied sciences, by providing them multidisciplinary and interdisciplinary courses. The design of choice-based curriculum can enrich students with analytical and problem-solving capabilities. It is designed to bring out the best of the abilities of each student, allow them to sharpen the scientific temper and be abreast with the contemporary developments in the area.

The programme includes a balanced combination of Core, Electives and Skill based Courses. The courses are designed in such a way to cover the entire spectrum of chemical sciences from fundamentals (that will bring admitted students from various backgrounds to a common level) to most recent advancements in the field (that will make them ready to take up challenging assignments in the real world).

The M.Sc. (Chemistry) Programme is of two years duration which is divided into four semesters. The teaching and learning in the Programme will involve theory

(lectures), practicals, tutorial and seminar-based classes. During the whole programme about 40 % syllabus of each course may be delivered via blended teaching learning approach.

The curriculum will be taught through formal lectures with the aid of pre-made presentations, audio and video tools whenever necessary. Other teaching aids can also be used as and when required. The additional requirements like industrial visits, summer training and project work are also incorporated into the curriculum.

AIM OF THE PROGRAMME

- To inculcate basic and advanced knowledge of chemical sciences among students.
- To provide higher education, disciplinary and inter/multi-disciplinary research oriented knowledge to the students to make them lifelong learners.
- To provide a learned, skilled and creative pool of graduates who are ready to take up challenging assignments in different kinds of chemical industries, research institutions and academia.
- To mould responsible, proactive citizens who are equipped with scientific thinking and skills to address problems of their locality
- Adequate blend of theory, computation and hands-on experiments.
- Modernized lab courses – close to recent/current research.

GRADUATE ATTRIBUTES

GA 1 Disciplinary Knowledge
GA 2 Self-directed Learning
GA 3 Multi-cultural Competency
GA 4 Research-related Skill
GA 5 Analytical Reasoning
GA 6 Moral and Ethical Reasoning
GA 7 Communication Skill

Disciplinary Knowledge:

a) ability to identify, speak and write about different literary genres, forms, periods and movements
b) ability to understand and engage with various literary and critical concepts and categories
c) ability to read texts closely, paying attention to themes, generic conventions, historical contexts, and linguistic and stylistic variations and innovations

d) ability to understand appreciate, analyse, and use different theoretical frameworks
e) ability to locate in and engage with relevant scholarly works in order to develop one's own critical position and present one's views coherently and persuasively
f) ability to situate one's own reading, to be aware of one's position in terms of society, religion, caste, region, gender, politics, and sexuality to be self-reflexive and self-questioning
g) ability to understand the world, to think critically and clearly about the local and the global through a reading of literatures in translation and in the original, to be a located Indian citizen of the world
h) ability to see and respect difference and to transcend binaries

Self-Directing Learning:

a) ability to work independently in terms of reading literary and critical texts
b) ability to carry out personal research, postulate questions and search for answers

Multicultural Competence:

a) ability to engage with and understand literature from various nations and reasons and languages
b) ability to respect and transcend differences

Research-Related Skills:

a) ability to problematize; to formulate hypothesis and research questions, and to identify and consult relevant sources to find answers
b) ability to plan and write a research paper

Analytical Reasoning:

a) ability to evaluate the strengths and weaknesses in scholarly texts spotting flaws in their arguments
b) ability to use critics and theorists to create a framework and to substantiate one's argument in one's reading of literary texts

Moral and Ethical Reasoning:

a) ability to interrogate one's own ethical values, and to be aware of ethical issues
b) ability to read values inherited in literary texts and criticism viz, the environment, religion and spirituality, as also structures of power

Communication Skills:

a) ability to speak and write clearly in standard, academic English

b) ability to listen to and read carefully various viewpoints and engage with them.

c) ability to use critical concepts and categories with clarity

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1	:	Post Graduates will be able to promote learning environment to meet the Industry expectation
PEO2	:	Post Graduates will be incorporated the critical thinking with good Communication and Leadership skills to become a self-employed
PEO3	:	Post Graduates will be upholding the human values and environmental sustenance for the betterment of the society

PROGRAMME OUTCOMES (POs)

PO1	:	Post graduates will attain profound proficiency and expertise
PO2	:	Post graduates will be ensured with corporative self – directed learning
PO3	:	Post graduates will acquire acumen to handle diverse contexts and function in domains of multiplicity
PO4	:	Post graduates will exercise intelligence in research Investigations and Introducing innovations
PO5	:	Post graduates will learn ethical values and commit to Professional ethics.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1	:	Construct a firm foundation in the fundamentals and connect the application with the current developments in chemistry
PSO2	:	Gain knowledge in laboratory techniques and be able to perform new experiments, obtain experimental data and its interpretation through the theoretical principle
PSO3	:	Possess capacity of working in research labs and related fields, ability to design a synthetic route for new compounds and transform innovative ideas into reality.
PSO4	:	Carry professional skills to handle standard equipment and to analyze the data, to be employed in the various sectors like chemical, pharmaceutical, food, and materials industries
PSO5	:	Stimulate the students to prepare for competitive examinations, and professional careers and get trained for industrial entrepreneurship

REGULATIONS (2024-2025)

1. DURATION OF THE PROGRAME

1.1 Two years (Four semesters)

1.2 Each academic year shall be divided into two semesters. The odd semesters Shall consist of the period from June to November of each year and the even Semesters from December to May of each year.

1.3 There shall be not less than 90 working days for each semester.

2. ELIGIBILITY FOR ADMISSION

2.1 A candidate who (1) has passed the B.Sc., Chemistry as the Main subject of study or (2) is a Graduate in B.Sc., Chemistry, or (3) an examination of Universities accepted by the Syndicate of the Periyar University as equivalent there to, shall be permitted to appear and qualify for the M. Sc., Degree examination in this Branch at Muthayammal College of Arts and Science (Autonomous), Rasipuram.

3. CREDIT REQUIRMENTS AND ELIGIBILITY FOR AWARD OF DEGREE

3.1. A Candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study in a College affiliated to the University for a period of not less than two academic years and passed the examinations of all the four Semesters prescribed earning a minimum of 91 credits as per the distribution given in Regulation fulfilled such other conditions as have been prescribed thereof.

4. COURSE OF STUDY, CREDITS AND SCHEME OF EXAMINATION

4.1 The Course Components and Credit Distribution shall consist of the following: (Minimum Number of Credits to be obtained)

S. No	Study Components	Credit Distribution
01	Core, Elective, EDC, and Project Courses	**84**
02	Internship	**02**
03	Human Rights	**02**
04	Professional Competency Skills	**02**
	Extension Activity	**01**
Total Credits		**91**

4.1.1 Extension Activity:

Students shall be awarded a maximum of 1 Credit for Compulsory Extension Service. All the Students shall have to enroll for clubs / NSO (Sports & Games) Retract / Youth Red Cross or any other Service Organizations in the College and shall have to put in compulsory minimum attendance of 40 hours which shall be duly certified by the Principal of the College before 31st March in a year. If a student lacks 40 hours attendance in the first year, he or she shall have to compensate the same during the subsequent years.

Those students who complete minimum attendance of 40 hours in one year will get 'half-a- credit and those who complete the attendance of 80 or more hours in Two Years will get 'one credit'. Literacy and Population Education and Field Work shall be compulsory components in the above extension service activities.

4.2 Inclusion of the Massive Open Online Courses (MOOCs) available on SWAYAM and NPTEL

4.2.1 Students can choose the MOOC Course Available on SWAYAM and NPTEL under Core, Elective or Soft skill category. He/ she will be awarded degree only after producing valid certificate of the MOOC course for credit Mobility

5. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

5.1 Eligibility: Students shall be eligible to go to subsequent semester only if they earn sufficient attendance as prescribed by the Periyar University.

5.2 Attendance: All Students must earn 75% and above of attendance for appearing for the End Semester Examination.(Theory/Practical)

5.3 Condonation of shortage of attendance: If a Student fails to earn the minimum attendance (Percentage stipulated), the Principals shall condone the shortage of attendance up to a maximum limit of 10% (i.e. between 65% and above and less than 75%) after collecting the prescribed fee for Theory/Practical examination separately, towards the condonation of shortage of attendance. Such fees collected and should be remitted to the University.

5.4 Non-eligibility for condonation of shortage of attendance: Students who have secured less than 65% but more than 50% of attendance are NOT ELIGIBLE for condonation of shortage of attendance and such Students will not be permitted to appear for the regular examination, but will be allowed to proceed to the next year/next semester of the program and they may be permitted to take next University examination by paying the prescribed condonation fee

5.5 Detained students for want of attendance: Students who have earned less than 50% of attendance shall not be permitted to proceed to the next semester and to complete the Program of study. Such Students shall have to repeat the semester, which they have missed by rejoining after completion of final semester of the course, by paying the fee for the break of study as prescribed by the College from time to time.

5.6 Condonation of shortage of attendance for married women students: In respect of married women students undergoing PG programs, the minimum attendance for condonation (Theory/Practical) shall be relaxed and prescribed as 55% instead of 65% if they conceive during their academic career. Medical certificate from the Doctor (D.G.O) from the Government Hospital and the prescribed fee along with attendance details shall be forwarded to the college to consider the condonation of attendance mentioning the category

5.7 Zero Percent (0%) Attendance: The Students, who have earned 0% of attendance, have to repeat the program (by rejoining) without proceeding to succeeding semester and they have to obtain prior permission from the College/University immediately to rejoin the program.

5.8 Transfer of Students and Credits: The strength of the credits system is that it permits inter-Institutional transfer of students. By providing mobility, it enables individual students to develop their capabilities fully by permitting them to move from one Institution to another in accordance with their aptitude and abilities by obtaining necessary permission from the university.

5.8.1. Transfer of Students is permitted from one Institution to another Institution for the same program with same nomenclature.

Provided, there is a vacancy in the respective program of Study in the Institution where the transfer is requested.

Provided the Student should have passed all the courses in the Institution from where the transfer is requested.

5.8.2 The marks obtained in the courses will be converted and grades will be assigned as per the College norms.

5.8.3 The transfer students are eligible for classification.

5.8.4 The transfer students are not eligible for Ranking, Prizes and Medals.

5.8.5 Students who want to go to foreign Universities up to two semesters or Project Work with the prior approval of the Departmental/College Committee are allowed to get transfer of credits and marks which will be converted in to Grades as per the University norms and are eligible to get CGPA and Classification; they are not eligible for Ranking, Prizes and Medals.

5.9. Students are exempted from attendance requirements for online courses of the College and MOOC's.

6. EXAMINATION AND EVALUATION

6.1 Register for all subjects: Students shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester Examination. For this purpose, Students shall register for all the arrear subjects of earlier semesters along with the current (subsequent) Semester Subjects.

6.2 Marks for Internal and End Semester Examinations

Category	Theory	Practical
Internal Assessment	**25**	**40**
End semester Examination	**75**	**60**

6.3 Procedure for Awarding Internal Marks Internal Examination Marks – Theory

Components	Marks
CIA I & II	10
Attendance	5
Assignment/Quiz	5
Seminar	5
Total	25

6.4. Awarding Marks for Attendance (out of 5)

Percentage of Attendance	Marks
Below 60%	0 marks
60% to 75%	3 marks
75% to 90%	4 marks
Above 90%	5 marks

6.5. Components for Practical CIA.

Components	Marks
CIA -I	15
CIA - II	15
Observation Note	05
Attendance	5
Total	40

6.6. Components for Practical ESE.

Components	Marks
Completion of Experiments	50
Record	05
Viva voce	05
Total	60

6.7. Internship/ Industrial Training, Mini Project and Major Project Work

Internship/Industrial Training		Project Work		
	Marks	Components		Marks
CIA*[1]		CIA		
Work Diary	25	a) Attendance	20 Marks	50
Report	50			
Viva-voce	25	b) Review / Work Diary*[1]	30 Marks	
Examination				
Total	100			
		ESE*[2]		
		a) Final Report	120 Marks	150
		b) Viva-voce	30 Marks	
		Total		200

*1 Evaluation of report and conduct of viva voce will be done jointly by Internal and External Examiners

6.8. Guidelines for Professional Competency Skill- Online Mode - Online Exam 3 hours

Components	Marks
100 Objective Type Questions 100*1=100 Marks	100

Objective type Questions from Question Bank.

- The passing minimum for this paper is 50%
- In case, the candidate fails to secure 50% passing minimum, he/ she may have to reappear for the same in the subsequent semesters.

6.9 Components for Human Rights Course (CIA Only)

The Course Human Rights is to be treated as 100% CIA course which is offered in II Semester for I year PG students.

Total Marks for the Course =100

Components	Marks
Two Tests	75
Assignments	25
Total	**100**

- In case the candidate fails to secure 50 marks, which is the passing minimum, he/she may have to reappear for the same in the subsequent semesters

QUESTION PAPER PATTERN FOR CIA I, II AND ESE	
(3 HOURS)	MAXIMUM:75Marks
SECTION-A (Objective Type) Answer ALL Questions **ALL Questions Carry EQUAL Marks**	**(10 x 1=10 marks)**
SECTION-B (Analytical Type) Answer any THREE Questions out of FIVE Questions **ALL Questions Carry EQUAL Marks**	**(3 x 5 = 15 marks)**
SECTION-C (Either or Type) Answer ALL Questions **ALL Questions Carry EQUAL Marks**	**(5 x 10 = 50 marks)**
(Syllabus for CIA-I 2.5 Unit ,Syllabus for CIA-II All 5 Unit)	

6.10 PASSING MINIMUM

6.10.1 There shall be no passing minimum for Internal.

6.10.2 For external examination, passing minimum shall be 50% [Fifty Percentage] of the maximum marks prescribed for the course for each Course/Practical/Project and Viva-Voce.

6.10.3 In the aggregate [External/Internal] the passing minimum shall be of 50%.

6.10.4 He / She shall be declared to have passed the whole examination, if he/she passes in all the Courses and Practical wherever prescribed as per the scheme of the examinations by earning 90 CREDITS. He/she shall also fulfill the extension activities prescribed earning a minimum of 1 credit to qualify for the Degree.

6.11 SUPPLEMENTARY EXAMINATION:

Supplementary Examinations is conducted for the students who appeared in the final semester examinations. Eligible criteria for appearing in the Supplementary Examinations are as follows:

6.11.1 Eligibility: A Student who is having arrear of only one theory course in any of the semester or two theory course in the Final semester of the PG degree programme alone is eligible for Supplementary Examinations.

6.11.2 Non-eligibility for those completed the program: Students who have completed their Program duration but having arrears are not eligible to appear for Supplementary Examinations.

6.12. RETOTALLING, REVALUATION AND PHOTOCOPY OF THE ANSWER SCRIPTS:

6.12.1 Re-totaling: All UG Students who appeared for their Semester Examinations are eligible for applying for re-totaling of their answer scripts.

6.12.2 Revaluation: All current batch Students who have appeared for their Semester Examinations are eligible for Revaluation of their answer scripts. Passed out candidates are not eligible for Revaluation.

6.12.3 Photo copy of the answer scripts: Students who have applied for revaluation can apply for the Photocopy of answer scripts by paying prescribed fee.

7. CLASSIFICATION OF SUCCESSFUL STUDENTS

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	DESCRIPTION
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

7.1. Computation of Grade Point Average (GPA) in a Semester, Cumulative Grade Point Average (CGPA) and Classification

$$\textbf{GPA for a Semester: } = \frac{\sum_i C_i G_i}{\sum_i C_i}$$

Ci= Credits earned for course I in any semester, That is, GPA is the sum of the multiplication of grade points by the credits of the courses divided by the sum of the credits of the courses in a semester.

$$\textbf{CGPA for the entire programme: } = \sum_n \sum_i C_{n_i} G_{n_i} \Big/ \sum_n \sum_i C_{ni}$$

That is, CGPA is the sum of the multiplication of grade points by the credits of the entire programme divided by the sum of the credits of the courses of the entire programme

Gi=Grade Points obtained for course in any semester; n=Semester in which such courses were credited.

7.2 Letter Grade and Classification

CGPA	GRADE	CLASSIFICATION OF FINAL RESULT
9.5-10.0	O+	First Class -Exemplary*
9.0 and above but below9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction*
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
0.0 and above but below 5.0	U	Re-appear

*The Students who have passed in the first appearance and within the prescribed semester of the PG Program are eligible.

8. RANKING

Students who pass all the examinations prescribed for the Program in the FIRST APPEARANCE ITSELF ALONE are eligible for Ranking I, II and III.

9. MAXIMUM PERIOD FOR COMPLETION OF THE PROGRAM TO QUALIFY FOR A DEGREE

9.1.A Student who for whatever reasons is not able to complete the program within the normal period (N) or the Minimum duration prescribed for the programme, may be allowed two years period beyond the normal period to clear the backlog to be qualified for the degree (Time span = N+2 years for the completion of the programme).

M.Sc., CHEMISTRY abstract under LOCF-CBCS Pattern with effect from 2023-2024 Onwards

Structure of Credit Distribution as per the TANSCHE / UGC Guidelines

S. No.	Study Components	Sem I		Sem II		Sem III		Sem IV		No. of Paper	Total Credit
		No. of Paper	Credit	No. of Paper	Credit	No. of Paper	Credit	No. of Paper	Credit		
1	DISCIPLINE SPECIFIC COURSE(DSC)-THEORY	2	10	2	10	2	10	2	10	8	40
2	DSC - PRACTICAL	1	4	1	4	1	5	1	3	4	16
3	DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE)	2	6	2	6	1	3			5	15
4	PROJECT WORK							1	5	1	5
5	INTERNSHIP					1	2			1	2
6	GENERIC ELECTIVE COURSES (GEC)- EDC					1	4			1	4
7	SKILL ENHANCEMENT COURSES (SEC)			1	2	1	2			2	4
8	HUMAN RIGHTS			1	2					1	2
9	ONLINE COMPETITIVE EXAMINATION							1	2	1	2
10	EXTENSION ACTIVITY							1	1	1	1
	Cumulative Credits	5	20	7	24	7	26	6	22	25	91

Total No. of Subjects	25
Marks	**2500**
Total Credits	91
Extra Credits	4
Total Credits	**95**

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE (Autonomous) - Rasipuram - 637 408
Scheme of Examinations LOCF-CBCS Pattern
(for the Students Admitted from the Academic Year:2023-2024 Onwards)
Programme : M.Sc. CHEMISTRY

S. No.	STUDY COMPONENTS	COURSE_CODE	TITLE OF THE COURSE	Hrs./W		CREDIT POINTS	MAX. MARKS		
				Lect.	Lab.		CIA	ESE	TOTAL
SEMESTER - I									
1	DSC THEORY - I	23M1PCHC01	ORGANIC REACTION MECHANISM - I	7	-	5	25	75	100
2	DSC THEORY - II	23M1PCHC02	STRUCTURE AND BONDING IN INORGANIC COMPOUNDS	7	-	5	25	75	100
3	DSC PRACTICAL - I	23M1PCHP01	PRACTICAL: ORGANIC CHEMISTRY	-	6	4	40	60	100
4	DSE THEORY - I		ELECTIVE - I	5	-	3	25	75	100
5	DSE THEORY - II		ELECTIVE - II	5	-	3	25	75	100
			TOTAL	**24**	**6**	**20**	**140**	**360**	**500**
SEMESTER II									
1	DSC THEORY - III	23M2PCHC03	ORGANIC REACTION MECHANISM - II	6	-	5	25	75	100
2	DSC THEORY - IV	23M2PCHC04	PHYSICAL CHEMISTRY - I	6	-	5	25	75	100
3	DSC PRACTICAL - II	23M2PCHP02	PRACTICAL: INORGANIC CHEMISTRY	-	6	4	40	60	100
4	DSE THEORY - III		ELECTIVE - III	4	-	3	25	75	100
5	DSE THEORY - IV		ELECTIVE - IV	4	-	3	25	75	100
6	SEC THEORY- I	23M2PCHS01	INDUSTRIAL CHEMISTRY	4	-	2	25	75	100

7	HUMAN RIGHTS	23M2PHR01	HUMAN RIGHTS	-	-	2	100	-	100
			TOTAL	**24**	**6**	**24**	**265**	**435**	**700**
SEMESTER III									
1	DSC THEORY - V	23M3PCHC05	PHYSICAL CHEMISTRY - II	6	-	5	25	75	100
2	DSC THEORY - VI	23M3PCHC06	CO-ORDINATION CHEMISTRY - I	6	-	5	25	75	100
3	DSC PRACTICAL - III	23M3PCHP03	PRACTICAL: PHYSICAL CHEMISTRY	-	6	5	40	60	100
4	DSE THEORY - V		ELECTIVE - V	5	-	3	25	75	100
5	EDC THEORY		EDC-I	4	-	4	25	75	100
6	SEC THEORY - II	23M3PCHS02	PREPARATION OF CONSUMER PRODUCTS	3	-	2	100	-	100
7	INTERNSHIP	23M3PCHIS1	INTERNSHIP	-	-	2	100	-	100
			TOTAL	**24**	**6**	**26**	**340**	**360**	**700**
SEMESTER IV									
1	DSC THEORY - VII	23M4PCHC07	CO-ORDINATION CHEMISTRY - II	6	-	5	25	75	100
2	DSC THEORY - VIII	23M4PCHC08	ORGANIC SYNTHESIS AND PHOTOCHEMISTRY	6	-	5	25	75	100
3	PROJECT WORK	23M4PCHPR1	PROJECT WORK	10	-	5	50	150	200
4	DSC PRACTICAL - IV	23M4PCHP04	PRACTICAL: ANALYTICAL INSTRUMENTATION TECHNIQUES	-	4	3	40	60	100
5	ONLINE COMPETITIVE EXAMINATION	23M4PCHOE1	CHEMISTRY FOR COMPETITIVE EXAMINATIONS	4	-	2	100	-	100

6	EXTENSION ACTIVITY	23M4PEXA01	EXTENSION ACTIVITY	-	-	1	-	-	-
			TOTAL	**26**	**4**	**21**	**240**	**360**	**600**
			OVERALL TOTAL	**98**	**22**	**91**	**985**	**1515**	**2500**
1	EXTRA CREDIT COURSE - ONLINE		MOOC Courses offered in SWAYAM/NPTEL			2			
2	VALUE ADDED COURSE		VALUE ADDED COURSE			2			

HoD **Member Secretary of Academic Council** **Principal**

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE
(Autonomous)
Rasipuram – 637408

M.Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHC01	**ORGANIC REACTION MECHANISM - I**	**DSC THEORY – I**	**I**	**7**	**4**	**3**	**-**	**5**
Objective	Students will understand the feasibility and the mechanism of various organic reactions, techniques in the determination of reaction mechanisms and concept of stereochemistry involved in Organic Compounds							

Unit	Course Content	Knowledge Levels	Sessions
I	**Methods of Determination of Reaction Mechanism:** Reaction intermediates, The transition state, Reaction coordinate diagrams, Thermodynamic and kinetic requirements of reactions: Hammond postulate. Methods of determining mechanism: non-kinetic methods - product analysis, determination of intermediates – isolation, detection, and trapping. Cross-over experiments, isotopic labeling, isotope effects and stereo chemical evidences. Kinetic methods - relation of rate and mechanism. Effect of structure on reactivity: Hammett and Taft equations. Linear free energy relationship, partial rate factor, substituent and reaction constants.	K2	16
II	**Aromaticity, Aromatic and Aliphatic Electrophilic Substitution:** Aromaticity in benzenoid, non-benzenoid, heterocyclic compounds and Annulenes. Aromatic electrophilic substitution: Orientation and reactivity of di- and polysubstituted phenol, nitrobenzene and halo benzene. Reactions involving nitrogen electrophiles: nitration, nitrosation and diazonium coupling; Sulphur electrophiles: sulphonation; Halogen electrophiles: chlorination and bromination; Carbon electrophiles: Friedel - Crafts alkylation, acylation and arylation reactions. Aliphatic electrophilic substitution Mechanisms: SE2 and SEi, SE1- Mechanism and evidences.	K3	16

III	**Aromatic and Aliphatic Nucleophilic Substitution:** Aromatic nucleophilic substitution: Mechanisms - S_NAr, S_N1 and Benzyne mechanisms - Evidences - Reactivity, Effect of structure, leaving group and attacking nucleophile. Reactions: Oxygen and Sulphur - nucleophiles,Bucherer and Rosenmund reactions, von Richter, Sommelet- Hauser and Smiles rearrangements. S_N1, ion pair, S_N2 mechanisms and evidences. Aliphatic nucleophilic substitutions at an allylic carbon, aliphatic trigonal carbon and vinyl carbon.S_N1, S_N2, S_Ni, and SE1 mechanism and evidences, Swain - Scott, Grunwald - Winstein relationship - Ambident nucleophiles.	K3	16
IV	**Stereochemistry-I:** Introduction to molecular symmetry and chirality – axis, plane, center, alternating axis of symmetry. Optical isomerism due to asymmetric and dissymmetric molecules with C, N, S based chiral centers. Optical purity,prochirality, enantiotopic and diastereotopic atoms, groups, faces, axial and planar chirality, chirality due to helical shape, methods of determining the configuration. Racemic modifications: Racemization by thermal, anion, cation, reversible formation, epimerization, mutarotation. D, L system, Cram's and Prelog's rules: R, S - notations, proR, proS, side phase and rephrase. Cahn-Ingold-Prelog rules, absolute and relative configurations. Configurations of allenes, spiranes, biphenyls, cyclooctene, helicene, binaphthyls, ansa and cyclophanic compounds, exo-cyclic alkylidene - cycloalkanes. Topicity and prostereoisomerism, chiral shift reagents and chiral solvating reagents. Criteria for optical purity: Resolution of racemic modifications, asymmetric transformations, asymmetric synthesis, destruction. Stereoselective and stereospecific synthesis.	K4	16
V	**Stereochemistry-II:** Conformation and reactivity of acyclic systems, intramolecular rearrangements, neighbouring group participation, chemical consequence of conformational equilibrium - Curtin-Hammett Principle. Stability of five and six-membered rings: mono-, di- and poly substituted cyclohexanes, Conformation and reactivity in cyclohexane systems. Fused and bridged rings: bicyclic, poly cyclic systems, decalins and Brett's rule. Optical rotation and optical rotatory dispersion, conformational asymmetry, ORD curves, octant rule, configuration and conformation, Cotton effect, axial halo ketone rule and determination of configuration.	K6	16
Course Outcome	**CO1:** Recall the basic principles of organic chemistry	K1	
	CO2: Understand the formation and detection of reaction intermediates of organic reactions.	K2	

	CO3: Predict the reaction mechanism of organic reactions and stereochemistry of organic compounds	K3	
	CO4: Apply the principles of kinetic and non-kinetic methods to determine the mechanism of reactions	K4	
	CO5: Design and synthesize new organic compounds by correlating the stereochemistry of organic compounds	K6	

Learning Resources				
Text Books	1. J. March and M. Smith, Advanced Organic Chemistry, 5th edition,John-Wiley and Sons.2001. 2. P.S.Kalsi, Stereochemistry of carbon compounds, 8th edition, NewAge International Publishers, 2015. 3. P. Y. Bruice, Organic Chemistry, 7thedn, Prentice Hall, 2013. 4. J.Clayden, N. Greeves, S. Warren, Organic Compounds, 2ndedition,Oxford University Press, 2014.			
Reference Books	1. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry Part-Aand B, 5th edition, Kluwer Academic / Plenum Publishers, 2007. 2. D. G. Morris, Stereochemistry, RSC Tutorial Chemistry Text 1, 2001. 3. E. L. Eliel, Stereochemistry of Carbon Compounds, Tata-McGrawHill, 2000. 4. I. L. Finar, Organic chemistry, Vol-1&2, 6th edition, Pearson Education Asia, 2004.			
Website Link	1. https://www.freebookcentre.net/Chemistry/Chemistry-Books-Online.html 2. https://www.organic-chemistry.org/			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**	
23M1PCHC01	**ORGANIC REACTION MECHANISM - I**					**DSC THEORY–I**		**I**	**7**	**4**	**3**	**-**	**5**	
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	M	S	S	S	S	S				
CO2	M	S	S	S	S	S	M	S	S	S				
CO3	S	S	M	S	L	S	S	S	S	S				
CO4	M	S	S	S	S	L	S	M	S	S				
CO5	M	S	M	S	S	S	S	S	M	S				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and learning through molecular models													
Teaching and Learning Methods	Chalk and Board class, Use of Molecular Models and PPT Presentation													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**							**Approved By** Member Secretary						
Mrs. M. Saranya	Dr. N. Nithiya							Dr. S. Shahitha						

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M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHC02	**STRUCTURE AND BONDING IN INORGANIC COMPOUNDS**	**DSC THEORY–II**	**I**	**7**	**4**	**3**	**-**	**5**
Objective	Students will learn about the structural properties of main group compounds and clusters, their structure and characterization techniques							

Unit	Course Content	Knowledge Levels	Sessions
I	**Structure of main group compounds and clusters:** VB theory – Effect of lone pair and electro negativity of atoms (Bent's rule) on the geometry of the molecules; Structure of silicates - applications of Paulings rule of electrovalence - isomorphous replacements in silicates – ortho, meta and pyro silicates – one dimensional, two dimensional and three-dimensional silicates. Structure of silicones, Structural and bonding features of B-N, S-N and P-N compounds; Poly acids – types, examples and structures; Borane cluster: Structural features of closo, nido, arachano and klado; carboranes, hetero and metalloboranes; Wade's rule to predict the structure of borane cluster; main group clusters –zintl ions and mno rule.	K2	16
II	**Solid State Chemistry – I:** Ionic crystals: Packing of ions in simple, hexagonal and cubic close packing, voids in crystal lattice, Radius ratio, Crystal systems and Bravis lattices, Symmetry operations in crystals, glide planes and screw axis; point group and space group; Solid state energetics: Lattice energy – Born-Lande equation - Kapustinski equation, Madelung constant.	K3	16
III	**Solid State Chemistry – II:** Structural features of the crystal systems: Rock salt, zinc blende &wurtzite, fluorite and anti-fluorite, rutile and anatase, cadmium iodide and nickel arsenide; Spinels -normal and inverse types and perovskite structures. Crystal Growth methods: From melt and solution (hydrothermal, sol-gel methods) – principles and examples.	K4	16

IV	**Techniques in solid state chemistry:** X-ray diffraction technique: Bragg's law, Powder diffraction method – Principle and Instrumentation; Interpretation of XRD data – JCPDS files, Phase purity, Scherrer formula, lattice constants calculation; Systematic absence of reflections; Electron diffraction technique – principle, instrumentation and application. Electron microscopy – difference between optical and electron microscopy, theory, principle, instrumentation, sampling methods and applications of SEM and TEM.	K5	16
V	**Band theory and defects in solids:** Band theory – features and its application of conductors, insulators and semiconductors, Intrinsic and extrinsic semiconductors; Defects in crystals – point defects (Schottky, Frenkel, metal excess and metal deficient) and their effect on the electrical and optical property, laser and phosphors; Linear defects and its effects due to dislocations.	K4	16
Course Outcome	**CO1:** Understand the structure of main group compounds and principles of diffraction and microscopic techniques.	K1	
	CO2: Recognize the packing of ions in crystals and apply the radius ratio rule to predict the coordination number of cations.	K2	
	CO3: Relate the various types of ionic crystal systems and analyze their structural features.	K3	
	CO4: Examine the various crystal growth methods.	K4	
	CO5: Predict the geometry of main group compounds and clusters and to arrive at solution for XRD data	K6	

Learning Resources	
Text Books	1. A R West, Solid state Chemistry and its applications, 2nd Edition (Students Edition), John Wiley & Sons Ltd., 2014. 2. A K Bhagi and G R Chatwal, A textbook of inorganic polymers, Himalaya Publishing House, 2001. 3. L Smart, E Moore, Solid State Chemistry – An Introduction, 4th Edition, CRC Press, 2012. 4. K. F. Purcell and J. C. Kotz, Inorganic Chemistry; W.B. Saunders company: Philadelphia, 1977. 5. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry; 4th ed.; Harper and Row: NewYork, 1983.
Reference Books	1. D. E. Douglas, D.H. McDaniel and J. J. Alexander, Concepts and Models in Inorganic Chemistry, 3rd Ed, 1994. 2. R J D Tilley, Understanding Solids - The Science of Materials, 2nd edition, Wiley Publication, 2013. 3. C N R Rao and J Gopalakrishnan, New Directions in Solid State 26 Chemistry, 2nd Edition, Cambridge University Press, 1999. 4. T. Moeller, Inorganic Chemistry, A Modern Introduction; John Wiley: New York, 2000. 5. D. F. Shriver, P. W. Atkins and C.H. Langford; Inorganic Chemistry; 3rd ed.; Oxford University Press: London, 2001.

Website Link	1. Lecture Videos | Introduction to Solid-State Chemistry | Materials Science and Engineering | MIT OpenCourseWare			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M.Sc - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards													
Course Code	**Course Title**					**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHC02	**STRUCTURE AND BONDING IN INORGANIC COMPOUNDS**					**DSC THEORY–II**		**I**	**7**	**4**	**3**	**-**	**5**
CO-PO Mapping													
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	S	S	S	S	M	S	S	S	S	S			
CO2	M	S	S	S	S	S	M	S	S	S			
CO3	S	S	M	S	S	S	S	M	S	M			
CO4	M	S	S	S	S	M	S	S	M	S			
CO5	M	S	M	S	S	S	S	S	S	S			
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG				
Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP												
Teaching and Learning Methods	Chalk and Board class and Use of Molecular Models												
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE												
Designed By	**Verified By**						**Approved By** Member Secretary						
Mrs. M. Saranya	Dr. N. Nithiya						Dr. S. Shahitha						

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M.Sc. -Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHP01	**PRACTICAL: ORGANIC CHEMISTRY**	**DSC PRACTICAL - I**	**I**	**6**	**-**	**-**	**6**	**4**
Objective	Students will learn about the principle behind qualitative analysis of mixture of compounds, estimations of organic compounds and to synthesize simple organic compounds							

S. No.	Course Content	Knowledge Levels	Sessions
1	**Separation and analysis:** A. Two component mixtures. B. Three component mixtures.	K4	30
2	**Estimations:** a) Estimation of Phenol (bromination) b) Estimation of Aniline (bromination) c) Estimation of Ethyl methyl ketone (iodimetry) d) Estimation of Glucose (redox) e) Estimation of Ascorbic acid (iodimetry) f) Estimation of Aromatic nitro groups (reduction) g) Estimation of Glycine (acidimetry) h) Estimation of Formalin (iodimetry) i) Estimation of Acetyl group in ester (alkalimetry) j) Estimation of Hydroxyl group (acetylation) k) Estimation of Amino group (acetylation)	K5	
3	**Two stage preparations:** a) p-Bromoacetanilide from aniline b) p-Nitroaniline from acetanilide c) 1,3,5-Tribromobenzene from aniline d) Acetyl salicyclic acid from methyl salicylate e) Benzilic acid from benzoin f) m-Nitroaniline from nitrobenzene g) m-Nitrobenzoic acid from methyl benzoate	K6	
Course Outcome	**CO1:** Recall the basic principles of organic separation, qualitative analysis and preparation	K1	
	CO2: Explain the method of separation and analysis of separated organic mixtures	K2	
	CO3: Determine the characteristics of separation of organic compounds by various chemical reactions	K3	
	CO4: Develop strategies to separate, analyze and prepare organic compounds.	K5	

	CO5: Formulate a method of separation, analysis of organic mixtures and design suitable procedure for organic preparations.		K6	
Learning Resources				
Text Books	1. Raj K. Bansal, Laboratory manual of Organic Chemistry, 3rdEdn., New Age International (P) Ltd. 1996. 2. B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A. R. Tatchell, Vogel's Practical Organic Chemistry. 5thedn. ELBS, 1989			
Reference Books	1. N. S. Gnanapragasam and G. Ramamurthy, Organic Chemistry Lab Manual, New Ed., SV Publishers 2006 2. P. S. Subramanian, R. Gopalan, K. Rangarajan, Elements of Analytical Chemistry, Sultan Chand & Sons, New Delhi, 2003.			
Website Link	1.Lecture Videos | Introduction to Solid-State Chemistry | Materials Science and Engineering | MIT OpenCourseWare			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards													
Course Code	**Course Title**					**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHP01	**PRACTICAL: ORGANIC CHEMISTRY**					**DSC PRACTICAL - I**		**I**	**6**	**-**	**-**	**6**	**4**
CO-PO Mapping													
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	S	S	S	S	M	S	S	S	S	S			
CO2	M	S	S	S	S	M	S	S	S	S			
CO3	S	S	M	S	S	S	S	M	S	S			
CO4	M	S	S	S	S	S	S	S	M	S			
CO5	M	S	M	S	S	S	S	S	S	M			
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG				
Tutorial Schedule	-												
Teaching and Learning Methods	Demo class and Practical class												
Assessment Methods	CIA examinations and End Semester Examination												
Designed By	**Verified By**							**Approved By** Member Secretary					
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M.Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHC03	**ORGANIC REACTION MECHANISM-II**	**DSC THEORY - III**	**II**	**7**	**4**	**3**	**-**	**5**
Objective	Students will learn about aromaticity, organic reaction mechanisms and applications of organic reagents							

Unit	Course Content	Knowledge Levels	Sessions
I	**Elimination and Free Radical Reactions and Mechanisms:** E2, E1, and E1cB mechanisms. Syn- and anti-eliminations. Orientation of the double bond: Hoffmann and Saytzeff rules. Reactivity: Effect of substrate, attacking bases, leaving group and medium. Stereochemistry of eliminations in acyclic and cyclic systems, pyrolytic elimination. Long lived and short-lived radicals – Production of radicals by thermal and photochemical reactions, Detection and stability of radicals, characteristics of free radical reactions and free radical, Reactions of radicals, polymerization, addition, halogenations, aromatic substitutions, rearrangements. Reactivity: Reactivity on aliphatic, aromatic substrates, reactivity in the attacking radical, effect of solvent.	K2	16
II	**Oxidation and Reduction Reactions and Mechanisms:** Direct electron transfer, hydride transfer, hydrogen transfer, displacement, addition-elimination, oxidative and reductive coupling reactions. Mechanism of oxidation reactions: Dehydrogenation by quinones, selenium dioxides, ferricyanide, mercuric acetate lead tetraacetate, permanganate, manganese dioxide, osmium tetroxide, oxidation of saturated hydrocarbons, alkyl groups, alcohols, halides and amines. Reactions involving cleavage of C-C bonds - cleavage of double bonds, oxidative decarboxylation, allylic oxidation, oxidation by chromium trioxide-pyridine, DMSO-Oxalyl chloride (Swern oxidation) and Corey-Kim oxidation, dimethyl sulphoxide- dicyclohexylcarbodiimide (DMSO-DCCD). Mechanism of reduction reactions: Wolff-Kishner, Clemmenson, Rosenmund, reduction with Trialkyl and triphenyltin hydrides, McFadyen-Steven's reduction, Homogeneous hydrogenation, Hydroboration with cyclic systems, MPV and Bouveault-Blanc reduction.	K6	16

III	**Rearrangements:** Rearrangements to electron deficient carbon: Pinacol-pinacolone and semi pinacolone rearrangements - applications and stereochemistry, Wagner Meerwein, Demjanov, Dienone-phenol, Baker-Venkataraman, Benzilic acid and Wolff rearrangements. Rearrangements to electron deficient nitrogen: Hofmann, Curtius, Schmidt, Lossen, Beckmann and abnormal Beckmann rearrangements. Rearrangements to electron deficient oxygen: Baeyer Villiger oxidation and Dakin rearrangements. Rearrangements to electron rich atom: Favorskii, Quasi-Favorskii, Stevens, [1,2]-Wittig and [2,3]-Wittig rearrangements. Fries and Photo Fries rearrangement. Intramolecular rearrangements – Claisen, abnormal Claisen, Cope, oxy-Cope Benzidine rearrangements.	K4	16
IV	**Addition to Carbon Multiple Bonds and Mechanisms:** Addition to carbon-carbon multiple bonds- Addition reactions involving electrophiles, nucleophiles, free radicals, carbenes and cyclic mechanisms - Orientation and reactivity, hydrogenation of double and triple bonds, Michael reaction, addition of oxygen and Nitrogen; Addition to carbon-hetero atom multiple bonds: Mannich reaction, acids, esters, nitrites, addition of Grignard reagents, Wittig reaction, Prins reaction. Stereochemical aspects of addition reactions. Addition to Carbon-Hetero atom Multiplebonds: Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Mechanism of condensation reactions involving enolates – Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.	K5	16
V	**Reagents and Modern Synthetic Reactions:** Lithium diisopropylamine (LDA), Azobisisobutyronitrile (AIBN), Sodium cyanoborohydride ($NaBH_3CN$), meta-Chloroperbenzoic acid (m-CPBA), Dimethyl aminio pyridine (DMAP), n-Bu_3SnD, Triethylamine (TEA), Diazobicyclo[5.4.0]undec-7-ene (DBU), Diisopropylazodicarboxylate (DIAD), Diethylazodicarboxylate (DEAD), N-bromosuccinimide (NBS), Trifluoroacetic acid (TFA), Tetramethyl piperiridin-1-oxyl (TEMPO), Phenyltrimethylammoniumtribromide (PTAB). Diazomethane and Zn-Cu, Diethyl maleate (DEM), Copper diacetylacetonate ($Cu(acac)_2$), $TiCl_3$, $NaIO_4$, Pyridiniumchlorochromate (PCC), Pyridinium dichromate (PDC), Meisenheimer complex. Suzuki coupling, Heck reaction, Negishi reaction, Baylis-Hillman reaction.	K6	16
Course Outcome	**CO1:** Recall the basic principles of Organic reaction mechanisms	K1	
	CO2: Understand the mechanism of various types of organic reactions.	K2	
	CO3: Predict the suitable reagents for the conversion of selective organic compounds.	K3	
	CO4: Correlate the principles of substitution, elimination, and addition reactions.	K5	

	CO5: Design new routes to synthesis organic compounds.		K6	
Learning Resources				
Text Books	1. M. B. Smith, March's Advanced Organic Chemistry: Reactons, Mechanims and Structure, 7th ed., John-Wiley and Sons.2015. 2. P. S. Kalsi, Stereochemistry of carbon compounds, 8thedn, New Age International Publishers, 2015. 3. P.Y.Bruice, Organic Chemistry, 7thedn., Prentice Hall, 2013. 4. R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee Organic Chemistry, 7thedn. Pearson Education, 2010.			
Reference Books	1. S. H. Pine, Organic Chemistry, 5thedn-Special Indian Edition, McGraw Hill International Edition, 2006. 2. L. F. Fieser and M. Fieser, Organic Chemistry, Asia Publishing House, Bombay, 2000. 3. E.S. Gould, Mechanism and Structure in Organic Chemistry, Holt, Rinehart and Winston Inc., 1959. 4. T. L. Gilchrist, Heterocyclic Chemistry, 3rd ed., Longman Press, 2005. 5. J. A. Joule and K. Mills, Heterocyclic Chemistry, 4thed.,JohnWiley, 2010.			
Website Link	1.https://sites.google.com/site/chemistryebookscollection02/home/organicchemistry/organic 2. https://www.organic-chemistry.org/			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHC03	**ORGANIC REACTION MECHANISM-II**					**DSC THEORY - III**			**II**	**7**	**4**	**3**	**-**	**5**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	M	S	S	S	S	S				
CO2	M	S	L	S	S	S	M	S	S	S				
CO3	S	S	M	S	S	S	L	S	M	S				
CO4	M	S	S	S	L	S	S	S	S	S				
CO5	M	S	M	S	S	S	S	S	L	S				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and learning through molecular models													
Teaching and Learning Methods	Chalk and Board class and PPT Presentation													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**							**Approved By** Member Secretary						
Mrs. M. Saranya	Dr. N. Nithiya							Dr. S. Shahitha						

M.Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHC04	**PHYSICAL CHEMISTRY-I**	**DSC THEORY - IV**	**II**	**7**	**4**	**3**	**-**	**5**
Objective	Students will understand the fundamentals and applications of thermodynamics – classical and statistical and kinetics of a reactions							

Unit	Course Content	Knowledge Levels	Sessions
I	**Classical Thermodynamics:** Partial molar properties-Chemical potential, Gibb's-Duhem equation binary and ternary systems. Determination of partial molar quantities. Thermodynamics of real gases - Fugacity- determination of fugacity by graphical and equation of state methods-dependence of temperature, pressure and composition. Thermodynamics of ideal and non-ideal binary mixtures, Duhem - Margulus equation applications of ideal and non-ideal mixtures. Activity and activity coefficients-standard states - determination-vapourpressure,EMF and freezing point methods.	K2	16
II	**Statistical thermodynamics:** Introduction of statistical thermodynamics concepts of thermodynamic and mathematical probabilities - distribution of distinguishable and nondistinguishable particles. Assemblies, ensembles, canonical particles. Maxwell - Boltzmann, Fermi Dirac & Bose-Einstein Statisticscomparison and applications. Partition functions - evaluation of translational, vibrational and rotational partition functions for monoatomic, diatomic and polyatomic ideal gases. Thermodynamic functions in terms of partition functions-calculation of equilibrium constants. Statistical approach to Thermodynamic properties: pressure, internal energy, entropy, enthalpy, Gibb's function, Helmholtz function residual entropy, equilibrium constants and equipartition principle. Heat capacity of mono and di atomic gases-ortho and para hydrogen. Heat capacity of solids-Einstein and Debye models.	K3	16
III	**Irreversible Thermodynamics:** 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.	K3	16

IV	**Kinetics of Reactions:** Theories of reactions-effect of temperature on reaction rates, collision theory of reaction rates, Unimolecular reactions -Lindeman and Christiansen hypothesis-molecular beams, collision cross sections, effectiveness of collisions, Potential energy surfaces. Transition state theory-evaluation of thermodynamic parameters of activation applications of ARRT to reactions between atoms and molecules, time and true order-kinetic parameter evaluation. Factors determine the reaction rates in solution - primary salt effect and secondary salt effect, Homogeneous catalysis- acid- base catalysis-mechanism of acid base catalyzed reactions-Bronsted catalysis law, enzyme catalysis – Michelis Menton catalysis	K5	16
V	**Kinetics of complex and fast reactions:** Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions. Chain reactions-chain length, kinetics of H_2 – Cl_2 & H_2 – Br_2 reactions (Thermal and Photochemical reactions) - Rice Herzfeld mechanism. Study of fast reactions - relaxation methods - temperature and pressure jump methods electric and magnetic field jump methods - stopped flow flash photolysis methods and pulse radiolysis. Kinetics of polymerization free radical, cationic, anionic polymerization – Poly condensation.	K6	16
Course Outcome	**CO1:** Explain the classical and statistical concepts of thermodynamics.	K1	
	CO2: Compare and correlate the thermodynamic concepts to study the kinetics of chemical reactions.	K2	
	CO3: Discuss the various thermodynamic and kinetic determinations.	K3	
	CO4: Evaluate the thermodynamic methods for real gases ad mixtures	K5	
	CO5: Compare the theories of reactions rates and fast reactions.	K6	

Learning Resources

Text Books	1. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics: Classical, Statistical and Irreversible, 1st edition, Pearson Education India, 2013 2. M.C. Gupta, Statistical Thermodynamics, New Age International, Pvt. Ltd., New Delhi,1995. 3. K.J. Laidler, Chemical Kinetics, 3rd edition, Pearson, Reprint - 2013. 4. J. Rajaram and J.C. Kuriokose, Kinetics and Mechanisms of chemical transformation, Macmillan India Ltd, Reprint - 2011.
Reference Books	1. D.A. Mcqurrie and J.D. Simon, Physical Chemistry - A Molecular Approach, Viva Books Pvt. Ltd., New Delhi, 1999. 2. R.P. Rastogi and R.R. Misra, Classical Thermodynamics, Vikas Publishing, Pvt. Ltd., New Delhi, 1990. 3. GurdeepRaj,Advanced Physical Chemistry, 4th ed., Goel Publishing House, 2013.
Website Link	1. https://nptel.ac.in/courses/104/103/104103112/ 2. https://bit.ly/3tL3GdN

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHC04	**PHYSICAL CHEMISTRY-I**					**DSC THEORY - IV**			**II**	**7**	**4**	**3**	**-**	**5**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	M	S	S	S	S	S				
CO2	M	S	S	S	S	S	L	S	M	L				
CO3	S	S	M	S	S	S	M	S	L	S				
CO4	M	S	S	S	S	S	S	M	S	M				
CO5	M	S	M	S	S	S	S	L	S	S				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP													
Teaching and Learning Methods	Chalk and Board class and Use of Molecular Models													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**					**Approved By** Member Secretary								
Mrs. M. Saranya	Dr. N. Nithiya					Dr. S. Shahitha								

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M.Sc. -Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHP02	**PRACTICAL: INORGANIC CHEMISTRY**	**DSC PRACTICAL - II**	**II**	**6**	**-**	**-**	**6**	**4**
Objective	Students will imbibe the methods of analyzing a given inorganic salt mixture, estimations ions present in a mixture and synthesize the complex compounds							

S. No.	Course Content	Knowledge Levels	Sessions
I	**Analysis of mixture of cations:** Analysis of a mixture of four cations containing two common cations and two rare cations. Cations to be tested. Group-I: W, Tl and Pb. Group-II: Se, Te, Mo, Cu, Bi and Cd. Group-III: Tl, Ce, Th, Zr, V, Cr, Fe, Ti and U. Group-IV: Zn, Ni, Co and Mn. Group-V: Ca, Ba and Sr. Group-VI: Li and Mg.	K3	30
II	**Preparation of metal complexes:** a. Preparation of tristhiourea copper(I)sulphate b. Preparation of potassium trioxalate chromate(III) c. Preparation of tetrammine copper(II) sulphate d. Preparation of Reineck's salt e. Preparation of hexa thioureacopper(I) chloride dihydrate f. Preparation of cis-Potassium tri oxalate diaquachromate(III) g. Preparation of sodium trioxalato ferrate(III) h. Preparation of hexathiourea lead(II) nitrate	K6	
III	**Complexometric Titration:** 1. Estimation of zinc, nickel, magnesium, and calcium. 2. Estimation of mixture of metal ions-pH control, masking and damasking agents. 3. Determination of calcium and lead in a mixture (pH control). 4. Determination of manganese in the presence of iron. 5. Determination of nickel in the presence of iron.	K5	
Course Outcome	**CO1:** Identify the anions and cations present in a mixture of salts.	K1	
	CO2: Apply the principles of semi micro qualitative analysis to categorize acid radicals and basic radicals.	K2	
	CO3: Acquire the qualitative analytical skills by selecting suitable confirmatory tests and spot tests.	K3	

	CO4: Choose the appropriate chemical reagents for the detection of anions and cations.	K5	
	CO5: Synthesize coordination compounds in good quality.	K6	

Learning Resources				
Text Books	1. A. Jeya Rajendran, Microanalytical Techniques in Chemistry: Inorganic Qualitative Analysis, United global publishers, 2021. 2. V. V. Ramanujam, Inorganic Semimicro Qualitative Analysis; 3rd ed., The National Publishing Company, Chennai, 1974. 3. Vogel's Text book of Inorganic Qualitative Analysis, 4th ed., ELBS, London.			
Reference Books	1. G. Pass, and H. Sutcliffe, Practical Inorganic Chemistry; Chapman Hall, 1965. 2. W. G. Palmer, Experimental Inorganic Chemistry; Cambridge University Press, 1954.			
Website Link	https://mis.alagappauniversity.ac.in/siteAdmin/dde-admin/uploads/3/PG_M.Sc._Chemistry_34434%20PRACTICAL%20INORGANIC%20CHEMISTRY.pdf			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards													
Course Code	**Course Title**					**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHP02	**PRACTICAL: INORGANIC CHEMISTRY**					**DSC PRACTICAL - II**		**II**	**6**	**-**	**-**	**6**	**4**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	S	S	S	S
CO2	M	S	S	S	S	S	S	L	M	S
CO3	S	S	M	S	S	M	S	M	L	S
CO4	M	S	S	S	S	S	S	S	S	M
CO5	M	S	M	S	S	S	S	M	L	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-	
Teaching and Learning Methods	Demo and Practical Class	
Assessment Methods	CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved By** Member Secretary
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M.Sc -Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHC05	**PHYSICAL CHEMISTRY-II**	**DSC THEORY- V**	**III**	**6**	**4**	**2**	**-**	**5**
Objective	After the completion of the course students will understand the need, principles and applications of Quantum Mechanics and Group Theory							

Unit	Course Content	Knowledge Levels	Sessions
I	**Introduction** Wave particle duality, Uncertainty principle, Particle wave and Schrodinger wave equation, wave function, properties of wave function. Normalized, Orthogonal, orthogonal, Eigenvalues, Eigen functions, Hermitian properties of operators. Introduction to quantum mechanics-black body radiation, photoelectric effect, hydrogen spectrum. Need for quantum mechanics, Postulates of Quantum Mechanics, Schrodinger wave equation, Time independent and time dependent.	K3	16
II	**Quantum models:** Particle in a box-1D, two dimensional and three-dimensional, degeneracy, application to linear conjugated molecular system, free particles, ring systems. Harmonic Oscillator-wave equation and solution, anharmonicity, force constant and its significance. Rigid Rotor-wave equation and solution, calculation of rotational constants and bond length of diatomic molecules.	K4	16
III	**Applications to Hydrogen and Poly electron atoms**: Hydrogen atom and hydrogen like ions, Hamiltonian-wave equation and solutions, radial and angular functions, representation of radial distribution functions. Approximation methods –variation methods: trial wave function, variation integral and application to particle in 1D box. Perturbation method - first order applications. Hartree-Fock self-consistent field method, Hohenberg-Kohn theorem and Kohn-Sham equation, Helium atom-electron spin, pauli's exclusion principle and Slater determination.	K4	16
IV	**Group theory:** Groups, sub groups, symmetry elements, operations, classification axial and nonaxial. Dihedral point groups- C_n,C_{nh}, D_n, D_{nh}, D_{nd}, T_d and O_h. Matrix representation and classes of symmetry operations, reducible irreducible and direct product representation. The Great orthogonality theorem – irreducible representation and reduction formula, construction of character table for C_{2v}, C_{2h}, C_{3v} and D_{2h} point groups.	K3	16

V	**Applications of quantum and group theory:** Hydrogen Molecule-Molecular orbital theory and Heitler London (VB) treatment, Energy level diagram, Hydrogen molecule ion; Use of linear variation function and LCAO methods. Electronic conjugated system: Huckel method to Ethylene, butadiene, cyclopropenyl, cyclobutadiene and Benzene. Applications of group theory to molecular vibrations, electronic spectra of ethylene. **Current Trends - * Symmetry elements present in Molecules***	K4	16
	***.....* Self study**		
Course Outcome	**CO1:** Discuss the characteristics of wave functions and symmetry functions.	K2	
	CO2: Classify the symmetry operation and wave equations.	K2	
	CO3: Apply the concept of quantum mechanics and group theory to predict the electronic structure.	K3	
	CO4: Specify the appropriate irreducible representations for theoretical applications.	K4	
	CO5: Develop skills in evaluating the energies of molecular spectra.	K5	

Learning Resources	
Text Books	1. R.K. Prasad, Quantum Chemistry, New Age International Publishers, New Delhi, 2010, 4th revised edition. 2. A. Vincent, Molecular Symmetry and Group Theory. A Programmed Introduction to Chemical Applications, John and Willy & Sons Ltd., 2013, 2nd Edition. 3. T. Engel & Philip Reid, Quantum Chemistry and Spectroscopy, Pearson, New Delhi, 2018, 4th edition.
Reference Books	1. N. Levine, Quantum Chemistry, Allyn & Bacon Inc, 2015, 2. D.A. McQuarrie and J. D. Simon, Physical Chemistry, A Molecular Approach, Viva Books Pvt. Ltd, New Delhi, 2012. 3. J. M. Hollas, Symmetry in Molecules, Chapman and Hall, London, 2011, Reprint.
Website Link	1. https://nptel.ac.in/courses/104101124 2. https://ipc.iisc.ac.in/~kls/teaching.html
Self-Study Material	https://rb.gy/x13xf1

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards													
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHC05	**PHYSICAL CHEMISTRY-II**					**DSC THEORY-V**			**III**	**6**	**4**	**2**	**-**	**5**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	S	S	M	S	S	S				
CO2	S	M	M	S	S	S	S	S	M	S				
CO3	S	M	M	S	S	S	M	S	S	S				
CO4	S	S	S	M	S	S	S	S	M	S				
CO5	S	S	M	S	S	S	M	S	S	S				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP													
Teaching and Learning Methods	Chalk and Board class and Use of Molecular Models													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**					**Approved By** Member Secretary								
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M. Sc. -Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHC06	**CO-ORDINATION CHEMISTRY – I**	**DSC THEORY-VI**	**III**	**6**	**4**	**2**	**-**	**5**
Objective	Students will learn the basic idea of theories of bonding in coordination compounds, its structure and reactions							

Unit	Course Content	Knowledge Levels	Sessions
I	**Modern theories of coordination compounds:** Crystal field theory - splitting of d orbitals in octahedral, tetrahedral and square planar symmetries - measurement of 10 Dq - factors affecting 10 Dq - spectrochemical series - crystal field stabilisation energy for high spin and low spin complexes- evidences for crystal field splitting - site selections in spinels and anti-spinels - 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.	K2	16
II	**Spectral characteristics of complexes:** 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 interelectronic repulsion parameter.	K4	16
III	**Stability and Magnetic property of the complexes:** 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, Polorographic 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.	K2	16

IV	**Kinetics and mechanisms of substitution reactions of octahedral and square planar complexes:** Inert and Labile complexes; Associative, Dissociative and S_NCB 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.	K3	16
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. **Current Trends - *Reaction mechanisms in organometallic compounds. Fast reaction apparatus for the study of kinetics of hydrolysis of organometallic compounds***	K5	16
	***…….* Self-study**		
Course Outcome	**CO1:** Understand and comprehend various theories of coordination compounds.	K1	
	CO2: Observe the spectroscopic and magnetic properties of coordination complexes.	K2	
	CO3: Interpret the stability of complexes and various experimental methods to determine the stability of complexes.	K3	
	CO4: Predict the electronic transitions in a complex based on correlation diagrams and UV visible spectral details.	K4	
	CO5: Comprehend the kinetics and mechanism of substitution reactions in octahedral and square planar complexes.	K5	

Learning Resources	
Text Books	1. J E Huheey, EA Keiter, RL Keiter and OK Medhi, Inorganic Chemistry – Principles of structure and reactivity, 4th Edition, Pearson Education Inc., 2006 2. G L Meissler and D ATarr, Inorganic Chemistry, 3rd Edition, Pearson Education Inc., 2008 3. D. Bannerjea, Co-ordination Chemistry, TATA Mcgraw Hill, 2009
Reference Books	1. Keith F. Purcell and John C. Kotz, Inorganic Chemistry, Saunders Publications, USA, 2010. 2. Peter Atkins and Tina Overton, Shriver and Atkins' Inorganic Chemistry, 5th Edition, Oxford University Press, 2010. 3. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson, P. L. Guas, John Wiley, 2002, 3rd edn.
Website Link	https://onlinecourses.nptel.ac.in/noc19_cy19/preview https://teachmint.storage.googleapis.com/public/2fc0c3a8-41fe-43e0-8706-70ae0845e0de.pdf
Self-Study Material	https://pubs.rsc.org/en/content/articlelanding/1958/tf/tf9585400838 https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCYA5202.pdf

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHC06	**CO-ORDINATION CHEMISTRY – I**			**DSC THEORY-VI**		**III**	**6**	**4**	**2**	**-**	**5**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S	S	M	S	M	S
CO2	S	M	M	S	S	S	M	L	M	S
CO3	S	L	M	S	S	S	M	S	M	S
CO4	S	S	S	M	S	S	M	S	M	S
CO5	S	S	S	S	L	S	M	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP	
Teaching and Learning Methods	Chalk and Board class and Use of Molecular Models	
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved By** Member Secretary
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M. Sc. -Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHP03	**PRACTICAL: PHYSICAL CHEMISTRY**	**DSC PRACTICAL - III**	**III**	**6**	**-**	**-**	**6**	**5**
Objective	Students will understand the principle of conductivity experiments, evaluate the order of the reaction by following pseudo first order kinetics, construct the phase diagram of two component systems forming congruent melting solid and find its eutectic temperatures and compositions,							

S. No.	Course Content	Knowledge Levels	Sessions
1	Determination of equivalent conductance of a strong electrolyte & the verification of DHO equation.	K5	30
2	Verification of Ostwald's Dilution Law & Determination of pKa of a weak acid.	K5	
3	Verification of Kohlrausch's Law for weak electrolytes.	K5	
4	Determination of solubility of a sparingly soluble salt.	K5	
5	Acid-base titration (strong acid and weak acid vs NaOH)	K5	
6	Precipitation titrations (mixture of halides only).	K5	
7	Study the kinetics of acid hydrolysis of an ester; determine the temperature coefficient and also the activation energy of the reaction.	K5	
8	Study the kinetics of the reaction between acetone and iodine in acidic medium by half-life method and determine the order with respect to iodine and acetone.	K5	
9	Construction of phase diagram for a simple binary system 1. Naphthalene-phenanthrene 2. Benzophenone- diphenyl amine	K5	
10	**Adsorption** Adsorption of oxalic acid on charcoal & determination of surface area (Freundlich isotherm only).	K6	
Course Outcome	**CO1:** Recall the principles associated with various physical chemistry experiments.	K1	
	CO2: Scientifically plan and perform all the experiments.	K2	
	CO3: Observe and record systematically the readings in all the experiments.	K3	
	CO4: Calculate and process the experimentally measured values and compare with graphical data.	K4	

	CO5: Interpret the experimental data scientifically to improve students' efficiency for societal developments.	K5	

Learning Resources	
Text Books	1. B. Viswanathan and P.S.Raghavan, Practical Physical Chemistry, Viva Books, New Delhi, 2009. 2. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996. 3. V.D. Athawale and Parul Mathur, Experimental Physical Chemistry, New Age International (P) Ltd., New Delhi, 2008.
Reference Books	1. J. B. Yadav, Advanced Practical Physical Chemistry, Goel Publishing House, 2001. 2. G.W. Garland, J.W. Nibler, D.P. Shoemaker, Experiments in Physical Chemistry, 8th edition, McGraw Hill, 2009. 3. Shailendra K Sinha, Physical Chemistry: A laboratory Manual, Narosa Publishing House Pvt, Ltd., New Delhi, 2014.
Website Link	1.http://web.iitd.ac.in/~nkurur/2015-16/Isem/cmp511/lab_handout_new.pdf 2. http://digimat.in/nptel/courses/video/104106094/L41.html

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHP03	**PRACTICAL: PHYSICAL CHEMISTRY**					**DSC PRACTICAL - III**			**III**	**6**	**-**	**-**	**6**	**5**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	S	S	M	S	M	S				
CO2	S	M	M	S	S	S	M	S	M	S				
CO3	S	S	M	S	S	S	M	S	M	S				
CO4	S	S	S	M	S	S	M	S	M	S				
CO5	S	S	S	S	S	S	M	S	S	S				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	-													
Teaching and Learning Methods	Demo Class													
Assessment Methods	CIA-I, CIA-II and ESE													
Designed By	**Verified By**					**Approved By** Member Secretary								
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M.Sc -Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M4PCHC07	**CO-ORDINATION CHEMISTRY – II**	**DSC THEORY-VII**	**IV**	**6**	**4**	**2**	**-**	**5**
Objective	Students after completing this course will be able to recognize the fundamental and structural aspects of organometallic compounds, their reactions, properties and applications of selected complexes.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Chemistry of Organometallic compounds:** Classification of Organometallic compounds based on M-C bond – 18 and 16 electron rule; Bonding in metal – olefin complexes (example: Zeise's salt), metal-acetylene and metal-allyl complexes; Metal cyclopentadienyl complexes – Examples and MO approach to bonding in metallocenes; fluxional isomerism. Metal – carbonyl complexes: MO diagram of CO; Structure and bonding − bonding modes, MO approach of M-CO bonding, π-acceptor nature of carbonyl group, synergistic effect (stabilization of lower oxidation states of metals); Carbonyl clusters: Low nuclearity and high nuclearity carbonyl clusters – Structures based on polyhedral skeleton electron pair theory or Wade's rule	K2	16
II	**Reactions and catalysis of Organometallic compounds:** Reactions of Organometallic compounds: Oxidative addition, reductive elimination (α and β eliminations), migratory insertion reaction and metathesis reaction. Organo-metallic catalysis: Hydrogenation of olefins (Wilkinson's catalyst), Hydroformylation of olefins using Cobalt or Rhodium catalysts (oxo process), Oxidation of olefin (Wacker process), olefin isomerisation, water gas shift reaction, Cyclo-oligomerisation of acetylenes using Reppe's catalysts, Monsonto process.	K3	16
III	**Inorganic spectroscopy - I:** IR spectroscopy Effect of coordination on the stretching frequency sulphato, carbonato, sulphito, aqua, nitro, thiocyanato, cyano, thiourea, DMSO complexes; IR spectroscopy of carbonyl compounds. NMR spectroscopy-Introduction, applications of ^{1}H, ^{15}N - NMR spectroscopy in structural identification of Inorganic complexes, fluxional molecules, quadrupolar nuclei-effect in NMR spectroscopy.	K3	16

IV	**Inorganic spectroscopy-II:** Introductory terminologies: g and A parameters - definition, explanation and factors affecting g and A; Applications of ESR to coordination compounds with one and more than one unpaired electrons – hyperfine and secondary hyperfine splitting and Kramer's doublets; ESR spectra of V(II), Mn (II), Fe(II), Co(II), Ni(II), Cu(II) complexes, bis (salicylaldimine) copper(II) and $[(NH_3)_5Co\text{-}O_2\text{-}Co(NH_3)_5]^{5+}$. Mossbauer spectroscopy – Mossbauer effect, Recoil energy, Mossbauer active nuclei, Doppler shift, Isomer shift, quadrupole splitting and magnetic interactions. Applications of Mössbauer spectra to Fe and Sn compounds.	K4	16
V	**Photo Electron Spectroscopy:** Theory, Types, origin of fine structures - shapes of vibrational fine structures – adiabatic and vertical transitions, PES of homonuclear diatomic molecules (N_2, O_2) and heteronuclear diatomic molecules (CO, HCl) and polyatomic molecules (H_2O, CO_2, CH_4, NH_3) – evaluation of vibrational constants of the above molecules. Koopman's theorem- applications and limitations. Optical Rotatory Dispersion – Principle of CD and ORD; Δ and λ isomers in complexes, Assignment of absolute configuration using CD and ORD techniques. **Current Trends - * Stability of Coordination compounds in solutions and Application of Photocatalysis in Air Purification***	K5	16
	***…….* Self-study**		
Course Outcome	**CO1:** Understand and apply 18 and 16 electron rule for organometallic compounds	K1	
	CO2: Summarize the structure and bonding in olefin, allyl, cyclopentadienyl and carbonyl containing organometallic compounds	K2	
	CO3: Observe the reactions of organometallic compounds	K3	
	CO4: Relate the mechanisms in catalytic cycles	K4	
	CO5: Identify and predict the structure of coordination complexes using spectroscopic tools and interpret the structure of molecules by various spectral techniques.	K5	

Learning Resources	
Text Books	1. J E Huheey, EA Keiter, RL Keiter and OK Medhi, Inorganic Chemistry – Principles of structure and reactivity, 4th Edition, Pearson Education Inc., 2006 2. G L Meissler and D ATarr, Inorganic Chemistry, 3rd Edition, Pearson Education Inc., 2008 3. B D Gupta and A K Elias, Basic Organometallic Chemistry: Concepts, Syntheses and Applications, University Press, 2013.
Reference Books	1. Crabtree, Robert H. The Organometallic Chemistry of the Transition Metals. 3rd ed. New York, NY: John Wiley, 2000. 2. P Gütlich, E Bill, A X Trautwein, Mossbauer Spectroscopy and Transition Metal Chemistry: Fundamentals and Applications, 1st edition, Springer-Verlag Berlin Heidelberg, 2011. 3. K. F. Purcell, J. C. Kotz, Inorganic Chemistry; Saunders: Philadelphia, 2010. 4. R. S. Drago, PhysicaI Methods in Chemistry; Saunders: Philadelphia, 2016.

Website Link	1. https://archive.nptel.ac.in/courses/104/101/104101100/ 2. https://www.sscasc.in/wp-content/uploads/downloads/Chemistry/Inorganic-Chemistry.pdf			
Self-Study Material	1. https://www.udemy.com/course/co-ordination-compounds/?couponCode=ST7MT41824 2. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCYA5202.pdf			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**				**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M4PCHC07	**CO-ORDINATION CHEMISTRY – II**				**DSC THEORY-VII**	**IV**	**6**	**4**	**2**	**-**	**5**

CO-PO Mapping

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	S	S	M	S	M	S
CO2	S	M	M	S	S	S	M	S	M	S
CO3	S	S	M	S	L	S	M	L	M	S
CO4	S	S	S	M	S	S	M	S	M	S
CO5	S	L	S	S	S	S	M	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP	
Teaching and Learning Methods	Chalk and Board class and powerpoint presentation	
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved By** Member Secretary
Mrs. M. Saranya	Dr. N. Nithiya	Dr. S. Shahitha

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE
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M.Sc. -Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M4PCHC08	**ORGANIC SYNTHESIS AND PHOTOCHEMISTRY**	**DSC THEORY - VIII**	**IV**	**6**	**4**	**2**	**-**	**5**
Objective	Students will acquire knowledge about designing an organic reactions and concepts and applications of pericyclic and photochemical reactions							

Unit	Course Content	Knowledge Levels	Sessions
I	**Planning an Organic Synthesis and Control elements:** Preliminary Planning - alternate synthetic routes, key intermediates that would be formed, available starting materials and resulting yield of alternative methods. Linear vs convergent synthesis. Synthesis based on umpolung concepts of Seeback, Control elements: Regiospecific control elements and stereospecific control elements.	K3	16
II	**Organic Synthetic Methodology:** Alternate synthetic routes-Synthesis of organic mono and bifunctional compounds via disconnection approach. Protection of hydroxyl, carboxyl, carbonyl, thiol and amino groups. Illustration of protection and deprotection in synthesis. Use of protective groups, activating groups, and bridging elements. Functional group alterations and transposition.	K4	16
III	**Pericyclic Reactions:** Woodward Hoffmann Rules, The Mobius and Huckel concept, FMO, PMO method and correlation diagrams. Cycloaddition and retrocycloaddition reactions; [2+2], [2+4], Electrocyclization and ring opening reactions of conjugated dienes and trienes. Sigmatropic rearrangements: (1,3), (1,5), (3,3) and (5,5)-carbon migrations, degenerate rearrangements. Ionic sigmatropic rearrangements. Group transfer reactions. Regioselectivity, stereoselectivity and periselectivity in pericyclic reactions.	K4	16
IV	**Organic Photochemistry-I:** Photochemical excitation, Experimental techniques, electronic transitions, Jablonskii diagrams, intersystem crossings, energy transfer processes, Stern Volmer equation. Triplets, π-π^* Reactions of electronically excited ketones, Norrish type-I and Norrish type-II cleavage reactions, photo reductions, Paterno-Buch reactions.	K5	16

V	**Organic Photochemistry-II:** Photochemistry of α,β-unsaturated ketones, cis-trans isomerisation. Photon energy transfer reactions, Photo cycloadditions, Photochemistry of aromatic compounds, photochemical rearrangements, photostationery state, di-π-methane rearrangement, Reaction of conjugated cyclohexadienone to 3,4-diphenyl phenols, Barton's reactions. **Current Trends-*Supramolecular Organic Photochemistry***	K4	16
	***…….* Self-study**		
Course Outcome	**CO1:** To recall the basic principles of organic chemistry and to understand the various reactions of organic compounds with reaction mechanisms.	K2	
	CO2: To understand the versatility of various special reagents and to correlate their reactivity with various reaction conditions.	K2	
	CO3:To implement the synthetic strategies in the preparation of various organic compounds	K3	
	CO4: To predict the suitability of reaction conditions in the preparation of tailor-made organic compounds.	K4	
	CO5: To design and synthesize novel organic compounds with the methodologies learnt during the course.	K5	

Learning Resources

Text Books	1. J. March and M. Smith, Advanced Organic Chemistry, 5th ed., John-Wiley and sons, 2016. 2. Clayden, Greeves, Warren, Organic Chemistry, Oxford University Press, Second Edition, 2016. 3. M. B. Smith, Organic Synthesis 3rd edition, McGraw Hill International Edition, 2011.
Reference Books	1. J.A. Joule, G.F. Smith, Heterocyclic Chemistry, Garden City Press, Great Britain, 2020 2. Jagdamba Singh and Jaya Singh, Photochemistry and Pericyclic Reactions, New Age International Publishers, New Delhi, 2012.
Website Link	1. https://www.britannica.com/science/photochemical-reaction 2. https://testbook.com/chemistry/pericyclic-reactions 3. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/synth2.htm
Self-Study Material	https://onlinecourses.nptel.ac.in/noc24_cy23/preview

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M4PCHC08	**ORGANIC SYNTHESIS AND PHOTOCHEMISTRY**					**DSC THEORY - VIII**			**IV**	**6**	**4**	**2**	**-**	**5**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	S	S	L	S	M	S				
CO2	S	M	M	S	S	S	M	L	S	S				
CO3	S	S	M	S	S	S	L	S	M	S				
CO4	L	S	S	M	S	S	M	S	S	S				
CO5	S	S	S	S	S	S	S	S	S	S				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and learning through molecular models													
Teaching and Learning Methods	Chalk and Board class and PPT Presentation													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**					**Approved By** Member Secretary								
Mrs. A. Dhivya	Dr. N. Nithiya					Dr. S. Shahitha								

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M.Sc. -Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M4PCHP04	**PRACTICAL: ANALYTICAL INSTRUMENTATION TECHNIQUES**	**DSC PRACTICAL - IV**	**IV**	**4**	**-**	**-**	**4**	**3**
Objective	Students will gain knowledge about chromatographic methods for identification of different constituents also, evaluate and analyse different constituents by turbidimetry, conductivity measurements, emissionand absorption techniques.							

S. No.	Course Content	Knowledge Levels	Sessions
1	**Conductometric and Potentiometric Titrations (any 5)** Determination of the equivalent conductance of a weak acid at different concentrations and verifying Ostwald dilution law. Calculation of the dissociation constant of the acid.	K4	30
2	Determination of the equivalent conductance of a strong electrolyte at different concentrations and examining the validity of the Onsager‟s theory as limiting law at high dilutions.	K5	
3	Conductometric titration of a mixture of HCl and CH_3COOH Vs NaOH.	K5	
4	Potentiometric titration of a mixture of HCl and CH_3COOH Vs NaOH	K5	
5	Determination of pKa of weak acid by EMF method.	K5	
6	Potentiometric titration of FAS Vs $K_2Cr_2O_7$	K5	
7	Potentiometric titration of KI Vs $KMnO_4$.	K5	
8	Determination of the pH of buffer solution by EMF method using Quinhydrone and Calomel electrode.	K5	
9	**Advanced Techniques (any 2)** Determination of spectro-photometrically the mole ratio of the ferrithiocyanate complex and equilibrium constant for the complex formation.	K5	
10	Estimation of the amount of sulphate present in the given solution using Nephelometricturbidimeter.	K5	
11	Estimation of the amount of nitrate present in the given solution using spectrophotometric method.	K5	
12	Determination of caffeine in soft drinks by HPLC	K5	
13	Analysis of water quality through COD, DO, BOD measurements.	K5	
14	Assay of Riboflavin and Iron in tablet formulations by spectrophotometry	K5	
15	Separation of (a) mixture of Azo dyes by TLC (b) mixture of metal ions by Paper chromatography	K5	

16	Estimation of chlorophyll in leaves and phosphate in waste water by colorimetry		K5	
17	**Structural Determination using Spectroscopic Techniques (any 5 compounds)** Interpretation and identification of the given spectra of various organic compounds arrived at from the following instruments 1.UV-Visible 2.IR 3.NMR 4.Mass		K6	
Course Outcome	**CO1:** Recall the principles associated with various inorganic organic and physical chemistry experiments		K3	
	CO2: Scientifically plan and perform all the experiments		K3	
	CO3: Observe and record systematically the readings in all the experiments		K4	
	CO4: Calculate and process the experimentally measured values and compare with graphical data		K5	
	CO5: Interpret the experimental data scientifically to improve students efficiency for societal developments		K6	
Learning Resources				
Text Books	1. S. B. Furnis, Vogel's textbook of practical organic chemistry. LONGMAN SCIENTIFIC AND TECHNICAL, 2020. 2. J. Mendham, Barnes, J. D. Denney, R. C. Thomas, M.J.K. Mate, Vogel's textbook of quantitative chemical analysis, Pearson education India, Sixth edition, 2009 3. J. Derek Woollins, John Wiley, Inorganic Experiments, Wiley-VCH, 3rd revised edition, 2010.			
Reference Books	1. N. S. Gnanapragasam and G. Ramamurthy, Organic Chemistry – Labmanual, S. Viswanathan Co. Pvt. Ltd, 2009. 2. J. N. Gurtu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 2011. 3. C. Arora, S. Bhattacharya, Advanced Physical Chemistry Practical Guide, Bentham Science Publishers. 2022			
Website Link	1. https://bit.ly/3QESF7t 2. https://bit.ly/3QANOnX			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards													
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M4PCHP04	**PRACTICAL: ANALYTICAL INSTRUMENTATION TECHNIQUES**					**DSC PRACTICAL - IV**			**IV**	**4**	**-**	**-**	**4**	**3**

CO-PO Mapping

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	S	S	S	S	S	M	S	M	S
CO2	S	M	M	M	S	S	S	S	M	M
CO3	S	S	M	S	S	S	M	S	S	S
CO4	S	S	S	M	S	S	M	S	M	S
CO5	S	M	S	M	S	S	M	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-		
Teaching and Learning Methods	Demo and Practical Classes		
Assessment Methods	Class practical, CIA-I, CIA-II and ESE		
Designed By	**Verified By**	**Approved By** Member Secretary	
Dr. P. Dhilip	Dr. N. Nithiya	Dr. S. Shahitha	

List of Elective Course (DSE) Details for M.Sc., Chemistry
SYLLABUS - LOCF-CBCS Pattern
EFFECTIVE FROM THE ACADEMIC YEAR 2023-2024 Onwards

S. No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	I	23M1PCHE01	ELECTIVE I: PHARMACEUTICAL CHEMISTRY
2	I	23M1PCHE02 / 24M1PCHE02	ELECTIVE I: NANO MATERIALS AND NANO TECHNOLOGY
3	I	23M1PCHE03	ELECTIVE II: ELECTROCHEMISTRY
4	I	23M1PCHE04	ELECTIVE II: MOLECULAR SPECTROSCOPY
5	II	23M2PCHE05	ELECTIVE III: MEDICINAL CHEMISTRY
6	II	23M2PCHE06	ELECTIVE III: GREEN CHEMISTRY
7	II	23M2PCHE07	ELECTIVE IV: BIO-INORGANIC CHEMISTRY
8	II	23M2PCHE08	ELECTIVE IV: MATERIAL SCIENCE
9	III	23M3PCHE09	ELECTIVE V: PHARMACOGNOSY ANDPHYTOCHEMISTRY
10	III	23M3PCHE10	ELECTIVE V: BIOMOLECULES AND HETEROCYCLIC COMPOUNDS

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M. Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHE01	**PHARMACEUTICAL CHEMISTRY**	**DSE THEORY - I**	**I**	**5**	**3**	**2**	**-**	**3**
Objective	Students will understand the advanced concepts of pharmaceutical chemistry, biological functions of various drugs and the analysis of drug and characterization of drugs							

Unit	Course Content	Knowledge Levels	Sessions
I	**Physical properties in Pharmaceuticals:** Physical properties of drug molecule: physical properties. Refractive index- Definition, explanation, formula, importance, determination, specific & molar refraction. Optical activity\rotation- monochromatic & polychromatic light, optical activity, angle of rotation, specific rotation examples, measurement of optical activity. Dielectric constant & Induced Polarization- Dielectric constant explanation & determination. Rheology of pharmaceutical systems: Introduction, Definition, Applications, concept of viscosity, Newton's law offlow, Kinematic, Relative, Specific, Reduced & Intrinsic viscosity. Newtonian system, non-Newtonian system- Plastic flow, Pseudoplastic flow, Dilatent flow. Viscosity measurements- selection of viscometer for Newtonian and non-Newtonian system.	K2	12
II	**Isotopic Dilution analysis:** Principle and applications, Neutron activation analysis: Principle, advantages and limitations, Scintillation counters. Body scanning. Introduction to radiopharmaceuticals. Properties of various types of radiopharmaceuticals, Radiopharmaceuticals as diagnostics, as therapeutics, for research and sterilization, Physico Chemical Properties and drug action. Physico chemical properties of drugs (a) Partition coefficient, (b) solubility (c) surface activity, (d) degree of ionization.	K3	12

III	**Drug dosage and product development:** Introduction to drug dosage Forms & Drug Delivery system – 30 Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms. Drug dosage and product development. Introduction to drug dosage Forms & Drug Delivery system – Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms.	K3	12
IV	**Development of new drugs:** Introduction, procedure followed in drug design, the research for lead compounds, molecular modification of lead compounds. Structure Activity Relationship (SAR): Factors effecting bioactivity, resonance, inductive effect, isoterism, bioisosterism, spatial considerations, biological properties of simple functional groups, theories of drug activity, occupancy theory, rate theory, induced-fit theory, Quantitative structure activity relationship(QSAR): Development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameters, electronic parameter, ionization constants, steric parameters, chelation parameters, redox potential, indicator-variables.	K5	12
V	**Computers in Pharmaceutical Chemistry:** Need of computers for chemistry. Computers for Analytical Chemists Introduction to computers: Organization of computers, CPU, Computer memory, I/O devices, information storage, software components. Application of computers in chemistry: Programming in high level language (C+) to handle various numerical methods in chemistry – least square fit, solution to simultaneous equations, interpolation, extrapolation, data smoothing, and numerical differentiation and integrations.	K6	12
Course Outcome	**CO1:** Identify the suitable drugs for various diseases.	K1	
	CO2: Apply the principles of various drug action and drug design.	K2	
	CO3: Acquire the knowledge on product development based on SAR.	K3	
	CO4: Apply the knowledge on applications of computers in chemistry.	K5	
	CO5: Synthesize new drugs after understanding the concepts SAR.	K6	
Learning Resources			

Text Books	1. Essentials of Physical Chemistry, A. Bahl, A. S. Bahl and G. D. Tuli, S. Chand Publications, 2010 2. Text Book of Physical Pharmaceutics, C.V.S. Subramanyam,2nd edition, VallabhPrakashan, 2019. 3. Medicinal Chemistry (Organic Pharmaceutical Chemistry), G.R Chatwal, Himalaya Publishing house, 2022. 4. Textbook of Pharmaceutical Chemistry by,JayshreeGhosh, S. Chand &Company Ltd., 2017. 5. Pharmaceutical Chemistry by Dr. S. Lakshmi, Sultan Chand & Sons, 2004.			
Reference Books	1. Ansels Pharmaceutical Dosage forms and Drug Delivery System by Allen Popvich and Ansel, Indian edition-B.I. Publication Pvt. Ltd., 2014. 2. Computers for Chemists, S.K Pundir, AnshuBansal, A pragateprakashan., 2nd edition, New age international (P) limited, New Delhi. 3. Martin's Physical Pharmacy and Pharmaceutical Sciences by, Patrick J. Sinko, Lippincott. William and Wilkins, 7th edition, 2016. 4. Cooper and Gunn's Tutorial Pharmacy, 6th edition by S.J. Carter, CBS Publisher Ltd., 2005 5. Computers in Chemistry, K.V. Raman, Tata Mc.Graw-Hill, 1993.			
Website Link	1. Types of Chemotherapy Drugs | SEER Training (cancer.gov) 2. Physiology, Body Fluids - StatPearls - NCBI Bookshelf (nih.gov)			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHE01	**PHARMACEUTICAL CHEMISTRY**					**DSE THEORY - I**			**I**	**5**	**3**	**2**	**-**	**3**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	M	S	S	S	S	S				
CO2	M	S	S	S	S	S	S	S	M	S				
CO3	S	S	M	S	S	M	S	M	S	S				
CO4	M	S	S	S	S	S	S	S	M	S				
CO5	M	S	M	S	S	S	S	S	S	M				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and video class													
Teaching and Learning Methods	Chalk and Board class, Google meet classrooms and PPT Presentation													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**								**Approved By** Member Secretary					
Mrs. M. Saranya	Dr. N. Nithiya								Dr. S. Shahitha					

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M.Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
24M1PCHE02	**NANO MATERIALS AND NANO TECHNOLOGY**	**DSE THEORY - I**	**I**	**5**	**3**	**2**	**-**	**3**
Objective	Students will understand the concept of Nano materials and Nano technology							

Unit	Course Content	Knowledge Levels	Sessions
I	**Introduction of nanomaterials and nanotechnologies:** Introduction-role of size, classification-0D, 1D, 2D, 3D. Synthesis - Bottom –Up, Top–Down, consolidation of Nano powders. Features of nanostructures, Background of nanostructures. Techniques of synthesis of nanomaterials, Tools of the nanoscience. Applications of nanomaterials and technologies.	K2	12
II	**Bonding and structure of the nanomaterials:** Predicting the Type of Bonding in a Substance crystal structure. Metallic nanoparticles, Surfaces of Materials, Nanoparticle Size and Properties. Synthesis - Physical and chemical methods - inert gas condensation, arc discharge, laser ablation, sol-gel, solvothermal and hydrothermal-CVD-types, metallo organic, plasma enhanced, and low-pressure CVD. Microwave assisted and electrochemical synthesis.	K3	12
III	**Structure and optical properties** Theories relevant to mechanical properties. Nanoparticles: gold and silver, metal oxides: silica, iron oxide and TiO_2, ZnO_2, WO_3 Nanoparticles – synthesis, properties and applications.	K3	12
IV	**Electrical properties:** Conductivity and Resistivity, Classification of Materials based on Conductivity, magnetic properties, electronic properties of materials. Classification of magnetic phenomena. Semiconductor materials – classification-Ge, Si, GaAs, SiC, GaN, GaP, CdS, PbS. Identification of materials as p and n – type semiconductor - Hall effect - quantum and anomalous, Hall voltage - interpretation of charge carrier density. Applications of semiconductors: p-n junction as transistors and rectifiers, photovoltaic and photogalvanic cell.	K5	12

V	**Characterization and applications:** Fullerenes (C60), Carbon nano tubes, Graphenes, Polymeric nanoparticles (Selected cases) Electrospinning and Nano fibres. Self assembled nano structures of various dimensions and applications- Characterization – SEM, TEM and AFM - principle, instrumentation and applications. Application of nanoparticles in different fields.	K6	12
Course Outcome	**CO1:** Explain methods of fabricating nanostructures.	K1	
	CO2: Relate the unique properties of nanomaterials to reduce dimensionality of the material	K2	
	CO3: Describe tools for properties of nanostructures.	K3	
	CO4: Discuss the applications of nanomaterials.	K5	
	CO5: Analyze the health and safety related to nanomaterial.	K6	

Learning Resources	
Text Books	1. S. Mohan and V. Arjunan, Principles of Materials Science, MJP Publishers, 2016. 2. Arumugam, Materials Science, Anuradha Publications,2007. 3. Giacavazzo et. al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010 4. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012.
Reference Books	1. S. Mohan and V. Arjunan, Principles of Materials Science, MJP Publishers, 2016. 2. Arumugam, Materials Science, Anuradha Publications, 2007. 3. Giacavazzo et. al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010 4. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012.
Website Link	1. http://xrayweb.chem.ou.edu/notes/symmetry.html. 2. http://www.uptti.ac.in/classroom-content/data/unit%20cell.pdf.

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
24M1PCHE02	**NANO MATERIALS AND NANO TECHNOLOGY**					**DSE THEORY - I**			**I**	**5**	**3**	**2**	**-**	**3**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	M	S	S	S	S	S				
CO2	M	S	S	S	S	S	L	S	M	S				
CO3	S	S	M	S	S	M	S	L	S	S				
CO4	M	S	S	S	S	S	M	S	L	M				
CO5	M	S	M	S	S	S	S	M	M	L				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP													
Teaching and Learning Methods	Chalk and Board class and powerpoint presentation													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**					**Approved By** Member Secretary								
Mrs. M. Saranya	Dr. N. Nithiya					Dr. S. Shahitha								

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M.Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHE02	**NANO MATERIALS AND NANO TECHNOLOGY**	**DSE THEORY - I**	**I**	**5**	**3**	**2**	**-**	**3**
Objective	Students will understand the concept of Nano materials and Nano technology							

Unit	Course Content	Knowledge Levels	Sessions
I	**Introduction of nanomaterials and nanotechnologies:** Introduction-role of size, classification-0D, 1D, 2D, 3D. Synthesis - Bottom –Up, Top–Down, consolidation of Nano powders. Features of nanostructures, Background of nanostructures. Techniques of synthesis of nanomaterials, Tools of the nanoscience. Applications of nanomaterials and technologies.	K2	12
II	**Bonding and structure of the nanomaterials:** Predicting the Type of Bonding in a Substance crystal structure. Metallic nanoparticles, Surfaces of Materials, Nanoparticle Size and Properties. Synthesis - Physical and chemical methods - inert gas condensation, arc discharge, laser ablation, sol-gel, solvothermal and hydrothermal-CVD-types, metallo organic, plasma enhanced, and low-pressure CVD. Microwave assisted and electrochemical synthesis.	K3	12
III	**Mechanical properties of materials** Theories relevant to mechanical properties. Techniques to study mechanical properties of nanomaterials, adhesion and friction, thermal properties of nanomaterials Nanoparticles: gold and silver, metal oxides: silica, iron oxide andalumina – synthesis and properties.	K3	12
IV	**Electrical properties:** Conductivity and Resistivity, Classification of Materials based on Conductivity, magnetic properties, electronic properties of materials. Classification of magnetic phenomena. Semiconductor materials – classification-Ge, Si, GaAs, SiC, GaN, GaP, CdS, PbS. Identification of materials as p and n – type semiconductor - Hall effect - quantum and anomalous, Hall voltage - interpretation of charge carrier density. Applications of semiconductors: p-n junction as transistors and rectifiers, photovoltaic and photogalvanic cell.	K5	12

V	**Nano thin films, nanocomposites:** Application of nanoparticles in different fields. Core-shell nanoparticles-types, synthesis and properties. Nanocomposites – metal -ceramic-and polymer – matrix composites - applications. Characterization–SEM, TEM and AFM - principle, instrumentation and applications.	K6	12
Course Outcome	**CO1:** Explain methods of fabricating nanostructures.	K1	
	CO2: Relate the unique properties of nanomaterials to reduce dimensionality of the material	K2	
	CO3: Describe tools for properties of nanostructures.	K3	
	CO4: Discuss the applications of nanomaterials.	K5	
	CO5: Analyze the health and safety related to nanomaterial.	K6	

Learning Resources				
Text Books	1. S. Mohan and V. Arjunan, Principles of Materials Science, MJP Publishers, 2016. 2. Arumugam, Materials Science, Anuradha Publications,2007. 3. Giacavazzo et. al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010 4. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012.			
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Website Link	1. http://xrayweb.chem.ou.edu/notes/symmetry.html. 2. http://www.uptti.ac.in/classroom-content/data/unit%20cell.pdf.			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHE02	**NANO MATERIALS AND NANO TECHNOLOGY**					**DSE THEORY - I**			**I**	**5**	**3**	**2**	**-**	**3**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	M	S	S	S	S	S				
CO2	M	S	S	S	S	S	L	S	M	S				
CO3	S	S	M	S	S	M	S	L	S	S				
CO4	M	S	S	S	S	S	M	S	L	M				
CO5	M	S	M	S	S	S	S	M	M	L				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP													
Teaching and Learning Methods	Chalk and Board class and powerpoint presentation													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**							**Approved By** Member Secretary						
Mrs. M. Saranya	Dr. N. Nithiya							Dr. S. Shahitha						

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M.Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHE03	**ELECTROCHEMISTRY**	**DSE THEORY - II**	**I**	**5**	**3**	**2**	**-**	**3**
Objective	Students will learn all the concepts of electrochemistry and its applications							

Unit	Course Content	Knowledge Levels	Sessions
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-HuckelBjerrum model. Derivation of Debye-Huckel limiting law at appreciable concentration of electrolytes modifications and applications. Electrolytic conduction Debye-Huckel Onsager treatment of strong electrolyte-qualitative and quantitative verification and limitations. Evidence for ionic atmosphere. Ion association and triple ion formations.	K2	12
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.	K3	12
III	**Electrodics of Elementary Electrode Reactions:** Behavior of electrodes: Standard electrodes and electrodes at equilibrium. Anodic and Cathodic currents, condition for the discharge of ions. Nernst equation, polarizable and non-polarizable electrodes. Model of three electrode system, over potential. Rate of electro chemical reactions: Rates of simple elementary reactions. Butler-Volmer equation-significance of exchange current density, net current density and symmetry factor. Low and high field approximations. Symmetry factor and transfer coefficient Tafel equations and Tafel plots.	K3	12

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.	K5	12
V	**Concentration Polarization, Batteries and Fuel cells:** Modes of Transport of electro active species - Diffusion, migration and hydrodynamic modes. Role of supporting electrolytes. Polarographyprinciple 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.	K6	12
Course Outcome	**CO1:** Understand the behaviour of electrolytes in solution and compare the structures of electrical double layer of different models.	K1	
	CO2: Predict the kinetics of electrode reactions applying Butler-Volmer and Tafel equations	K2	
	CO3: Study different thermodynamic mechanism of corrosion	K3	
	CO4: Discuss the theories of electrolytes, electrical double layer, electrodics and activity coefficient of electrolytes	K5	
	CO5: Gain knowledge on storage devices and electrochemical reaction mechanism.	K6	

Learning Resources

Text Books	1. D. R. Crow, Principles and applications of electrochemistry, 4th edition, Chapman & Hall/CRC, 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 and P.S. Raghavan, Electrochemistry-Principles and applications, S. Viswanathan Printers, Chennai,2007.
Reference Books	1. J.O.M. Bockris and A.K.N. Reddy, Modern Electro chemistry, vol.1 and 2B, Springer, Plenum Press, New York, 2008. 2. J.O.M. Bockris, A.K.N. Reddy and M.G. AldecoMorden Electro chemistry, vol. 2A, Springer, Plenum Press, New York, 2008. 3. Philip H. Rieger, Electrochemistry, 2nd edition, Springer, New York, 2010. 4. K.L. Kapoor, A Text book of Physical chemistry, volume-3, Macmillan, 2001.

Website Link	1. https://www.pdfdrive.com/modern-electrochemistry-e34333229.			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHE03	**ELECTROCHEMISTRY**					**DSE THEORY - II**			**I**	**5**	**3**	**2**	**-**	**3**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	M	S	S	S	S	S				
CO2	M	S	S	S	S	S	L	M	S	M				
CO3	S	S	M	S	S	S	M	L	S	S				
CO4	M	S	S	S	S	S	S	M	L	S				
CO5	M	S	M	S	S	S	L	M	S	L				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP													
Teaching and Learning Methods	Chalk and Board class and powerpoint presentation													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**					**Approved By** Member Secretary								
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Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHE04	**MOLECULAR SPECTROSCOPY**	**DSE THEORY - II**	**I**	**5**	**3**	**2**	**-**	**3**
Objective	Students will understand the principle and applications of various spectroscopic techniques							

Unit	Course Content	Knowledge Levels	Sessions
I	**Rotational and Raman Spectroscopy:** Rotational spectra of diatomic and polyatomic molecules. Intensities of rotational spectral lines, effect of isotopic substitution. Non-rigid rotators. Classical theory of the Raman effect, polarizability as a tensor, polarizability ellipsoids, quantum theory of the Raman effect, Pure rotational Raman spectra of linear and asymmetric top molecules, Stokes and anti-Stokes lines. Vibrational Raman spectra, Raman activity of vibrations, rule of mutual exclusion, rotational fine structure -O and S branches, Polarization of Raman scattered photons	K2	12
II	**Vibrational Spectroscopy:** Vibrations of molecules, harmonic and anharmonic oscillatorsvibrational energy expression, energy level diagram, vibrational wave functions and their symmetry, selection rules, expression for the energies of spectral lines, computation of intensities, hot bands, effect of isotopic substitution. Diatomic vibrating rotor, vibrational - rotational spectra of diatomic molecules, P, R branches, breakdown of the Born-Oppenheimer approximation. Vibrations of polyatomic molecules – symmetry properties, overtone and combination frequencies. Influence of rotation on vibrational spectra of polyatomic molecule, P, Q, R branches, parallel and perpendicular vibrations of linear and symmetric top molecules.	K3	12
III	**Electronic spectroscopy:** Electronic Spectroscopy: Electronic spectroscopy of diatomic molecules, Frank-Condon principle, dissociation and pre dissociation spectra. $\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$ transitions and their selection rules. Photoelectron Spectroscopy: Basic principles, photoelectron spectra of simple molecules, X-ray photoelectron spectroscopy (XPS). Lasers: Laser action, population inversion, properties of laser radiation, examples of simple laser systems.	K4	12

IV	**NMR and Mass Spectrometry:** Chemical shift, Factors influencing chemical shifts: Electronegativity and electrostatic effects; Mechanism of shielding and deshielding. Spin systems: First order and second order coupling of AB systems, Simplification of complex spectra. Spin-spin interactions: Homonuclear coupling interactions - AX, AX_2, AB types. Vicinal, germinal and longrange coupling-spin decoupling. Nuclear Overhauser effect (NOE), Factors influencing coupling constants and Relative intensities. ^{13}CNMR and structural correlations, Satellites. Brief introduction to 2D NMR – COSY, NOESY. Introduction to ^{31}P, ^{19}F NMR. Mass Spectrometry: Ionization techniques - Electron ionization (EI), chemical ionization (CI), desorption ionization (FAB/MALDI), electrospray ionization (ESI), isotope abundance, molecular ion, fragmentation processes of organic molecules, deduction of structure through mass spectral fragmentation, high resolution. Effect of isotopes on the appearance of mass spectrum.	K5	12
V	**ESR and Mossbauer Spectroscopy:** ESR spectroscopy Characteristic features of ESR spectra, line shapes and line widths; ESR spectrometer. The g value and the hyperfine coupling parameter (A), origin of hyperfine interaction. Interpretation of ESR spectra and structure elucidation of organic radicals using ESR spectroscopy; Spin orbit coupling and significance of g-tensors, zero/non-zero field splitting, Kramer's degeneracy, application to transition metal complexes (having one to five unpaired electrons) including biological molecules and inorganic free radicals. ESR spectra of magnetically dilute samples. Structural elucidation of organic compounds by combined spectral techniques. Principle of Mossbauer spectroscopy: Doppler shift, recoil energy. Isomer shift, quadrupole splitting, magnetic interactions. Applications: Mossbauer spectra of high and low-spin Fe and Sn compounds.	K6	12
Course Outcome	**CO1:** Understand the importance of rotational and Raman spectroscopy.	K1	
	CO2: Apply the vibrational spectroscopic techniques to diatomic and polyatomic molecules.	K2	
	CO3: Evaluate different electronic spectra of simple molecules using electronic spectroscopy.	K3	
	CO4: Outline the NMR, ^{13}C NMR, 2D NMR – COSY, NOESY, and Introduction to ^{31}P, ^{19}FNMR and ESR spectroscopic techniques.	K5	
	CO5: Develop the knowledge on principle, instrumentation and structural elucidation of simple molecules using Mass Spectrometry, EPR and Mossbauer Spectroscopy techniques.	K6	
Learning Resources			

Text Books	1. C. N. Banwell and E. M. McCash, Fundamentals of Molecular Spectroscopy, 4th Ed., Tata McGraw Hill, New Delhi, 2000. 2. R. M. Silverstein and F. X. Webster, Spectroscopic Identification of Organic Compounds, 6th Ed., John Wiley & Sons, New York, 2003. 3. W. Kemp, Applications of Spectroscopy, English Language Book Society, 3rd ed., 2019. 4. D. H. Williams and I. Fleming, Spectroscopic Methods in Organic Chemistry, 6th Ed., Tata McGraw-Hill Publishing Company, New Delhi, 2007.			
Reference Books	1. P.W. Atkins and J. de Paula, Physical Chemistry, 7th Ed., Oxford University Press, Oxford, 2002. 2. I. N. Levine, Molecular Spectroscopy, John Wiley & Sons, New York, 1974. 3. A. Rahman, Nuclear Magnetic Resonance-Basic Principles, Springer-Verlag, New York, 2008. 4. K. Nakamoto, Infrared and Raman Spectra of Inorganic and coordination Compounds, PartB: 5th ed., John Wiley& Sons Inc., New York, 1997.			
Website Link	1. https://onlinecourses.nptel.ac.in/noc20_cy08/preview 2. https://www.digimat.in/nptel/courses/video/104106122/L14.html			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M1PCHE04	**MOLECULAR SPECTROSCOPY**					**DSE THEORY - II**			**I**	**5**	**3**	**2**	**-**	**3**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	M	S	S	S	S	S				
CO2	M	S	S	L	S	S	M	S	L	S				
CO3	S	S	M	S	S	M	L	M	S	S				
CO4	M	S	S	L	S	S	M	S	S	S				
CO5	M	S	M	S	S	S	S	L	M	S				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP													
Teaching and Learning Methods	Chalk and Board class and powerpoint presentation													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**					**Approved By** Member Secretary								
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M. Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHE05	**MEDICINAL CHEMISTRY**	**DSE THEORY - III**	**II**	**4**	**2**	**2**	**-**	**3**
Objective	Students will study the chemistry behind the development of pharmaceutical materials, mechanism and action of drugs, need of antibiotics and usage of drugs, mode of action of diabetic agents and treatment of diabetes and to identify and apply the action of various antibiotics.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Introduction to receptors:** Introduction, targets, Agonist, antagonist, partial agonist. Receptors, Receptor types, Theories of Drug – receptor interaction, Drug synergism, Drug resistance, physicochemical factors influencing drug action.	K2	12
II	**Antibiotics:** Introduction, Targets of antibiotics action, classification of antibiotics, enzyme-based mechanism of action, SAR of penicllins and tetracyclins, clinical application of penicillins, cephalosporin. Current trends in antibiotic therapy.	K3	12
III	**Antihypertensive agents and diuretics:** Classification of cardiovascular agents, introduction to hypertension, etiology, types, classification of antihypertensive agents, classification and mechanism of action of diuretics, Furosemide, Hydrochlorothiazide, Amiloride.	K5	12
IV	**Antiviral and Antibacterial:** Classification of antiviral agents, Mechanism of action - Chloroquine Phosphate, Amodiaquine hydrochloride and Pyrimethamine. Antibacterial: Classification and mechanism of action Sulphanilamide, Sulphapyridine, Sulphadiazine and Sulphisoxazole	K5	12
V	**Analgesics, Antipyretics and Anti-inflammatory Drugs:** Introduction, Mechanism of inflammation, classification and mechanism of action and paracetamol, Ibuprofen, Diclofenac, naproxen, indomethacin, phenylbutazone and meperidine. Medicinal Chemistry of Antidiabetic Agents Introduction, Types of diabetics, Drugs used for the treatment, chemical classification, Mechanism of action, Treatment of diabetic mellitus. Chemistry of insulin, sulfonyl urea.	K6	12
Course	**CO1:** Predict the drug properties based on its structure.	K1	

Outcome	**CO2:** Describe the factors that affect its absorption, distribution, metabolism, and excretion, and hence the considerations to be made in drug design.	K2	
	CO3: Explain the relationship between drug's chemical structure and its therapeutic properties.	K3	
	CO4: Designed to give the knowledge of different theories of drug actions at molecular level.	K5	
	CO5: Identify different targets for the development of new drugs for the treatment of infectious diseases.	K6	

Learning Resources	
Text Books	1. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry, 12th ed., Walters Kluwer India PVt., Ltd., 2010, 2. JayashreeGhosh, A textbook of Pharmaceutical Chemistry, S.ChandandCo. Ltd,2017. 4. O. LeRoy, Natural and synthetic organic medicinal compounds, Ealemi, 1976. 5. S. AshutoshKar, Medicinal Chemistry, 7th ed., New Age International Publishers, 2018.
Reference Books	1. Foye'sPrincles of Medicinal Chemistry, Lipincott Williams, 7th Edition, 2012 2. Burger's Medicinal Chemistry, Drug Discovery and Development, Donald J. Abraham, David P. Rotella, Alfred Burger, Academic press, 2010. 3. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry,John M. Beale JrandJohn M. Block, Wolters Kluwer, 2011,12thedn. 4. S. Ramakrishnan, K. G. Prasannan and R. Rajan,Textbook of Medical Biochemistry,Hyderabad: Orient Longman.3rd edition,2001.
Website Link	1. https://www.ncbi.nlm.nih.gov/books/NBK482447/ 2. https://training.seer.cancer.gov/treatment/chemotherapy/types.html 3. https://www.classcentral.com/course/swayam-medicinal-chemistry12908

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHE05	**MEDICINAL CHEMISTRY**					**DSE THEORY - III**			**II**	**4**	**2**	**2**	**-**	**3**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	M	S	S	S	S	S				
CO2	M	S	S	S	S	S	L	M	L	S				
CO3	S	S	M	S	S	S	M	L	S	S				
CO4	M	S	S	S	S	S	S	S	L	M				
CO5	M	S	M	S	S	S	S	M	M	S				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP													
Teaching and Learning Methods	Chalk and Board class and powerpoint presentation													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**					**Approved By** Member Secretary								
Mrs. M. Saranya	Dr. N. Nithiya					Dr. S. Shahitha								

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Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHE06	**GREEN CHEMISTRY**	**DSE THEORY - III**	**II**	**4**	**2**	**2**	**-**	**3**
Objective	Students will learn about the basic principles of Green Chemistry, its importance and various methodologies available to carry out Green Chemistry experiments							

Unit	Course Content	Knowledge Levels	Sessions
I	**Introduction for Green Chemistry:** Need for Green Chemistry. Goals of Green Chemistry. Limitations/ of Green Chemistry. Chemical accidents, terminologies, International green chemistry organizations and Twelve principles of Green Chemistry with examples.	K1	12
II	**Green reagents and solvents:** Choice of starting materials, reagents, catalysts and solvents in detail, Green chemistry in day today life. Designing green synthesisgreen reagents: dimethyl carbonate. Green solvents: Water, Ionic liquids-criteria, general methods of preparation, effect on organic reaction. Supercritical carbon dioxide- properties, advantages, drawbacks and a few examples of organic reactions in sc CO_2. Green synthesis-adipic acid and catechol.	K2	12
III	**Green catalyst:** Environmental pollution, Green Catalysis-Acid catalysts, Oxidation catalysts, Basic catalysts, Polymer supported catalysts-Poly styrene aluminum chloride, polymeric super acid catalysts, Poly supported photosensitizers.	K3	12
IV	**Green synthesis:** Phase transfer catalysis in green synthesis-oxidation using hydrogen peroxide, crown ethers-esterification, saponification, anhydride formation, Elimination reaction, Displacement reaction. Applications in organic synthesis.	K4	12
V	**Green synthesis applications:** Micro wave induced green synthesis-Introduction, Instrumentation, Principle and applications. Sonochemistry – Instrumentation, Cavitation theory - Ultra sound assisted green synthesis and Applications.	K5	12
Course Outcome	**CO1:** Recall the basic chemical techniques used in conventional industrial preparations and in green innovations.	K1	
	CO2: Understand the various techniques used in chemical industries and in laboratory.	K2	

	CO3: Compare the advantages of organic reactions assisted by renewable energy sources and non-renewable energy sources.	K3	
	CO4: Apply the principles of PTC, ionic liquid, microwave and ultrasonic assisted organic synthesis.	K5	
	CO5: Design and synthesize new organic compounds by green methods.	K6	

Learning Resources	
Text Books	1. Ahluwalia, V.K. and Kidwai, M.R. New Trends in Green Chemistry, Anamalaya Publishers, 2005. 2. W. L. McCabe, J.C. Smith and P. Harriott, Unit Operations of Chemical Engineering, 7thedition, McGraw-Hill, NewDelhi, 2005. 3. V. K. Ahluwalia and R. Aggarwal, Organic Synthesis: Special Techniques, Narosa Publishing House, New Delhi, 2001. 4. A. K. De, Environmental Chemistry, New Age Publications, 2017.
Reference Books	1. Anastas, P.T. and Warner, J.K. Oxford Green Chemistry -Theory and Practical, University Press, 1998 2. Matlack, A.S. Introduction to Green Chemistry, Marcel Dekker, 2001 3. Cann, M.C. and Connely, M.E. Real-World Cases in Green Chemistry, American Chemical Society, Washington, 2000 4. Ryan, M.A. and Tinnesand, M., Introduction to Green Chemistry, American Chemical Society Washington, 2002.
Website Link	1. https://www.organic-chemistry.org/ 2. https://www.studyorgo.com/summary.php

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards													
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHE06	**GREEN CHEMISTRY**					**DSE THEORY - III**			**II**	**4**	**2**	**2**	**-**	**3**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	M	S	S	S
CO2	M	S	S	S	S	S	S	M	L	S
CO3	S	S	M	S	S	S	L	S	M	L
CO4	M	S	S	S	S	S	S	S	L	S
CO5	M	S	M	S	S	S	M	L	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Group Discussion		
Teaching and Learning Methods	Chalk and Board class and powerpoint presentation		
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE		
Designed By	**Verified By**	**Approved By** Member Secretary	
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Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHE07	**BIO-INORGANIC CHEMISTRY**	**DSE THEORY - IV**	**II**	**4**	**2**	**2**	**-**	**3**
Objective	Students will learn about the role of trace elements, biological significance of iron, sulpur, toxicity of metals in medicines, knowledge on diagnostic agents and discuss on various metalloenzymes properties.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Essential trace elements:** Selective transport and storage of metal ions: Ferritin, Transferrin and sidorphores; Sodium and potassium transport, Calcium signalling proteins. Metalloenzymes, Zinc enzymes–carboxy peptidase and carbonic anhydrase. Ironenzymes–catalase, peroxidase. Copper enzymes – superoxide dismutase, Plastocyanin, Ceruloplasmin, Tyrosinase. Coenzymes - Vitamin-B_{12} coenzymes.	K2	12
II	**Transport Proteins:** Oxygen carriers-Hemoglobin and myoglobin - Structure and oxygenation Bohr Effect. Binding of CO, NO, CN– to Myoglobin and Hemoglobin. Biological redox system: Cytochromes - Classification, cytochrome a, b and c. Cytochrome P-450. Non-heme oxygen carriers Hemerythrin and hemocyanin. Iron-sulphur proteins- Rubredoxin and Ferredoxin-Structure and classification.	K3	12
III	**Nitrogen fixation:** Introduction, types of nitrogen fixing microorganisms. Nitrogenase enzyme - Metal clusters in nitrogenase- redox property - Dinitrogen complexes transition metal complexes of dinitrogen - nitrogen fixation via nitride formation and reduction of dinitrogen to ammonia. Photosynthesis, photosystem-I and photosystem-II-chlorophylls structure and function.	K3	12
IV	**Metals in medicine:** Metal Toxicity of Hg, Cd, Zn, Pb, As, Sb. Therapeutic Compounds, Vanadium-Based Diabetes Drugs; Platinum-Containing 61 Anticancer Agents, Chelation, therapy, Cancer treatment. Diagnostic Agents, Technetium Imaging Agents; Gadolinium MRI Imaging Agents, temperature and critical magnetic Field.	K5	12

V	**Enzymes :** Introduction and properties - nomenclature and classification. Enzyme kinetics, free energy of activation and the effects of catalysis. Michelis - Menton equation - Effect of pH, temperature on enzyme reactions. Factors contributing to the efficiency of enzyme.	K6	12
Course Outcome	**CO1:** Recall the various nethodologies to analyse trace elements.	K1	
	CO2: Explain the biological redox systems.	K2	
	CO3: Gain skills in analyzing the toxicity in metals.	K3	
	CO4: Experience in various methods available for diagnosis.	K5	
	CO5: Learn about the nitrogen fixation and photosynthetic mechanism.	K6	

Learning Resources

Text Books	1. Williams,D.R. –Introdution to Bioinorganic chemistry, Murphy and Moore Publications, 2022. 2. F.M. Fiabre and D.R. Williams– The Principles of Bioinorganic Chemistry, RoyalSociety of Chemistry, Monograph for Teachers-31 3. K.F. Purcell and Kotz., Inorganic chemistry, Cengage Publishers, 2010. 4. G.N. Mugherjee and Arabinda Das, Elements of Bioinorganic Chemistry, 4th ed., U. N. Dhur and Sons Pvt. Ltd., 2012. 5. R. Gopalan, V. Ramalingam, Concise Coordination Chemistry, S. Chand, 2001.
Reference Books	1. M.Satake and Y.Mido, Bioinorganic Chemistry- Discovery Publishing House, New Delhi, 1996 2. M.N. Hughes, The Inorganic Chemistry of Biological processes, II Edition, Wiley London, 1982. 3. R. W. Hay, Bio Inorganic Chemistry, Ellis Horwood, 1987. 4. R. M. Roat-Malone, Bio Inorganic Chemistry, John Wiley, 2002.
Website Link	1. https://www.pdfdrive.com/instant-notes-in-inorganic-chemistrythe-instant-notes-chemistry-series-d162097454.html 2.https://www.pdfdrive.com/shriver-and-atkins-inorganic-chemistry5th-edition-d161563417.html

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**					**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHE07	**BIO-INORGANIC CHEMISTRY**					**DSE THEORY - IV**	**II**	**4**	**2**	**2**	**-**	**3**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	S	S	S	S
CO2	M	S	S	S	S	S	S	L	S	S
CO3	S	S	M	S	S	M	S	M	L	M
CO4	M	S	S	S	S	S	S	M	S	S
CO5	M	S	M	S	S	S	S	S	S	M
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP	
Teaching and Learning Methods	Chalk and Board class and powerpoint presentation	
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved By** Member Secretary
Mrs. M. Saranya	Dr. N. Nithiya	Dr. S. Shahitha

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M.Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
24M2PCHE08	**MATERIAL SCIENCE**	**DSE THEORY - IV**	**II**	**4**	**2**	**2**	**-**	**3**
Objective	Students will understand the types of crystals, growth methods, properties, characterization techniques and applications.							

Unit	Course Content	Knowledge Levels	Sessions
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.	K1	12
II	**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.	K2	12
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.	K3	12

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 gian 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 $LiNbO_3$.	K4	12
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 on to 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.	K5	12
Course Outcome	**CO1:** Understand and recall the synthesis and characteristics of crystal structures	K1	
	CO2: Integrate and assess the structure of different materials and their properties.	K2	
	CO3: Analyze and identify new materials for energy applications.	K3	
	CO4: Investigate the importance of crystal structures.	K5	
	CO5: Design and develop new materials with improved property for energy applications.	K6	

Learning Resources

Text Books	1. S. Mohan and V. Arjunan, Principles of Materials Science, MJP Publishers, 2016. 2. Arumugam, Materials Science, Anuradha Publications, 2007. 3. Giacavazzo et. al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010 4. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012. 5. James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science for Engineers. 6th ed., PEARSON Press, 2007.
Reference Books	1. M.G. Arora, Solid State Chemistry, Anmol 65 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.
Website Link	1. http://xrayweb.chem.ou.edu/notes/symmetry.html. 2. http://www.uptti.ac.in/classroom-content/data/unit%20cell.pdf. 3. https://bit.ly/3QyVg2R

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards													
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
24M2PCHE08	**MATERIAL SCIENCE**					**DSE THEORY - IV**			**II**	**4**	**2**	**2**	**-**	**3**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	M	S	S	S	S	S
CO2	M	S	S	S	S	S	M	L	M	S
CO3	S	S	M	S	S	S	L	S	M	S
CO4	M	S	S	S	S	S	M	L	S	M
CO5	M	S	M	S	S	S	S	M	S	L
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP	
Teaching and Learning Methods	Chalk and Board class and powerpoint presentation	
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE	
Designed By	**Verified By**	**Approved By** Member Secretary
Mrs. M. Saranya	Dr. N. Nithiya	Dr. S. Shahitha

MUTHAYAMMAL COLLEGE OF ARTS AND SCIENCE
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Rasipuram – 637408

M.Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHE09	**PHARMACOGNOSY AND PHYTOCHEMISTRY**	**DSE THEORY - V**	**III**	**5**	**2**	**3**	**-**	**3**
Objective	The students will acquire the following after completion of this course: To develop the knowledge of natural products, their isolation and separation of bioactive compounds and theirbiological functions and pharmacological uses.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Pharmacognosy and Standardization of Herbal drugs:** Introduction, definition, development classification and Source of Drugs: Biological, mineral, marine, and plant tissue cultures. Study of pharmacognostic of a crude drug. Biosynthesis: Shikimic acid pathway and acetate pathway. Systematic analysis of Crude drugs. Standardization of Herbal drugs. WHO guidelines, Sampling of crude drug, Methods of drug evaluation. Determination of foreign matter, moisture Ash value. Phyto-chemical investigations - General chemical tests.	K2	12
II	**Extraction Techniques** General methods of extraction, types – maceration, Decoction, percolation, Immersion and soxhlet extraction. Advanced techniques- counter current, steam distillation, supercritical gases, sonication, microwaves assisted extraction. Factors affecting the choice of extraction process.	K4	12
III	**Drugs containing Terpenoids and volatile oils** Terpenoids: Classification, Isoprene rule, Isolation and separation techniques, General properties of Camphor, Menthol, Eucalyptol. Volatile Oils or Essential Oils: Method of Preparations, Classifications of Volatile oils, Camphor oil, Geranium oil, Citral- Structure uses. Penta cyclic triterpenoids: amyrines; taraxasterol: Structure and pharmacological applications.	K2	12
IV	**Drugs containing alkaloids** Occurrence, function of lkaloids in plants, pharmaceutical applications. Isolation, Preliminary Qualitative tests and general properties. General methods of structural elucidation. Morphine, Reserpine, papaverine - chemical properties, structure and uses.	K3	12

V	**Plant Glycosides and Marine drugs:** Glycosides, Basic ring system, classification, isolation, properties, qualitative analysis. Pharmacological activity of Senna glycosides, Cardiac glycosides-igoxin, digitoxin, Steroidal saponins glycosides-Diosgenin, hecogenin. Plant pigments: Occurrence and general methods of structure determination, isolation and synthesis of quercetin and cyaniding chloride. Marine drugs -Selected Drug Molecules: Cardiovascular active substances, Cytotoxic compounds, antimicrobial compounds, antibiotic compounds, Anti-inflammatory agents. Marine toxins. **Current Trends - *Development of heterocyclic compounds in drug discovery***	K5	12
	***…..* Self study**		
Course Outcome	**CO1:** Recall the sources of natural medicines and analysis of crude drugs.	K1	
	CO2: Understand the methods of evaluation based on various parameters.	K2	
	CO3: Analyze the isolated drugs	K3	
	CO4: Apply various techniques to discover new alternative medicines.	K4	
	CO5: Evaluate the isolated drugs for various pharmacological activities heterocyclic compounds by different methods.	K5	

Learning Resources

Text Books	1. Gurdeep R Chatwal, Organic chemistry of Natural products, Volume I&II, 5th edition, Himalaya publishingHouse, 2016. 2. S.V.Bhat, B.A. Nagasampagi, M.Sivakumar, Chemistry of Natural Products, Revised edition, Narosa Publishers,2014.
Reference Books	1. Jeffrey B. Harborne, Phytochemical methods: A Guide to Modern Techniques of Plant Analysis, 4th edition,Indian reprint, Springer 2012. 2. Ashutoshkar, Pharmacognosy and Pharmaco biotechnology, 2 nd edition, New age international (P) limited, New Delhi, 2007.
Website Link	https://nptel.ac.in/courses/104105120 https://onlinecourses.swayam2.ac.in/aic23_ge18/preview https://nptel.ac.in/courses/102105342
Self-Study material	https://www.udemy.com/course/introduction-to-drug-discovery-and-drug-development/

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**				**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**	
23M3PCHE09	**PHARMACOGNOSY AND PHYTOCHEMISTRY**				**DSE THEORY - V**			**III**	**5**	**3**	**2**	**-**	**3**	
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	M	S	S	S	S	S	S	S	S				
CO2	M	S	M	S	S	S	S	M	L	S				
CO3	S	S	M	S	M	S	S	S	M	S				
CO4	M	S	S	S	S	M	M	S	S	M				
CO5	S	S	S	S	S	S	S	S	S	S				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP													
Teaching and Learning Methods	Chalk and Board class and powerpoint presentation													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**						**Approved By** Member Secretary							
Dr. J. Sangeetha	Dr. N. Nithiya						Dr. S. Shahitha							

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Rasipuram – 637408

M.Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHE10	**BIOMOLECULES AND HETEROCYCLIC COMPOUNDS**	**DSE THEORY - V**	**III**	**5**	2	**3**	**-**	**3**
Objective	Students will learn about the fundamental ideas and biological significance of natural products and biomolecules and create the structure and extract novel terpenoids and alkaloids using various techniques.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Chemistry and metabolism of carbohydrates:** Definition, classification and biological role of carbohydrates. Monosaccharide's: Linear and ring structures (Haworth formula) of ribose, glucose, fructose and mannose (structure determination not required), physical and chemical properties of glucose and fructose. Disaccharides: Ring structures (Haworth formula) –occurrence, physical and chemical properties of maltose, lactose and sucrose. Polysaccharides: Starch, glycogen and cellulose – structure and properties, glycolysis of carbohydrates.	K1	12
II	**Steroids and Hormones:** Steroids-Introduction, occurrence, nomenclature, configuration of substituents. Diels' hydrocarbon, stereochemistry, classification, biological importance, colour reactions of sterols, cholesterol-occurrence, tests, physiological activity, biosynthesis of cholesterol from squalene. Hormones-Introduction, classification, functions of sex hormones- androgens and estrogens, adrenocortical hormones-cortisone and cortisol structure and functions of non-steroidal hormones-adrenaline and thyroxin.	K2	12
III	**Proteins and nucleic acids:** Separation and purification of proteins – dialysis, gel filtration and electrophoresis. Catabolism of amino acids - transamination, oxidative deamination and decarboxylation. Biosynthesis of proteins: Role of nucleic acids. Amino acid metabolism and urea cycle. Structure, methods for the synthesis of nucleosides - direct combination, formation of heterocyclic base and nucleoside modification, conversion of nucleoside to nucleotides. Primary and secondary structure of RNA and DNA, Watson-Crick model, solid phase synthesis of oligonucleotides.	K3	12
IV	**Vitamins:** Introduction, Classification, Sources and deficiency diseases. Structural determination and synthesis of Vitamin A1, Vitamin B6, Vitamin B12, Folic acid, Vitamin H, Vitamin E and Vitamin K2.	K4	12

V	**Fused Ring Heterocyclic Compounds:** Benzofused five membered rings: Indole, isoindole, benzofuranand benzothiophene, Preparation and properties. Benzofused six membered rings: Quinoline and isoquinoline: Preparation by ring closure reactions, Reactions: Mechanism of electrophilic and nucleophilic substitutions, oxidation and reduction reactions. ***Current trends: Development of heterocyclic compounds in drug discovery ***	K5	12
	***…….* Self-study**		
Course Outcome	**CO1: C**omprehend the fundamental ideas behind natural products and biomolecules.	K1	
	CO2: Evaluate the many techniques for producing biomolecules and natural products with distinct structural properties	K2	
	CO3: Illustrate the uses of biomolecules and how they affect living things' metabolism	K3	
	CO4: Investigate the structure and synthesis of heterocyclic molecules.	K4	
	CO5: Invent the structure of biologically important heterocyclic compounds by different methods.	K5	

Learning Resources

Text Books	1. T. K Lindhorst, Essentials of Carbohydrate Chemistry and Biochemistry, Wiley VCH,North America,2007. 2. V. K. Ahluwalia and M. Goyal, Textbook of Heterocyclic compounds,Narosa Publishing, New Delhi,2000. 3.M. K. Jain and S. C. Sharma, Modern Organic Chemistry, Vishal Publishing Co., Jalandhar, Delhi, 2014. 4. V. K. Ahluwalia, Steroids and Hormones, Ane books pub., New Delhi,2009.
Reference Books	1. I. L. Finar, Organic Chemistry Vol-1, 6thedition, Pearson Education Asia, 2004. 2. Pelletier,Chemistry of Alkaloids, Van Nostrand Reinhold Co, 2000. 3. I. A. Khan, and A. Khanum. Role of Biotechnology in medicinal & aromatic plants, Vol 1 and Vol 10, Ukkaz Publications, Hyderabad,2004.
Website Link	1.https://onlinecourses.nptel.ac.in/noc22_bt62/preview 2.https://nptel.ac.in/courses/102105089 3.https://nptel.ac.in/courses/102105089
Self-Study Material	https://www.udemy.com/course/introduction-to-drug-discovery-and-drug-development/

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards													
Course Code	**Course Title**				**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHE10	**BIOMOLECULES AND HETEROCYCLIC**				**DSE THEORY - V**			**III**	**5**	**2**	**3**	**-**	**3**
CO-PO Mapping													
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	S	M	S	S	S	S	S	S	S	S			
CO2	S	M	M	S	S	S	S	M	L	S			
CO3	S	S	M	S	S	S	S	S	M	S			
CO4	S	S	S	S	S	S	M	S	S	S			
CO5	S	S	S	S	S	S	S	S	S	S			
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG				
Tutorial Schedule	Group Discussion and Problem solving from Competitive examination QP												
Teaching and Learning Methods	Chalk and Board class and powerpoint presentation												
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE												
Designed By	**Verified By**							**Approved By** Member Secretary					
Mr. S. Ramkumar	Dr. N. Nithiya							Dr. S. Shahitha					

List of Skill Based Elective Course (SEC) Details for M.Sc., Chemistry
SYLLABUS - LOCF-CBCS Pattern
EFFECTIVE FROM THE ACADEMIC YEAR 2023-2024 Onwards

S. No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	II	23M2PCHS01	INDUSTRIAL CHEMISTRY
2	III	23M3PCHSP1	PREPARATION OF CONSUMER PRODUCTS

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M.Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHS01	**INDUSTRIAL CHEMISTRY**	**SEC THEORY - I**	**II**	**4**	**2**	**2**	**-**	**2**
Objective	Students will gain Knowledge on the important chemical and reagents used in chemical industries, basic principle behind various mixtures used in chemical industries and their selection in respective applications, safety and Hazardous criteria related to unit process and fertilizer							

Unit	Course Content	Knowledge Levels	Sessions
I	**Principles Of Chemical Technology:** Introduction – basic principles of chemical technology – importance of chemical technology – classification of technological process – designing and modeling of chemical plants – unit process and unit operations. Basic requirements of industrial reactors – choice and selectivity of reactor – basic principles of homogeneous and heterogeneous processes and reactors with examples.	K2	6
II	**Raw Materials and Energy for Chemical Industry:** Raw materials – Characteristics of raw materials and their resources – methods of raw material concentration – integral utilization of raw materials. Energy for chemical industry – power and fuels – classification of fuels – coal – fuel gases and liquid fuels – petroleum – cracking – chemical corrosion – types of corrosion and preventive measures.	K3	6
III	**Small Scale Chemical Industries:** Electro-thermal and electro- chemical industries: electroplating – surface coating industries – oils, fats and waxes – soaps and detergents – cosmetics. Match industries and Fire Works: Manufacture of some industrially important chemicals like potassium chlorate, potassium nitrate, barium nitrate and red phosphorous – metal powders.	K3	6
IV	**Large Scale Chemical Industries:** Manufacturing process – raw materials – composition and uses of products in Portland cement – ceramics – plastics, synthetic fibres – 67 synthetic rubber – fertilizers – insecticides and pesticides – photo film industries – commercial aspects of starting an industry	K5	6

V	**Safety Signs And Colours Used In Industries:** Industrial Hazards and Accidents – Classification of Hazards – Physical, chemical Biological, Ergonomic and stress Hazards – Causes, prevention and control – case study on industrial accidents – Bhopal gas Tragedy – Heat stress – sources and control – Noise pollution in industry – sources and control.	K6	6
Course Outcome	**CO1:** Understand and recall the principles involved in chemical technology	K1	
	CO2: Integrate raw materials and energy of chemical industry	K2	
	CO3: Analyze the process of Electro-thermal and electro- chemical industries	K3	
	CO4: Investigate the Manufacturing process of cement and pesticide, etc	K5	
	CO5: Implement the Safety Signs and Colours used in Industries to avoid accidents	K6	

Learning Resources	
Text Books	1. A. K. De, Environmental Chemistry, New Age International Publishers, 9th ed., 2018. 2. R.K. Goel, Process know-how and material of construction for Chemical Industries, S.B. Publ., Delhi, 1977. 3. B.N. Chakrabarthy, Industrial Chemistry, Oxford and IBH Publ., Now Delhi, 1984. 4. Industrial Safety and Environment – A.K. Gupta,Laxmi Publications Pvt. Ltd., 3rd ed., 2023.
Reference Books	1. Mukhlynov (ed.), Chemical Technology, Vol.1, Mir Publication, Moscow, 3rdedn., 1979. 2. R. Norris Shreve and J.A. Brink, Jr. Chemical Process Industries, 4thedn., McGraw Hill, Tokyo, 1977.
Website Link	1.https://prochoicesafetygear.com/ppe/blog/safety-signage/colour-for-marking-physical-hazards-saa-industrial-safety-colour-code/

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards													
Course Code	**Course Title**				**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHS01	**INDUSTRIAL CHEMISTRY**				**SEC THEORY - I**			**II**	**4**	**2**	**2**	**-**	**2**
CO-PO Mapping													
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**			
CO1	S	S	S	S	M	S	S	S	S	S			
CO2	M	S	S	S	S	S	S	M	S	L			
CO3	S	S	M	S	S	M	S	L	M	L			
CO4	M	S	S	S	S	L	S	S	S	S			
CO5	M	S	M	S	S	S	M	S	L	S			
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG				
Tutorial Schedule	Group Discussion and factory visit												
Teaching and Learning Methods	Chalk and Board class and PPT Presentation												
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE												
Designed By	**Verified By**							**Approved By** Member Secretary					
Mrs. M. Saranya	Dr. N. Nithiya							Dr. S. Shahitha					

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M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHSP1	**PREPARATION OF CONSUMER PRODUCTS**	**SEC PRACTICAL -I**	**III**	**3**	**-**	**-**	**3**	**2**
Objective	To provide basic knowledge in about the preparation of everyday consumer products in chemistry							

S. No.	Course Content	Knowledge Levels	Sessions
	Preparation of following Consumer Products	K5	30
1	Soaps		
2	Laundry Detergents		
3	Shampoos		
4	Talc powder		
5	Incense sticks		
6	Toothpaste		
7	Candles		
8	Lysol		
9	Disinfectants		
10	Handwash soaps		
11	Eyeliner		
12	Eye shadow		
13	Lipstick		
14	Fragrance		
15	Facewash		
Course Outcome	**CO1:** Cognize the application of chemicals in daily use	K1	
	CO2: Know the types of chemicals avail in consumer products manufacturing	K2	
	CO3: Design and formulate a standard operating procedure for consumer products preparation	K3	
	CO4: Apply and improve the standard operating procedure for consumer products preparation	K4	
	CO5: Evaluate quantitatively and qualitatively the chemical compounds in prepared consumer products	K5	
Learning Resources			

Text Books	1. K.Landmann**,** Making Soap, Search Press publications, 2019. 2. P. K. Chattopadhyay, Modern Technology of Soaps, Detergents & Toiletries (with Formulae & Project Profiles),Publications, NIIR project consultancy services, 4th Revised Edition, 2016. 3. A. K. Gupta, Soaps, Detergents and Disinfectants, Technology Handbook, Publisher: NIIR project consultancy services, 3rd Revised Edition, 2021.
Reference Books	1. C.vanLoveren,Tooth pastes, S. Karger, 2013. 2. R. Margret Chandira, S. Lokeshwaran and S. Gracy Gladin, Formulation and Evaluation of Herbal Soap by using Melt and Pour Method, 2022
Website Link	1.https://www.researchgate.net/publication/341617719_Aloe_Vera_Aloe_barbadensis_Miller_Extract_as_a_Natural_Antimicrobial_Agent_in_Hand-Washing_Liquid_Soap 2.https://pubs.rsc.org/en/content/articlehtml/2023/su/d2su00130f

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHSP1	**PREPARATION OF CONSUMER PRODUCTS**			**SEC PRACTICAL - I**		**III**	**3**	**-**	**-**	**3**	**2**
CO-PO Mapping											
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	S	S	S	M	S	S	M	S	S	S	
CO2	S	M	S	S	S	S	S	M	M	S	
CO3	S	M	S	S	S	S	M	S	S	S	
CO4	S	S	S	M	S	S	M	S	M	S	
CO5	S	S	M	S	S	S	M	S	S	S	
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG		

Tutorial Schedule	-
Teaching and Learning Methods	Demo class
Assessment Methods	Only Internal Examination CIA – I – 50 Marks CIA – II – 50 Marks

Designed By	**Verified By**	**Approved By** Member Secretary
Dr. P. Dhilip	Dr. N. Nithiya	Dr. S. Shahitha

List of Extra Disciplinary Course (EDC) Details for M.Sc.,
SYLLABUS - LOCF-CBCS Pattern
EFFECTIVE FROM THE ACADEMIC YEAR 2023-2024 Onwards

S. No.	SEM	COURSE_CODE	TITLE OF THE COURSE
1	II	23M2PCHED1	CHEMISTRY FOR FOOD PRESERVATION
2	II	23M2PCHED2	CHEMISTRY IN CONSUMER PRODUCTS

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Rasipuram – 637408

M.Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHED1	**CHEMISTRY FOR FOOD PRESERVATION**	**EDC THEORY - I**	**II**	**4**	**4**	**-**	**-**	**4**
Objective	To learn important methods for food preservation are to ensure the quality of processed food, prevent Microbial contaminations to kill pathogens and to minimize food spoilage and food poisoning.							

Unit	Course Content	Knowledge Levels	Sessions
I	**A. Principles of Food Preservation:** a. Meaning, mode of action and changes in foods **B. Use of High temperature (Heat preservation). Moist and Dry heat methods:** a. Blanching b. Dehydration c. Concentration d. Canning e. Commercial sterilization f. Pasteurization	K2	10
II	**A.Use of Low Temperatures:** a. Cold Preservation: Freezing and Refrigeration- Air freezing b. Indirect contact freezing c. Immersion freezing d. Dehydro-freezing e. Cryo-freezing f. Changes in foods during refrigeration and frozen storage **B. Use of dehydration and Concentration. Benefits and factors affecting heat and mass transfer** a. Physical and chemical changes during dehydration and concentration b. Methods and techniques used (Air convection, drum driers and vacuum driers) c. Use of various evaporators for concentration of foods	K2	10

III	**Use of Ionizing radiation and microwave heating:** a. Ionizing radiations and sources b. Units of radiation c. Radiation effects d. Mechanism of microwave heating e. Application of radiation technology **B. Use of Fermentation:** a. Benefits and mechanisms of fermentation b. Fermented food products e.g Beer, Wine, Soya sauce, Cheese, Soya bean products c. Microbial Vs Industrial Fermentation	K3	10
IV	**A. Use of Food Additives** a. Broad classes b. Intentional and unintentional food additives c. Laws and regulations **B. Food Enzymes and their applications in Food industry. Application of Hurdle Technology** a) Fermentation	K4	10
V	**Recent advances in food preservation:** a. Pulse electric field special packaging b. Use of technology for minimal processing for preservation of fresh foods c. Use of Antioxidants in food preservation d. Cold pressed juices e. Use of Natural Preservatives f. Preservatives on food labels	K5	8
Course Outcome	**CO1:** Recall the principles of food preservation	K1	
	CO2: Interpret the changes of foods at low temperature, concentrations.	K2	
	CO3: Use radiation and fermentation process in foods	K3	
	CO4: Relate the role of additives and food enzymes in food	K4	
	CO5: Compile the recent advances in food preservation	K5	
Learning Resources			
Text Books	1. Rick Parker (2003) Introduction to Food Science, New York: Delmar Thomson Learning. 2. Scottsmith and Hui Y.H (Editiors) (2004) Food Processing – Principles and Applications London Blackwell Publishing. 3. Subbulakshmi, G and Udipi, S. A. (2001).Foods Processing and Preservation, New Delhi: New Age International (P) Ltd. Publishing. 4. Swaminathan, M. (1995).Food Science Chemistry and Experimental Food. The Bangalore Printing and Publishing Co. Ltd.		

Reference Books	1. Borvers, J. (1992). Food Theory and Application (2nd Ed), New York: Maxwell MacMillan International Edition. Manay, N. S. and Sharaswamy, S. M. (1997).Foods: Facts and Principles New Delhi: New Age International Publishers. 2. McWilliams, M (2007). Foods:Experimental Perspectives 5th Ed, New Jersey: Macmillar Publishing Co. Potter, N. N. and Hutchkiss, J. H. (1997).Food Science, 5th Ed, New Delhi: CBS Publishers and Distributors.			
Website Link	1.https://download.e-bookshelf.de/download/0000/6660/90/L-G-0000666090-0002366513.pdf			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHED1	**CHEMISTRY FOR FOOD PRESERVATION**			**EDC THEORY-I**		**II**	**4**	**4**	**-**	**-**	**4**
CO-PO Mapping										
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	S	S	S	M	S	S	S	S	S
CO2	M	S	S	S	S	S	L	S	M	S
CO3	S	S	M	S	S	M	M	L	S	L
CO4	M	S	S	S	S	S	L	S	M	L
CO5	M	S	M	S	S	S	S	M	S	S
Level of Correlation between CO and PO	L-LOW			M-MEDIUM			S-STRONG			
Tutorial Schedule	-									
Teaching and Learning Methods	Chalk and Board class, Demo class and PPT Presentation									
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE									
Designed By	**Verified By**					**Approved By** Member Secretary				
Mrs. M. Saranya	Dr. N. Nithiya					Dr. S. Shahitha				

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M.Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHED2	**CHEMISTRY IN CONSUMER PRODUCTS**	**EDC THEORY - II**	**II**	**4**	**4**	**-**	**-**	**4**
Objective	To provide basic knowledge in consumer products in chemistry and modern trend in Industry.							

Unit	Course Content	Knowledge Levels	Sessions
I	**Inorganic Consumer Products**: Ceramic materials – Preparation, Properties and Uses. Glass- Preparation, Properties and Uses. Graphite- Preparation, Properties and Uses. Silica Aerogel- Preparation, Properties and Uses.	K1	10
II	**Soaps And Detergents:** Saponification of oils and fats – Manufacture of soaps – Formulation of toilet soaps – Different ingredients used – Their functions – Mechanism of action of soaps - ISI specifications – Testing procedures/limits. Anionic detergents: Manufacture of LAB (linear alkyl benzene) - Sulphonation of LAB preparation of acid slurry – Different ingredients in the formulation of detergent powders and soaps – Liquid detergents – Foam boosters - AOS (alpha olefin sulphonates) Cationic detergents: examples Manufacture and applications - Mechanism of action of detergents Comparison of soaps and detergents - Biodegradation – environmental effects.	K2	10
III	**Shampoos:** Manufacture of SLS and SLES – Ingredients – Functions - Different kinds of shampoos – anti-dandruff, anti-lice, herbal and baby shampoos. Hair dye - Manufacture of conditioners - Coco betaines or coco diethanolamides – ISI specifications - Testing procedures and limits.	K3	9
IV	**Skin Preparations:** Face and skin powders - Ingredients, functions - Different types - Snows and face creams - Chemical ingredients used - Anti perspirants - Sun screen preparations - UV absorbers - Skin bleaching agents – Depilatories - Turmeric and Neem preparations - Vitamin oil. Nail polishes: nail polish preparation, nail polish removers - Article removers. Lipsticks, roughes, eyebrow pencils - Ingredients and functions – hazards - ISI specifications.	K4	9

V	**Consumer education:** Leading firms, brand names, choosing the right product. Packing regulations – Marketing - Licensing – drug license – legal aspects. GMP – ISO 9000/12000 – consumer education - Evaluation of the product – advertisements.	K5	10
Course Outcome	**CO1:** Know the preparation, properties and uses of inorganic consumer products	K1	
	CO2: Summarize the formulation and mechanism of soaps	K2	
	CO3: Sketch the manufacture of shampoo and Hair dyes	K3	
	CO4: Point out the properties and uses of skin powder, Anti-perspirants and Skin bleaching agents	K4	
	CO5: Assess the methodologies involved in legalizing the products and marketing them	K5	

Learning Resources

Text Books	1. GobalaRao.S , Outlines of chemical technology, Affiliated East West press,1998 2. Kafaro, Wasteless chemical processing, Mir publishers, 1995.
Reference Books	1.Sawyer.W, Experimental cosmetics,Dover publishers, New york, 2000
Website Link	1. http://eknygos.lsmuni.lt/springer/99/493-506.pdf

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards														
Course Code	**Course Title**					**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M2PCHED2	**CHEMISTRY IN CONSUMER PRODUCTS**					**EDC THEORY -II**			**II**	**4**	**4**	**-**	**-**	**4**
CO-PO Mapping														
CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**				
CO1	S	S	S	S	M	S	M	S	S	S				
CO2	M	S	S	S	S	S	L	M	S	L				
CO3	S	S	M	S	S	S	S	L	M	S				
CO4	M	S	S	S	S	S	S	S	S	M				
CO5	M	S	M	S	S	S	S	S	M	S				
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG					
Tutorial Schedule	-													
Teaching and Learning Methods	Chalk and Board class and Demo Class													
Assessment Methods	Assignment, Seminar, CIA-I, CIA-II and ESE													
Designed By	**Verified By**							**Approved By** Member Secretary						
Mrs. M. Saranya	Dr. N. Nithiya							Dr. S. Shahitha						

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M.Sc., Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHIS1	**INTERNSHIP**	**INTERNSHIP**	**III**	**-**	**-**	**-**	**-**	**2**
Objective	To Learn academic credit and develop new skills, work habits and attitudes necessary for job success. Internships must take place outside college viz., Research Institute, Chemical industries.							

Guidelines for internship training programme	**Knowledge Levels**	**Sessions**
I. The students are expected to have a practical training in any industry or Research institute to enable them to acquaint him / her with the procedure, practice and working of companies. II. Each student should undergo industrial training for a minimum period of two weeks at the end of the Second semester vacation. III. He / She shall undergo the above training in the institutions like other Institutes, R&D Lab, private limited and public limited companies, CLRI, CECRI,NIT,IIT, Molecular connexions, Milk, Water & soil testing labs, Microlabs, Biocon, Biosis, Golbal calcium & Sandmar. IV. Students may make their own arrangements in fixing the companies for candidates should submit a report in not less than 25 type written pages. V. Candidates should submit the attendance certificate from the institution for having attended the training for two weeks. VI. Industrial training reports shall be prepared by the students under the supervision of the faculty of the department. VII. Industrial training report must contain the following: Cover page Copy of training certificate Profile of the industry, Objectives, work diary, Acknowledgement, content, Aim & scope, Report about the work undertaken by them during the tenure of training Observation and conclusion about the concern Findings VIII. Internship viva – voce examination will be conducted with internal & external examiners at the end of the third semester and the credits will be awarded	K6	90

Course Outcome	**CO1:** Upgrade the learning in a professional environment	K3	
	CO2: Gaining experience with current science & technology	K4	
	CO3: Contributing to significant projects	K4	
	CO4: Building personal skills, Developing a resume that highlights desirable skills	K4	

	CO5: Networking with people working in the science community	K5	

Learning Resources
Learning Resources : Hands on training

	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M3PCHIS1	**INTERNSHIP**			**INTERNSHIP**		**III**	**-**	**-**	**-**	**-**	**2**

CO-PO Mapping

CO Number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	S	S	M	M	S	M	S	S	S
CO2	M	S	M	S	M	S	S	M	S	S
CO3	S	S	S	S	S	S	M	S	S	S
CO4	S	M	S	S	S	S	S	S	M	M
CO5	S	S	S	S	S	S	S	S	S	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Preparation of Work diary & Internship report preparation
Teaching and Learning Methods	Training in industries, PT Classes, Smart classroom
Assessment Methods	Attendance, Internal & external viva-voce exams

Designed By	**Verified By**	**Approved By Member Secretary**
Mrs. A.Dhivya	Dr. N. Nithiya	Dr. S. Shahitha

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M.Sc Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M4PCHPR1	**PROJECT WORK**	**PROJECT WORK**	**IV**	**10**	**-**	**-**	**10**	**5**
Objective	To Identify Problems related to their area of interest in the Chemistry and Chemical industry and enhance problem solving skills and research knowledge.							

Details	Course Content	Knowledge Levels	Sessions
Cover Page & Title Page	**Cover Page & Title Page:** The fonts and locations of various items on this page should be exactly as shown in a specimen copy**.**	K4,K6	
Inside cover page	Inside cover page Same as cover page.	K4,K6	
Bonafide Certificate	**Bonafide Certificate**: The Bonafide Certificate shall be in double line spacing using Font Style Times New Roman and Font Size 14.	K4,K6	
Acknowledgement	**Acknowledgement:** This should not exceed one page. The candidate should convey his appreciation to all whom have played a role for completion of his M. Sc Project work.	K4,K6	
Abstract	**Abstract:** An abstract should provide a concise summary of your research project. It should include the principal objectives of the study, methods employed, a summary of the results and primary conclusions. It should contain approximately 250 words written in the past tense and should not include references.	K4,K6	
Contents	**Table of Contents:** The table of contents should list all headings, sub headings after the table of contents page, as well as any titles preceding it. The title page and Bonafide Certificate will not find a place among the items listed in the Table of Contents. One and a half spacing should be adopted for typing the matter under this head.	K4,K6	
Tables	**List of Tables**: The list should use exactly the same captions as they appear above the tables in the text. 1.5 spacing should be adopted for typing the matter under this head.	K4,K6	
Figures	**List of Figures**: The list should use exactly the same captions as they appear below the figures in the body of the text. One and a half spacing should be adopted for typing the matter under this head. All charts, graphs, maps, photographs and diagrams should be designated as figures. X and Y axes titles are mandatory for all the graphs.	K4,K6	
Symbols	**List of Symbols, Abbreviations and Nomenclature:** 1.5 spacing should be adopted or typing the matter under this head. Standard symbols, abbreviations etc. should be used.	K4,K6	

Chapters	**Chapter I - Introduction:** Statement of the Problem, Significance, Need for the study, Objectives	K4,K6	
	Chapter II- Aim & Scope	K4,K6	
	Chapter III- Experimental methods: Procedures, Hypothesis.	K4,K6	
	Chapter IV- Results and Discussion: Tables and Figures, Statistical Presentations, Hypothesis Testing.	K4,K6	
	Chapter V- Conclusion	K4,K6	
	Chapter VI-References	K4,K6	
	References	K4,K6	
GUIDELINES FOR PROJECT PREPARATION			
Numbering	● Every page in the project report, except the project report title page, must be accounted for and numbered. ● The page numbering, starting from acknowledgements and till the beginning of the introductory chapter, should be printed in small Roman numbers, i.e, i, ii, iii, iv..... ● The page number of the first page of each chapter should not be printed (but must be accounted for). All page numbers from the second page of each chapter should be printed using Arabic numerals, i.e. 2,3,4,5... ● All printed page numbers should be located at the right corner at the bottom of the page.	K4,K6	
Chapters	● Use only Arabic numerals. Chapter numbering should be centered on the top of the page using large bold print. <Size 14><Times New Roman>	K4,K6	
TEXT			
Regular Text	**Regular Text**: Times Roman 12 pts and normal print.	K4,K6	
Chapter Heading	**Chapter Heading -** Times Roman 14 pts. Bold and capital.	K4,K6	
Section Headings	**Section Headings -** Times roman 12 pts. Bold and capital.	K4,K6	
Subsection Headings	**Subsection Headings** - times roman 12 pts. bold print and Leading capitals i.e, only first letter in each word should be in capital.	K4,K6	
Special Text	**Special Text-** Italics/Superscript /Subscript/Special symbols, etc., as per necessity. Special text may include footnotes, endnotes, physical or chemical symbols, mathematical notations, etc.	K4,K6	
Sections	**Sections:** Use only Arabic numerals with decimals. Section numbering should be left justified using bold print. Example: 1.1, 1.2, 1.3, etc.	K4,K6	
Sub Sections	**Sub Sections:** Use only Arabic numerals with two decimals. Subsection numbering should be left Justified using bold print. Example: 1.1.1, 1.1.2, 1.1.3, etc.	K4,K6	

References	Use only Arabic numerals. Serial numbering should be carried out based on Alphabetical order of surname or last name of first author. The format is written like, author name followed by year followed by title of the work followed by details of the journal. Same font as regular text, serial number and all authors names to be in bold print. Title and Journal names should be in italic. 1. **Alvarez LH and Cervantes FJ**, 2011. "(Bio) nanotechnologies to enhance environmental quality and energy production". *J ChemTechnolBiot*86 (1354–1363). 2. **Banjong B, Rattanai B, Zongporn J, Naratip V**, 2010. "Grass blade-like microparticle $MnPO_4 \cdot H_2O$ prepared by a simple precipitation at room temperature".*Power Techno.* 203 (310 - 314).	K4,K6	
Typing Instructions	**Typing Instructions:** The impression on the typed copies should be black in color. One and a half spacing should be used for typing the general text. The general text shall be typed in the Font style 'Times New Roman' and Font size 12. Use A4 (210 mm X 297 mm) bond un-ruled paper (80 gsm) for all copies submitted. Use one side of the paper for all printed/typed matter.	K4,K6	
Justification	**Justification:** The text should be fully justified	K4,K6	
Margins	**Margins:** The margins for the regular text are as follows LEFT - 1.5" RIGHT - 1" TOP - 1" BOTTOM - 1"	K4,K6	
Paragraph Spacing	Use 6 pts before & 6 pts after paragraphs. All paragraphs in the seminar/project report should be left justified completely, from the first line to the last line. Use 1.5 spacing between the regular text and quotations. Provide double spaces between: (a) From top of page to chapter title, (a) Chapter title and first sentence of a chapter, Use single spacing (a) In footnotes and endnotes for text. (b) In explanatory notes for tables and figures. (c) In text corresponding to bullets, listings, and quotations in the main body of seminar/project report. Use single space in references and double space between references.	K4,K6	
Tables	All tables should have sharp lines, drawn in black ink, to separate rows/columns as and when necessary. Tables should follow immediately after they are referred to for the first time in the text. Splitting of paragraphs, for including tables on a page, should be avoided. Provide double spaces on the top and the bottom of all tables to separate them from the regular text, wherever applicable. The title of the table etc. should be placed on the top of the table. The title should be centered with respect to the table. The titles must be in the same font as the regular text	K4,K6	

	and should be single spaced.		
Figures	All figures, drawings, and graphs should be drawn in black ink with sharp lines and adequate contrast between different plots if more than one plot is present in the same graph. The title of the figure etc. should be placed on the bottom of the figure. Figures should follow immediately after they are referred to for the first time in the text. Splitting of paragraphs, for including figures on a page, should be avoided. Provide double spaces on the top and the bottom of all figures to separate them from the regular text, wherever applicable. Figures should be centered with respect to the figure. The titles must be in the same font as the regular text and should be single spaced. The title format is given below: Fig. <blank><chapter number>.<serial number><left indent><figure	K4,K6	
Page Dimension & Binding Specifications	The project report should be prepared in A4 size. The dissertation shall be properly bound; The bound front cover should indicate in Silver and embossed letter.	K4,K6	
Course Outcome	**CO1:** Identification of research idea	K2	
	CO2: Analyze of problem solving skills	K4	
	CO3: Analyze sources for conduct of Research	K4	
	CO4: Evaluate the research report	K5	
	CO5: Create the research report	K6	

Learning Resources				
Text Books	1. Research Methodology: Methods and Techniques, by C.R. Kothari,New Age Publications, 2009.			
Reference Books	1.Research Methodology: Methods and Techniques by C.R. Kothari, New Age Publications, 1985. 2.Essentials of Research Design and Methodology by: Geoffrey R. Marczyk, David DeMatteo, David Festinger, 2005.			
Website Link	1. http://gen.lib.rus.ec/			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc. - Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards										
Course Code	**Course Title**			**Course Type**		**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M4PCHPR1	**PROJECT WORK**			**PROJECT WORK**		**IV**	**10**	**-**	**-**	**10**	**5**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	S	M	M	S	S	S
CO2	S	S	S	S	S	M	S	S	S	S
CO3	S	S	S	S	S	S	S	S	M	M
CO4	S	S	S	M	S	S	S	S	M	M
CO5	M	M	M	S	S	M	M	S	M	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	-
Teaching and Learning Methods	-
Assessment Methods	**EA - 100%** 1. Project Report - 150 Marks 2. Viva-Voce - 50 Marks 3. Total - 200 Marks

Designed By	**Verified By**	**Approved By Member Secretary**
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M.Sc. -Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards								
Course Code	**Course Title**	**Course Type**	**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M4PCHOE1	**CHEMISTRY FOR COMPETITIVE EXAMINATIONS**	**ONLINE COMPETITIVE EXAMINATION**	**IV**	**4**	**4**	**-**	**-**	**2**
Objective	To improve the competency skills of the students and to make them confident to attend the competitive examinations							

Unit	Course Content	Knowledge Levels	Sessions
I	Assemblage of different topics related to Chemistry in particular, Organic, Inorganic, Physical, Pharmaceutical, Spectroscopy, Analytical, Forensic, Food Chemistry etc. Major emphasis has been put forth to include recent developments in the subjects. This course aims to give a holistic view of all the topics which comprised of some factual text points, multiple choice questions (MCQ), it is extremely suitable for students pursuing their higher degree in University/institute for their entrance exams, students preparing for various national and state level competitive entrance exams such as CSIR/UGC-NET/JRF/SRF; ICMR, DBT, GATE, BARC, TIFR, IISc, JNU, BHU etc. to get admission in Ph.D., in Chemistry. In addition, it is also useful for UPSC and states PSC. **Rules for creating MCQ pattern.** 1. Objective type online examination will be conducted at the end of 4th semester. 2. Questions must be taken from all previous question papers of CSIR-NET, SET, GATE, IISc, BARC, TIFR, UPSC, IBPS and Common Entrance Test for Ph.D. 3. **Test critical thinking**. Multiple choice questions to test the superficial knowledge. Learners to interpret facts, evaluate situations, explain cause and effect, make inferences, and predict results. 4. **Emphasize Higher-Level Thinking** Use memory-plus application oriented questions. These questions require students to recall principles, rules or facts in a real life context	K6	20

Eg.1

Ability to Justify Methods and Procedures

In the synthesis of polydimethylsiloxane, the chain forming , branching and terminating agent respectively , are

a. 20 , 28 , 50 and 126
b. 24 , 28 ,82 and 126
c. 20 , 50 , 80 and 184
d. 28 , 50 , 82 and 180

Eg.2

Ability to Interpret Cause-and-Effect Relationships

The chemical potential (μ) of 2 molar Na_2SO_4 solution is expressed in terms of mean ionic activity co-efficient ($\gamma_{\pm}$) as

a. $\mu_0 + 5\ RT\ ln2 + 3\ RT\ ln\ \gamma_{\pm}$
b. $\mu_0 + 3\ RT\ ln2 + 3\ RT\ ln\ \gamma_{\pm}$
c. $\mu_0 + 5\ RT\ ln\ \gamma_{\pm}$
d. $\mu_0 + 4\ RT\ ln\gamma_{\pm}$

5. **Mix up the order of the correct answers**

Keep correct answers in random positions and don't let them fall into a pattern that can be detected

6. **Use a Question Format**

Multiple-choice items to be prepared as questions (rather than incomplete statements)

Incomplete Statement Format:

The capital of California is in Direct Question Format------ Less effective.

In which of the following cities is the capital of California? - This is Best format.

7. **Keep Option Lengths Similar**

Avoid making your correct answer the long or short answer

8. **Avoid the "All the Above" and "None of the Above" Options**

Students merely need to recognize two correct options to get the answer correct

9. HOD's instruct to the faculty to prepare minimum 500 questions booklet (cumulatively for each programme) with solutions and circulate among the students.

10. Each Department has to prepare the Questions (MCQ pattern with four answers) and submit to ICT.

Course Outcome	**CO1:** Identification of pattern of questions asked in competitive exams	K2	
	CO2: Analyze the topics that are repeated in competitive exams	K4	
	CO3: Able to categorize the topics and select the topics of their interest	K4	
	CO4: Ability to solve problems related to each topic	K5	
	CO5: Get confidence about appearing for competitive exams	K6	

Learning Resources				
Text Books	1. Trueman's UGC NET Chemical Sciences - 2023 Edition Paperback – 1, M. Gagan, January 2023 2. Joint CSIR-UGC NET: Chemical Sciences - Previous Years' Papers (Solved) Paperback, RPH Editorial Board , Ramesh Publishing House, 2024. 3. CSIR NET Chemical Science Previous Year Questions Papers with Answers and Detailed Solutions from 2011- Dec 2023 | Best Book for CSIR UGC NET JRF, GATE, SET Examinations in India Paperback, IFAS PUBLICATIONS, 2024.			
Reference Books	1. NTA CSIR UGC NET/SET (JRF & Lecturership) Chemical Sciences Paperback, Preeti Gupta (JRF) Dr. Aditya Tomar, Dr. Naveen Sharma, Arihant Publications, 2023. 2. GATE Chemistry book - (2000-2024) 25 years Previous Year Questions with detailed explanation Upto date gate organic, inorganic and physical chemistry PYQ Paperback, IFAS Publications (Author) 2024.			
Website Link	1. https://ifasonline.com/			
	L-Lecture	T-Tutorial	P-Practical	C-Credit

M. Sc.- Chemistry Syllabus LOCF - CBCS with effect from 2023-2024 Onwards													
Course Code	**Course Title**				**Course Type**			**Sem**	**Hours**	**L**	**T**	**P**	**C**
23M4PCHOE1	**CHEMISTRY FOR COMPETITIVE EXAMINATIONS**				**ONLINE COMPETITIVE EXAMINATION**			**IV**	**4**	**2**	**2**	**-**	**2**

CO-PO Mapping

CO Number	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	S	S	S	S	S	S	S
CO2	S	S	M	S	S	S	M	S	M	S
CO3	S	M	M	S	S	S	S	M	S	S
CO4	S	S	S	M	M	S	M	S	S	M
CO5	M	S	S	S	S	S	S	S	M	S
Level of Correlation between CO and PO	L-LOW					M-MEDIUM			S-STRONG	

Tutorial Schedule	Video classes
Teaching and Learning Methods	Problem solving class
Assessment Methods	Assignment, CIA-I and CIA-II

Designed By	**Verified By HoD**	**Approved By Member Secretary**
Mrs. A. Dhivya	Dr. N. Nithiya	Dr. S. Shahitha