ALAGAPPA UNIVERSITY

(A State University Established in 1985)
Karaikudi - 630003, Tamil Nadu, India

2017 Accredited with A+ Grade by NAAC (CGPA : 3.64)

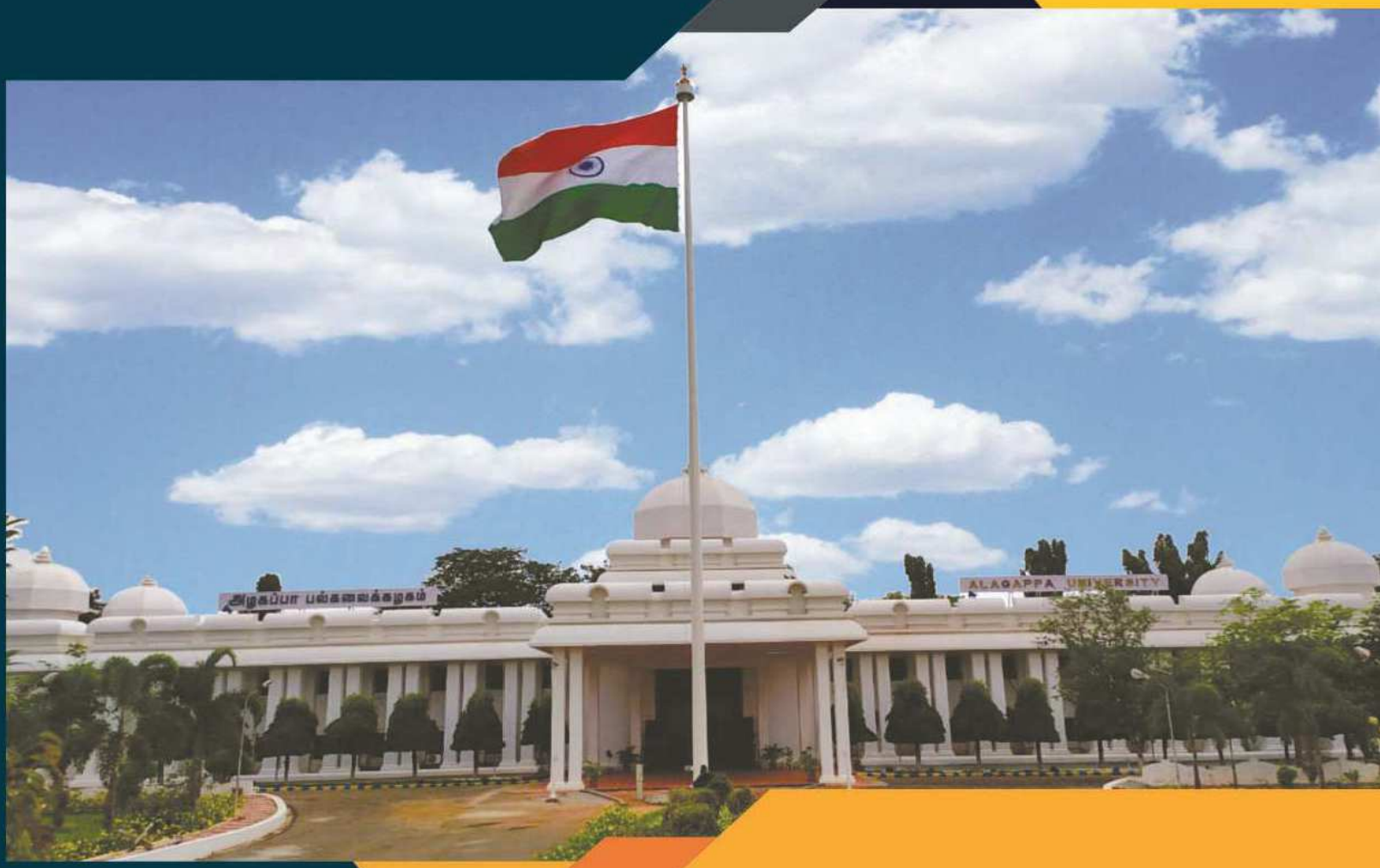
2018 MHRD Govt. of India, UGC — Graded as Category - 1 & Granted Autonomy

2018 MHRD GOVERNMENT OF INDIA — Swachh Campus Rank : 4

2019 nirf NATIONAL INSTITUTIONAL RANKING FRAMEWORK — Rank : 28

2019 QS — India Rank : 20, BRICS Rank : 104, Asia Rank : 216

DEPARTMENT OF INDUSTRIAL CHEMISTRY



M.Sc., CHEMISTRY

[Choice Based Credit System (CBCS)]

[For the candidates admitted from the academic year 2019-2020]

Programme general objectives

Chemistry is a pervasive subject. All the branches of science need chemistry. It is an experimental science and students need to train in practicals to get expertise in doing fine experiments and handle sophisticated instruments. Along with the data obtained its statistical analysis is also required to establish authenticity in the fields like environmental science, space chemistry and biotechnology. Hence, Hence our goal in floating the M.Sc programme in Chemistry is to educate the undergraduate students of chemistry in the fascinating fields of chemistry in an effective manner. The general objectives include;

1. Develop the skill set necessary to continue on to higher studies such as M.Phil and Ph.D. in Chemistry.
2. Can confidently attend and clear competitive examinations especially CSIR NET.
3. Become chemistry teachers in educational institutes and scientist in research laboratories

Programme specific objectives

1. To provide, thorough well designed studies of theoretical and experimental chemistry, a worthwhile educational experience for all students
2. To acquire deep knowledge in fundamental aspects of all branches of chemistry
3. To acquire basic knowledge in the specialized thrust areas like Supramolecular chemistry, Materials Chemistry, Chemistry in Nanoscience and Technology etc. and
4. To develop abilities and skills that:
   - are relevant to the study and practice of science,
   - are useful in everyday life,
   - are encouraging efficient and safe practice and effective communication.

Programme outcome

1. Apply knowledge obtained in Chemistry lecture to problem solving and critical thinking in the laboratory.
2. Utilize mathematical knowledge gained from general chemistry to perform common calculations, including mass balance, limiting reagent, and percent yield.
3. Engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately, using general guidelines and basic knowledge about the common hazards associated with them in an organic chemistry laboratory.
4. Develop the skill set necessary to continue on to higher studies such as M.Phil and Ph.D. in Chemistry

CONTENTS

I. ELIGIBILITY FOR ADMISSION

A candidate who is a B.Sc. graduate of this University or any recognised University in the main subject/subjects as given below or who has passed an examination accepted by the Syndicate as equivalent thereto is eligible for admission to M.Sc. Chemistry programme.

M.Sc. Chemistry (2 Years)	:	B.Sc., Degree Examination with Chemistry / Industrial Chemistry / Applied Chemistry / any other specialization in Chemistry as main subject of study and any two of Mathematics, Physics, Botany, Zoology, Computer Application, Microbiology, Applied Chemistry as ancillary subjects.

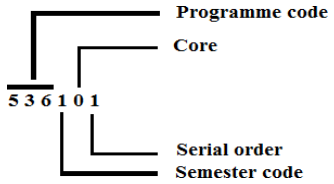
The admission is subject to the prevailing rules and regulations for PG admission of this University. The candidate has to undergo this programme in the Department of Industrial Chemistry, School of Chemical Sciences, Alagappa University and complete all the examinations prescribed under the four semesters to qualify for this degree.

II. DURATION OF THE PROGRAMME

The programme is for a period of two years. Each year shall consist of two semesters viz. Odd and Even semesters. Odd semesters shall be from July to November and even semesters shall be from December to April. There shall be 90 working days which shall comprise 540 teaching clock hours for each semester (exclusive of the days for the conduct of University end semester examination).

III. COURSES IN THE PROGRAMME

M.Sc. Chemistry programme consists of number of courses. The term 'course' is applied to indicate a logical part of the subject matter of the programme and invariably equivalent to the subject matter of a "paper" in the conventional sense.



Elective Code : 53605x
Non Major Elective code : 53607x

M.Sc. CHEMISTRY

Sem	Course Code	Course Title	Credit	Hrs	Marks		
					CIA	ESE	Total
SEMESTER I							
I	536101	Inorganic Chemistry-I	5	5	25	75	100
	536102	Organic Chemistry-I	5	5	25	75	100
	536103	Physical Chemistry-I	5	5	25	75	100
	536104	Inorganic Chemistry Practical	4	8	25	75	100
	53605x	Elective- I	5	5	25	75	100
		Library and seminar		2			
		Total	**24**	**30**	**125**	**375**	**500**
SEMESTER II							
II	536201	Inorganic Chemistry-II	5	5	25	75	100
	536202	Organic Chemistry -II	5	5	25	75	100
	536203	Physical Chemistry -II	5	5	25	75	100
	536204	Organic Chemistry Practical	4	8	25	75	100
	53605x	Elective -II	4	4	25	75	100
	---------	NME-I*	2	3	25	75	100
	SLC-1	MOOC	E.C	-	-	-	-
		Total	**25+ E.C**	**30**	**150**	**450**	**600**
SEMESTER III							
III	536301	Advanced Inorganic Chemistry	5	5	25	75	100
	536302	Advanced Organic Chemistry	5	5	25	75	100
	536303	Advanced Physical Chemistry	5	5	25	75	100
	536304	Physical Chemistry Practical	4	8	25	75	100
	---------	NME-II*	2	3	25	75	100
	SLC-1	MOOC	E.C				
		Library, Seminar, Yoga , Online courses		4			
		Total	**21**	**30**	**125**	**375**	**500**
SEMESTER IV							
IV	536401	Comprehensive Chemistry	5	5	25	75	100
	536402	Analytical Chemistry Practical	4	8	25	75	100
	536403	Project Work	6	12	Viva +Thesis100		100
	53605x	Elective III	5	5	25	75	100
		Total	**20**	**30**	**75**	**325**	**400**
GRAND TOTAL			**90**	**120**	**475**	**1525**	**2000**

CIA=Continuous Internal Assessment, ESE= End-Semester Examination, *NME = Non Major Elective,
E.C = Extra Credit, MOOC= Massive Open Online Courses

ELECTIVE COURSES

Course Code	Course Title
536051	Instrumental Methods of Analysis
536052	Natural products and Introductory Biochemistry
536053	Spectroscopic Methods of Analysis
536054	Environmental and Green Chemistry
536055	Materials Chemistry
536056	Polymer Chemistry
536057	Supramolecular Chemistry
536058	Medicinal Chemistry
536059	Chemical and Electrochemical Energy Systems

NON MAJOR ELECTIVE PAPERS FOR OTHER DEPARTMENTS

S. No.	Course Title	Credit	Marks		
			CIA	ESE	Total
1.	Fundamental Aspects in Materials Chemistry	2	25	75	100
2.	Basic Concepts in Polymer Chemistry	2	25	75	100
3.	Basics in Environmental Science	2	25	75	100
4.	Pharmaceutical Chemistry	2	25	75	100
5.	Chemistry in Everyday Life	2	25	75	100
6.	Polymers and Plastics: A Chemical Introduction	2	25	75	100

(a) PROJECT

Each candidate shall be required to take up a Project Work and submit the report at the end of the second year. The Head of the Department shall assign the Guide who in turn will suggest the Project Work to the student in the beginning of the second year. One typed copy of the Project Report shall be submitted to the University through Head of the Department on or before the date fixed by the University.

The project report will be evaluated by an Internal Examiner and an External, nominated by the University. The candidate concerned will have to defend his project in a Viva-Voce examination.

IV. SEMESTERS

An Academic year is divided into two **semesters.** In each semester, courses are offered in 18 teaching weeks including the duration of conduct of internal examination. Each week has 30 working hours spread over 5 days a week.

V. CREDITS

The term "Credit" refers to the weight age given to a course, usually in relation to the instructional hours assigned to it. For instance, a four hour course is assigned four credits, three hour course is assigned three credits. However, in no instance the credits of a course can be greater that the hours allotted it. The total minimum credits, required for completing a PG programme is 90. The details of credits for individual components are given in Table 1.

Table 1. Details on the number of courses and credits per course

Study Components	Number of courses	Credit per Courses	Total Credits	Total hours	Total marks
1. Core Courses - Theory	10	5	50	900	1000
2. Core Courses - Practical	4	4	16	576	400
3. Project work (Core)	1	6	6	216	100
4.Elective Courses	5	(2x5)+(1x4)+(2x2)	18	360	500
Total	20	--	90	2052	2000

Total working hours = 2052 + 108 (Library, seminar, Yoga, Online courses = 2160 hrs

VI. TEACHING METHODOLOGIES

The classroom teaching would be through conventional lectures and use of Power Point presentations and smart classroom facilities. The lecture would be such that the student should participate actively in the discussion. Student seminars would be conducted and scientific discussions would be arranged to improve their communicative skill.

In the laboratory, instruction would be given for the experiments followed by demonstration and finally the students have to do the experiments individually.

Periodic tests would be conducted and for the students of slow learners would be given special attention.

VII. EXAMINATIONS

i) There shall be examinations at the end of each semester, for odd semesters in the month of October/November; for even semesters in April/May.

ii) A candidate who does not pass the examination in any course(s) may be permitted to appear in such failed course(s) in the subsequent examinations to be held in October/November or April/May. However candidates who have arrears in Practical shall be permitted to take their arrear practical examination only along with regular practical examination in the respective semester.

iii) A candidate should get registered for the first semester examination. If registration is not possible

owing to shortage of attendance beyond condonation limit/regulation prescribed or belated joining or on medical grounds, the candidates are permitted to move to the next semester. Such candidates shall re-do the missed semester after completion of the course.

iv) Viva-Voce: Each candidate shall be required to appear for Viva-Voce Examination (in defending the Project only).

v) For the Project Report, the maximum marks will be 75 for project report evaluation and for the Viva-voce it is 25. At the end of fourth semester viva-voce will be conducted on the basis of the Dissertation/Project report submitted by the student. HOD and external examiner will conduct the viva-voce jointlyin the presence of Guide.

vi) The ESE for the course 536401 Comprehensive Chemistry will be conducted by the HOD at the end of the semester and the final marks will be given to COE. The question paper pattern is as that of CSIR NET examination pattern i.e. 150 objective type questions.

vi) The results of all the examination will be published through the University Department where the student underwent the programme as well as through University Website.

vii) Practical examination for M.Sc. Chemistry programme shall be conducted at the end of each semester.

VIII. CONDONATION

Studentmust have earned 75% of attendance in each course for appearing for the examination. Students who have earned 74% to 70% of attendance to be applied for condonation in the prescribed form with prescribed fee. Students who have earned 69% to 60% of attendance are to apply for condonation in the prescribed form with the prescribed fee along with the Medical Certificate. Students who have attended below 60% are not eligible to appear for the examination and they shall re-do the semester after completion of the programme, with the prior permission of the Registrar of the University.

IX. QUESTION PAPER PATTERN

(For all theory courses except 536401 Comprehensive Chemistry course)

Time: 3 Hours **Max. Marks: 75**

PART-A: 10x2=20

(Answer all questions)

(Two questions from each unit)

Q.No. 1 – 10

PART-B: 5x5=25

(Answer all questions)

(One question from each unit with internal choice)

11. a) or b)

12. a) or b)

13. a) or b)

14. a) or b)

15. a) or b)

PART-C: 3x10=30

(Answer any three questions)

(One question from each unit)

Q.No. 16 – 20

X. EVALUATION

The performance of a student in each course is evaluated in terms of percentage of marks with a provision for conversion to grade points. Evaluation for each course shall be done by continuous internal assessment by the concerned Course Teacher as well as by an end semester examination and

will be consolidated at the end of the course. The components for continuous internal assessment are:

Two tests	- 15marks (Third /repeat tests for genuine candidates/absentees)
Seminar/Quiz	- 05 marks
Assignment	- 05 marks
	- 25 marks

Attendance need not be taken as a component for continuous assessment, although the student should put in a minimum of 75% attendance in each course. In addition to continuous evaluation component, the end semester examination, which will be a written examination of at least 3 hours duration, would also form an integral component of the evaluation. The ratio of marks to be allotted to continuous internal assessment and to end semester examination is 25:75. The evaluation of laboratory component, wherever applicable, will also be based on continuous internal assessment for 25 marks and on end-semester practical examination 75 marks.

Distribution of marks for practical examinations

(CIA marks 25 + ESE Marks 75 marks)

ESE mark distribution	
Quantitative/ Qualitative analysis	50 marks
Viva – Voce in practical	15 marks
Record Note	10 marks
Total	75 marks

Project Work (PW)

Project report evaluation	75 marks
Viva-Voce examination	25 marks
Total	100 marks

(a) Topic:

The topic of the dissertation shall be assigned to the candidate before the end of second semester and a copy of the same should be submitted to the HOD.

(b) Plan of Work:

The student should prepare plan of work for the dissertation well in advance and get the approval of the guide during the first week of third semester of their study. In case the student wants to avail the facility or to carryout part of the work from other University/Research Institute/Laboratories in Industry, they can undertake the work with the permission of the guide and HOD and acknowledge the alien facilities/co-supervisor.The duration of the dissertation research shall be a minimum of three months in the fourth semester. In case the student stays away for work from the Department for more than one month, specific approval of the HOD should be obtained.

(c) No. of copies/distribution of dissertation:

The students should prepare four copies of dissertation and submit the same for the evaluation by Examiners. After evaluation one copy is to be retained in the Department library and one copy is to be submitted to the University, one copy can be given to the guide and one copy can be held by the student.

(f)Format to be followed:

The format/certificate for dissertation to be submitted by the students is given below:

Format for the preparation of project work:

(a) Title page
(b) Bonafide Certificate
(c) Acknowledgement
(d) Table of contents

CONTENTS

Format of the Title Page:

TITLE OF THE DISSERTATION

Dissertation Submitted in part fulfilment of the requirement for the Degree of Master of Science in Chemistry (CBCS) to the Alagappa University, Karaikudi.

By

Students Name:

Register Number:

Under the Guidance of

(Faculty Name)

University Emblem

Department of Industrial Chemistry

(UGC SAP, DST FIST and DST-PURSE Sponsored Department)

School of Chemical Sciences

AlagappaUniversity

(Accredited with A+ Grade by NAAC (CGPA : 3.64) in the Third Cycle and Graded as Category-I University by MHRD-UGC)

Karaikudi - 630003

Month and Year:

Format of the Certificate:

CERTIFICATE

This is to certify that the dissertation entitled ---------- submitted in part fulfilment of the requirement of the degree of Master of Science in Chemistry (CBCS) to the Alagappa University, Karakudi is a record of bonafide research work carried out by---------- under my supervision and guidance and that no part of the dissertation has been submitted for the award of any degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part or full in any scientific or popular journals or magazines.

Date:

Place: Signature of the Guide

XI. PASSING MINIMUM

A candidate shall be declared to have passed in each course if he/she secures not less than 50% marks in the University ESE and not less than 50% in the aggregate, taking continuous assessment and University Examination marks together.

Candidates, who have secured the pass marks in the end-semester examination (ESE) but failed to secure the aggregate minimum pass mark (50%) are permitted to improve their CIA mark in the following semester and/or in University examinations.

A candidate shall be declared to have passed in the Project work if he/she gets not less than

50% in each of the Project Report and Viva-voce but not less that 50% in the aggregate of both the marks for Project Report and Viva-voce.

A candidate who gets less than 50% in the Project Report must resubmit the Project Report. Such candidates need take again the Viva-Voce on the resubmitted Project.

Improvement of marks – Norms for the Improvement marks

a) Candidates willing to improve his/her performance of marks in the University Examination (other than Practical /Project work) in Theory course shall be permitted to re-appear again in the succeeding semester examination for the theory course(s) in which he/she has passed in the first appearance.

b) Improvement of performance of marks is allowed only once of a (theory course) course.

c) If the candidate shows no improvement in such appearance, marks secured by him/her in the first appearance will remain. No fresh marks statement will be issued in such cases.

d) If the candidate shows improvement, a revised mark statement will be issued on production of the original mark statement issued to him/her.

e) On improvement of performance, if a candidate becomes eligible for a higher class/ GPA and CGPA it shall be incorporated/awarded in the mark statement/provisional certificate/degree certificate on an application made by the candidate (along with the original Mark Statement/Provisional Certificate/Degree Certificate) already issued (as the case may be) together with a fee prescribed for the purpose. However, he/she is not eligible for Revision of Rank of for the award of Prize.

f) Candidates willing to appear for the examination for improvement of marks at his/her last semester examination may await for the result of his/her latest appearance and re-appear twice in the immediately succeeding examination session.

g) The fee for permission re-appear for improvement of marks is to be paid in addition to the examination fee for each course for which he/she is appearing for.

h) The application for permission of re-appearance must be sent separately to the Controller of Examination in the prescribed form duly recommended by the HOD of the College on or before the last date for receipt of application for registration.

i) Fees paid once by these candidates will not be refunded or adjusted under any circumstances.

XII. GRADING

Once the marks of the CIA and end-semester examination for each of the courses are available, they will be added. The marks, thus obtained will then be graded as per the scheme provided in Table 2.

Table 2 Grading of the Courses

Marks	Grade Point	Letter Grade
96 and above	10	S+
91 – 95	9.5	S
86 – 90	9.0	D++
81 – 85	8.5	D+
76 – 80	8.0	D
71 – 75	7.5	A++
66 – 70	7.0	A+
61 – 65	6.5	A
56 – 60	6.0	B
50 – 55	5.5	C
Below 50	0	F

Grading System

< 50 Marks in all	50 < Your Marks < 60	60 < Your Marks < 75	Your Marks ≥ 75
Fail	II Class	I Class	Distinction

From the second semester onwards the total performance within a semester continuous performance starting from the first semester is indicated respectively **Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA).** These two are calculated by the following formulae.

$$GPA = \frac{\sum_{i=1}^{n} Ci\ Gi}{\sum_{i=1}^{n} Ci}$$

Where 'Ci' is the Credit earned for the course i in any semester; 'Gi' is the Grade Point obtained by the student for the course i and 'n' is the number of courses **passed** in that semester.

CGPA (Cumulative Grade Point Average) = Average Grade Point of all the Courses starting from the first semester to the current semester.

XIV. CONFERMENT OF THE MASTER'S DEGREE

A candidate shall be eligible for the conferment of the Degree only after he/she has earned the minimum required credits for the programme prescribed therefore (i,e. 90credits).

XV. RANKING: UNIVERSITY RANK EXAMINATION

Candidates who pass all the examinations prescribed for the programme in the first instance and within a period two academic years from the year of admission to the programme only are eligible for University Ranking.

A candidate is deemed to have secured first rank provided he/she

(i) should have passed all the papers in first attempt itself

(ii) should have secured the highest overall grade point average (CGPA)

Rank certificate will be issued for a programme as follows:

a) Only THREE ranks if the students strength is below 20.

b) Only FIVE ranks if the student strength is above 20 but below 50.

c) Only TEN ranks if the student strength is above 50 but below 100

XVI. GRIEVANCE REDRESSAL COMMITTEE

The Department shall form a Grievance Redressal Committee for each course with the course Teacher and the HOD as the members. This committee shall solve all grievances relating to the internal Assessment marks of the students.

XVII. TRANSFER OF CREDITS

Students are permitted to transfer their programme credits from Directorate of Distance Education (DDE) of AlagappaUniversity to Regular Stream and Vice-versa, if the PG degree programme is same.

XVIII. REVISION OF REGULATIONS AND CURRICULUM

The University may from time to time revise, amend and change the regulation and the curriculum, if found necessary.

XIX. COMMENCEMENT OF THIS REGULATION

These regulations shall take effect from the academic year 2019-20 i.e., for students who are to be admitted to the first year of the programme during the academic year 2019-20 and thereafter.

XX. TRANSITORY PROVISION

Candidates who were admitted to the M.Sc. Chemistry programme of study from or after 2019-20 shall be permitted to appear for the examinations under the above regulations for a period of four years. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

Assessment & Evaluation: Student evaluation is based on exams, assignments, Seminar/Quizzes and class participation. The grade allocation is as follows:

Continuous Internal Assessment : 25 Marks		**End-Semester Exam: 75 Marks**
Two, 2 hour tests for 15 marks in all	Assignments, Seminars for 10 Marks	Three Hour examination on the whole syllabus for 75 Marks.

Attendance: Attendance and participation are vital to the student's success in this course.Students are expected to attend class every day. Minimum attendance to be eligible to take end-semester-examination is **80%.**

Punctuality: Punctuality is an essential element in achieving success. Therefore, anyone arriving after daily roll-call (about 5 minutes after the class begins) will be marked absent. A valid excuse for being absent from class shall be a medical or a personal emergency acceptable at the discretion of the Dean/Chairman/Head of the Dept.

Class Participation: Class participation and interaction helps to form a complete educational experience. However, class participation and interaction is to be relevant to course content and context. Deviant behaviour may lead to dismissal or suspension

Submission of Assignments: When submitting any assignments, your name, your student identification number, course number and date of submissionshould be clearly written on every page and all pages should be stapled together. The timely submission of assignments is an essence of personal discipline and will contribute towards forming a person's professional responsibility. The soft copy of the assignment also submitted to the Faculty in charge.

Preparedness: Students are expected to have read and be able to discuss the assigned chapter before attending the lecture. In addition, students should be prepared to discuss homework problems.

Academic Dishonesty: Academic work produced using dishonest methods has no value. Academic dishonesty also includes copying - verbatim or otherwise, and plagiarism i.e., the use of an author's ideas, statements, or approaches without crediting the source. A clear indication of academic dishonesty will result in a grade of "F" being assigned to that particular piece of work.

Subject to change clause: This syllabus, the course schedule and reading assignments are subject to change at the discretion of the Professor to accommodate instructional and/or student needs.

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SEMESTER-1			
Course Code: 536101	**Subject: INORGANIC CHEMISTRY -I**	**Credits: 5**	**Hours:90**
Objectives	The major objectives of this course are to understand the concepts of: Chemical periodicity, structure and bonding of atoms. Solid state structures and its determination. The structure and packing og inorganic solid state crystal. Basic concepts of coordination chemistry. The formation of coordination compounds by VBT, CFT and MOT. Extraction, spectral and magnetic properties of lanthanides and actinides.		
Unit-I	**STRUCTURE AND BONDING, CONCEPT OF ACID AND BASES:-** Chemical periodicity - ionic radii, ionization potential, electron affinity, electro negativity, concept of hybridization - Molecular orbitals and electronic configuration of homonuclear and heteronuclear diatomic molecules - Shapes of polyatomic molecules - VSEPR theory. Bond order and magnetism - Types of chemical bonds - Intermolecular forces - Dipole moment - Lattice energy–Born Land equation - Born Haber cycle. Bronsted and Lewis concept of acids and bases. Hard and Soft Acid and Bases (HSAB) principle– applications-limitations. Non – Aqueous solvents.		
Unit-II	**COORDINATION COMPOUNDS –I:-** Valence Bond Theory-octahedral, square planar and tetrahedral complexes-limitations of VBT; Crystal Field Theory - splitting of d-orbitals in square plannar, trigonal bipyramidal, octahedral, tetrahedral complexes - factors affecting the magnitude of 10 Dq, spectrochemical series, crystal field stabilization energy of octahedral and tetrahedral complexes- distortion of octahedral complexes-Jahn-Teller distortion, applications of CFT; Spinels - structure, classification and site selection.		
Unit-III	**COORDINATION COMPOUNDS -1I:-** Molecular Orbital Theory – sigma and pi bonding in octahedral complexes. Comparison of VBT, CFT and MOT. Ligand Field Theory, brief introduction to theory beyond MOT (LFT), Extended huckel theory, angular overlap and semi empirical methods.		
Unit-IV	**SOLID STATE CHEMISTRY:-** Packing of ions in HCP, FCC and BCC structure – determination of packing fraction in SC, BCC, FCC and HCP structure-density of cubic crystals; limiting radius ratio of trigonal, tetrahedral, octahedral and cubic site – its influence on ionic structures; structure of ionic crystals - AB type of crystals -Sodium chloride, Zinc blende, Wurtzite and Caesium chloride - AB_2 type of crystals- Fluorite, Rutile and Calcium carbide; A_2B type of crystals - Anti-fluorite; structure of covalent crystals - graphite and diamond.		
UNIT-V	**CHEMISTRY OF LANTHANIDES AND ACTINIDES :-** Lanthanides- occurrence, position in the periodic table - electronic configuration - oxidation states - size relationships -lanthanide contraction - spectral and magnetic properties - condition compounds of lanthanides - uses of lanthanides and their compounds. Shape of 4f orbitals and CFT of 4f orbitals. Hydrophilic stability – triflates as green lewis acids. Actinides: Synthesis of elements - position in the periodic table, electronic configuration and oxidation states - spectral and magnetic properties - comparative account of lanthanides and actinides.		

REFERENCES AND TEXTBOOKS:-

Cotton, F. A., Wilkinson, G., Murillo, C. A., Bochmann, M., & Grimes, R. (1988). *Advanced inorganic chemistry* (Vol. 6). New York:

Wiley.De, A. K. (2003). *A Text Book of Inorganic Chemistry*, (9^{th} ed.), NAIP.

Huheey, J. E., Keiter, E. A., Keiter, R. L., & Medhi, O. K. (2006). *Inorganic chemistry: principles of structure and reactivity*. Pearson Education India.

Kettles, S. F. A. (1996). *Physical Inorganic Chemistry.* Springer.

Malik, W. U., Tuli, G. D., & Madan, R. D. (2006). *Selected topics in inorganic chemistry*. S. Chand Publishing.

Miessler, G. L., Fischer, P. J., Tarr, D. A. (2013). *Inorganic Chemistry* (5th ed.), Person Edu. India.

Sathyaprakash, Tuli, G. D., Basu, S. K., Madan, R. D., Chand, S. & Co. (2011). *Advanced Inorganic Chemistry (Vol I & II)*. New Delhi.

West, A. R. (1984). *Solid State Chemistry and its Applications*. New York: Wiley.

Willam, L. (2007). *Modern Inorganic Chemistry* (2nd ed.). McGraw-Hill.

Outcomes	The student would be able to Predict the shape of atoms and chemical bonding. To apply the Bronsted and Lewis concept of acids and bases for different explanations. Understand the structure of solids having differentratio of atoms. Predict the structure and stability of the coordination compounds. The formation of complexes based on the various theories. Solving of problems about lanthanide and actinides.

Name of the Course Teacher

Dr. S. Tambidurai,Professor
Dr. G. Gopu, Assistant Professor

SEMESTER – I			
Course Code: 536102	**SUBJECT: ORGANIC CHEMISTRY - I**	**Credits: 5**	**Hours: 90**
Objectives	The major objectives of this course are to understand the concepts of: ➢ To provide, thorough well designed studies of theoretical and experimental chemistry, a worthwhile educational experience for all students ➢ To acquire deep knowledge in fundamental aspects of all branches of chemistry ➢ To acquire basic knowledge in the specialized thrust areas like Supramolecular chemistry, Materials Chemistry, Chemistry in Nanoscience and Technology etc. and ➢ To develop abilities and skills that: ❖ Are relevant to the study and practice of science, ❖ Are useful in everyday life, ❖ Are encouraging efficient and safe practice and effective communication. ➢ To develop attitudes relevant to science such as: ❖ Concern for accuracy and precision, ❖ Objectivity, ❖ Integrity, ❖ Enquiry, ❖ Initiative and ❖ Inventiveness.		
Unit-I	**INTRODUCTORY CONCEPTS AND REACTIONS MECHANISM:-** **Basic concepts:** Inductive effect, electromeric effect, resonance effect, hyperconjugation, the formalism of curved arrow mechanisms. **IUPAC nomenclature:** Bicyclic, polycyclic, spiro compounds and heterocyclic compounds. **Aromaticity:** Concept of aromaticity, delocalization of electrons - Hückel's rule, criteria for aromaticity, examples of neutral and charged aromatic systems – annulenes - NMR as a tool for aromaticity - anti- and homo-aromatic systems- fullerenes (C_{60}).		
Unit-II	**PHYSICAL ORGANICCHEMISTRY:-** **Determination of reaction mechanism:** Factors affecting the strength of acids and bases – Bronsted and Lewis concepts of acids and bases - Guidelines to propose a reasonable reaction mechanism – Energy profile, intermediate, transition state – kinetic and thermodynamic control – Hammond postulate – methods of determining reaction mechanism – kinetic methods – primary and secondary kinetic isotopic effect – non kinetic methods – isotope labelling, crossover experiment, trapping of intermediates, stereo chemical studies.Mechanism according to free-energy correlation and correspondence with theory of orbital interaction. linear free energy relationship – Curtin-Hammett principle – significance of *sigma* and *rho* – Hammett and Taft equations.		
Unit-III	**SUBSTITUTION AND ELIMINATION REACTIONS:-** **Aliphatic Nucleophilic Substitution:** S_N1 and S_N2 mechanisms – kinetic and stereochemical features – Neighbouring group participation and nature of nucleophile, solvent polarity, leaving group ability on the course of the reactions – S_NI reaction - Allylic and vinylic substitution. **Aliphatic electrophilic substitution:**Mechanism of aliphatic electrophilic substitution reactions – S_E1, S_E2 and S_EI mechanisms. **Elimination Reactions:** E_1, E_2, E_1CB mechanisms - Stereochemistry of elimination - Hofmann and Zaitsev rules - Competition between elimination and substitution. Bredt's rule. **Aromatic Electrophilic Substitution:** The arenium ion mechanism, Friedel-Crafts alkylation, acylation and diazonium coupling, orientation and reactivity. **Aromatic Nucleophilic substitution**: The benzyne intermediate mechanism, aromatic nucleophilic substitution of activated halides-Ziegler alkylation.		

Unit-IV	**FUNDAMENTALS OF STEREOCHEMISTRY:-** Introduction to molecular symmetry and chirality - axis, plane, centre, alternating axis of symmetry. Stereoisomerism - definition based on symmetry and energy criteria - configuration and conformational stereoisomers. Center of chirality - molecules with C, N, S based chiral centers -absolute configuration -Sawhorse, Fischer and Newman projections, interconversion of projections- enantiomers - racemic modifications - R and S nomenclature using Cahn-Ingold-Prelog rules - molecules with a chiral center and Cn -molecules with more than one center of chirality -definition of diastereoisomers- constitutionally symmetrical and unsymmetrical chiral molecules- *erythro* and *threo* nomenclature -E and Z nomenclature - out/in isomers.
UNIT-V	**CONFORMATIONALANALYSIS AND REACTIVITY:-** Conformational analysis: Introduction to conformational analysis, steric, electronic and stereoelectronic effects in governing the conformation of acyclic and cyclic (5 and 6 membered rings) systems, A-strains and anomeric effect, decalins, transannular interactions in medium size rings. Conformation and reactivity: steric and electronic effects in syn-elimination, E2 elimination and neighboring group participation (Woodward, Prevost methods) of acyclic and cyclohexyl systems, esterification, substitution reaction and formation and opening of epoxide in cyclohexyl systems (Furst Plattner rule).

REFERENCES AND TEXTBOOKS:-

Ahluwalia, V. K. & Prashar, R. K. (2011).*Organic Reaction Mechanisms* (4th ed.). Alpha Science International.

AMIT Arora. (2003). *Aromatic Organic Synthesis*. New Delhi: Discovery Private Limited.

Badger, G. M. (1969). *Aromatic Character and Aromaticity*, Cambridge.

Bansal, R. K. (2003).*Reaction Mechanism in Organic Chemistry (*4thed.) New Age International.

Finar, I. L. (2004). *Organic Chemistry Vol. I & II* (5thed.), Singapore: Pearson Education.

Fleming, S. A., Norton, W. W. & Compound. (2010). *Organic Chemistry,* (4th ed.). London.

Francis A. Carey. (2009).*Organic chemistry* (7thed.) New York.

Garratt, P. J., Mc Graw Hill. (1971). *Aromaticity*.

Harris, J. M. & Wamser, C. C. (1976). *Fundamentals of Organic reaction Mechanisms*, New York: John Wiley & Sons.

Kalsi, P. S. (2014). *Organic reaction and their Mechanism* (2nd ed.), New Delhi: New Age International Private Limited.

Lowry, T. H., Richardson, K. S. (1976). *Mechanism and theory in Organic Chemistry*. New York: Harper and Row.

March, J. (1992). *Advanced organic chemistry: reactions, mechanisms, and structure*. John Wiley & Sons.

Morrison, R. T. & Boyd's, R. N. (2008). *Organic Chemistry* (6th ed.): Springer.

Mukherji, S. P & Singh, S. P. (2004).*Reaction Mechanism in Organic Chemistry* (3rd ed.), New Delhi: Macmillan India Ltd.

Narain, R. P. (2011). *Fundamentals of Reaction Mechanisms in Organic Chemistry*. PHI LearningPrivate Limited, New Delhi.

Peter Skyes. (2003).*A Guide book to Mechnism in Organic Chemistry*, New Delhi: Orient Longman Private Limited.

Outcomes	The student would be able to:- ➢ Understand and give the IUPAC name of all organic compounds, reaction mechanism, aromaticity nature of the compounds. ➢ Efficient knowledge in the reaction mechanism of electrophilic and Nucleophilic reaction and naming reactions. ➢ Increase in ability of isomerism and stereochemistry of organic compounds. ➢ Create a valuable understanding of the main and important concepts in this course.

Name of the Course Teacher

Dr. M. Sundrarajan, Assistant Professor,Dr. S. Viswanathan, Assistant Professor

SEMESTER – I			
Course Code: 536103	**SUBJECT: PHYSICAL CHEMISTRY-I**	**Credits: 5**	**Hours: 90**

Objectives	The major objectives of this course are to understand the concepts of: ➢ Quantum Chemistry will be applied to understanding the basic energetics of atoms and molecules. ➢ Covers the fundamental principles and operation of symmetry molecules, study of group theory. ➢ This unit covers the principles of chemical kinetics, including differential rate laws, derivation of exact and approximate integral rate laws for common elementary reactions. ➢ Familiarity with basic concepts in thermodynamics and to relate the characteristics and relative energies of different liquid and solid solutions to the phase diagram of the system. ➢ An overview of excited state chemistry focuses on the theory of electron transfer process.
Unit-I	**FUNDAMENTAL OF QUANTUM CHEMISTRY:-** **Basic principles of quantum mechanics:** Postulates of quantum mechanics, wave functions and probabilities, Black-body radiation, Photoelectric effect, Planck's radiation law, Compton effect, Atomic hydrogen spectra, The Bohr model, Wave-particle duality of material particles and de Broglie's hypothesis, Quantisation of angular momentum, Heisenberg's uncertainty principle. **Quantum mechanics:** Schrodinger equations, Operator algebra: Operators, linear and hermitian, Eigen functions and Eigen values.
Unit-II	**GROUP THEORY:-** Symmetry elements and symmetry operations Centre of symmetry, Plane and its types of Symmetry, Proper and Improper axis of Symmetry, Principal axis and subsidiary axes. The concept of groups, Assigning Point groups with illustrative examples, Symmetry operations and order of a group - Group theoretical rules (Group postulates), reducible and irreducible representations, matrix representations of symmetry operations, Construction of Character Tables for C_{2V} and C_{3V} point group molecules, and Great orthogonality theorem and its proof. Application of group theory to atomic orbitals in ligand fields, molecular orbitals, hybridization.
Unit-III	**THEORIES OF CHEMICAL KINETICS:-** **Theories of Reaction Rates**: Rate laws and rate constants, reaction order, determination of rate law, reactions approaching equilibrium, temperature dependence of reaction rates, Arrhenius parameters, consecutive elementary reactions, steady-state approximation, Kinetic isotope effect. Transport properties: Diffusion, Thermal conductivity, Viscosity, Effusion, Drift velocity, Nernst-Einstein equation, Stokes-Einstein equation Complex reactions Chain reactions. Unimolecular reactions: Lindemann- Hinshelwood mechanism and activation energy of a composite reaction. Elementary Reactions in Solutions: Activated complex theory; Bronsted-Bjerrum equation - Primary and secondary salt effects, Eyring equation.
Unit-IV	**THERMODYNAMICS:-** **Chemical Thermodynamics:** Thermodynamic properties, Boyle's Laws, Ideal-gas absolute temperature scale, Reversible and irreversible P-V works, first law of thermodynamics, Joule-Thomson experiments, Second law of thermodynamics, Carnot's principle, Gibbs and Helmholtz energies, The Maxwell relations, Le Chatelier principle. **Solids:** Thermodynamics of solids - Einstein and Debye models. T^3 dependence of heat capacity of solids at low temperatures (universal feature). **Metals:** Fermi function, Fermi energy, free electron model and density of states,

	chemical potential of conduction electrons.
UNIT-V	**PHOTOCHEMISTRY AND SOLAR ENERGY CONVERSION:-** **Photochemistry:** Photochemical laws, Quantum yield, Electronically excited states, Jablonski diagram, Radiation less processes, Energy level diagrams, Assignment of n, π^* and π, π^* configurations, Forbidden transitions, Fluorescence and Phosphorescence, Emission lifetimes, Mechanism of energy transfer. Marcus theory of electron transfer, Free energy and rate relation, RehmWeller behaviour, Marcus Inverted Region. **Solar energy conversion:** Solar cell structure, materials and properties, Solar cell fabrications, Dye sensitized solar cells, efficiency and measurements.

REFERENCES AND TEXTBOOKS:-

Atkins, P. &Paula, J. (2014). *Physical Chemistry* (10th ed.). Oxford University Press, Oxford.

Berry, R. A., Rice, S. A. & Ross, J. (2007). *Physical Chemistry* (2nd ed.). Oxford University Press, Oxford.

Cotton, F. A. (1996).*Chemical Applications of Group Theory.* Wiley.

Fonash, S.J. (2010).*Solar Cell Device Physics* (2nd ed.). Academic Press is an imprint of Elsevier, Kidlington, Oxford.

Laidler, K. J. Harper & Row. (1998). *Chemical Kinetics* (3rd ed.). New York.

McQuarrie, D. A. (1983). *Quantum Chemistry*. University Science Books.

Mukherjee, K. K. (2014).*Fundamentals of Photochemistry*. (3rd ed.). New Delhi: New Age InternationalPvt. Ltd.

Silbey, R. J., Alberty, R. A. & Bawendi, M. G. (2005). *Physical Chemistry* (4th ed.). NewDelhi: Wiley-India.

Steindeld, J. I., Francisco, J. S. & Hase, W. L. (1989). *Chemical Kinetics and Dynamics* (2nd ed.). New York: PrenticeHall International Inc.

Outcomes	The student would be able to:- ➢ Recognize the importance of quantum chemistry and of its applications. ➢ Describe and understand the fundamentals of group theory. ➢ Describe the fundamental chemical and physical properties that determine chemical reaction rates. ➢ Understanding the use of free energies as equilibrium criteria and also determine the equilibrium state of a wide range systems, ranging from mixture of gases and mixture of liquids and solids that can each include multiple components. ➢ Describe and explain common photochemical and photo physical processes and mechanisms and explain solar energy conversion.

Name of the Course Teacher

Dr. G. Paruthimal Kalaignan, Senior Professor

Dr. T. Stalin, Assistant Professor

SEMESTER – I			
Course Code: 536104	**SUBJECT: INORGANIC CHEMISTRY PRACTICAL**	**Credits: 4**	**Hours:144**

Objectives	The major objectives of this course are to understand the concepts of: ➢ This course will help in developing practical skill with reference to EDTA and Redox titrations method of analysis of metal ions and synthesis and studies of some properties of co-ordination complexes.
1.	**Quantitative Analysis:-** a) EDTA titrations: (i)Ca, (ii)Mg, (iii)Ni and (iv) Zn. b) Redox titrations: Fe(II) *vs* Ce(IV), Fe(II) *vs* dichromate and NO^{2-} *vs* Ce(IV).
2.	**Preparation and Analysis of Coordination Complexes** a) Preparation of co-ordination complexes by double stage method (Any Four). b) Characterization of the prepared complexes. ➢ Solubility. ➢ Melting point. ➢ UV spectroscopy. ➢ Infrared spectroscopy. ➢ Thermal analysis. ➢ Spectrocolorimetry.

REFERENCES AND TEXTBOOKS:-

Basset, J., Denney, R. C., Jeffery G. H., Mendham, J. (1994). *Vogel's text book of quantitative*

Ekeley, J. B. (2010). *ALaboratory Manual of Inorganic Chemistry*. BiblioLife.

Grindley, D.N. (1964). *An advanced course in practical Inorganic Chemistry*. Butterworths.

Inorganic analysis. ELBS.

Palmer, W.G., (1972). *Experimental Inorganic Chemistry,* London: Van Nostrand Reinhold Co.

Veeraswamy, R., Kulandaivelu, A., Venkateswaran, V., Sultan (1997).*Basic Principles of Practical Chemistry (*2nd ed.). Chand & Sons.

Outcomes	The student would be able to:- ➢ The student would have through practical knowledge in preparation of co-ordination complexes and its characterization with suitable instrumentation.

Name of the Course Teacher

Dr. G. Gopu, Assistant Professor

Dr. S. Umadevi, UGC Assistant Professor

SEMESTER – II			
Course Code: 536201	**SUBJECT: INORGANIC CHEMISTRY –II**	**Credits: 4**	**Hours: 90**

Objectives	The major objectives of this course are to understand the concepts of: ➢ Predict their structures and bonding found in inorganic rings. ➢ To distinguish isopolyacids from heteropolyacids. ➢ Know about the basic mechanism of nuclear reactions. ➢ Substitution reactions in octahedral and square planar complexes.
Unit-I	**MAIN GROUP ELEMENTS:-** Compounds of alkali and alkaline earth metals- preparation and uses. Catenation - heterocatenation - intercalation chemistry - Poly anions and isopoly anions of Phosphorous, Vanadium, Chromium, Molybdenum and Tungsten, heteropoly anions of Molybdenum and Tungsten. Hydrides, oxides and oxy acids of nitrogen, phosphorous, sulphur; phosphines, phosphazines, sulphur-nitrogen compounds. Silicates, borazines and boron nitrides – Heterogenous catalysis – Zeolites – structure and reactivity.
Unit-II	**CAGES AND METAL CLUSTERS:-** Inorganic chains - rings - cages and clusters -Chemistry of boron – borane, higher boranes, carboranes, Structure and bonding in polyhedral boranes and carboranes,metalloboranes, metallocarboranes, styx notation; Wade's rule; Jemmis MNO rule in polyhedral boranes. electron count in polyhedral boranes; isolobal analogy; Metal clusters - dinuclear clusters - trinuclear clusters - tetranuclear clusters - hexanuclear cluster. Metal Organic Framework – basics and applications.
Unit-III	**LIGAND SUBSTITUTION REACTIONS IN COMPLEXES:-** Types of substitution reactions-S_N1, S_NI and S_N2 reaction mechanism in octahedral complexes-aquation, factors affecting aquation; base hydrolysis, conjugate base mechanism, anation reactions-substitution reactions without breaking metal-ligand bond.Sterochemistry of substitution reaction in octahedral complexes. Substitution reactions in square planar complexes - Trans effect –uses; theories of trans effect-electrostatic polarization theory - pi bonding theory; factors affecting the rate of substitution reactions- isomerisation in planar complexes; electron transfer reactions in coordination compounds - inner sphere mechanisms -outer sphere mechanisms - complementary - non-complementary electron transfer reaction mechanism.
Unit-IV	**METAL CARBON BONDING:-** Review of formalisms such as oxidation state, 18-electron rule, classes of ligands, Valence electron count (16/18 electron rules); Metal carbon bond types- Structure and bonding. Structure and bonding in mono and polynuclear metal carbonyls; substituted metal carbonyls and related compounds; reactivity of metal carbonyls; vibrational spectra of metal carbonyls; dinitrogen and dioxygen as ligands in organometallic compounds. Wades rule and isolobal relationship. Nitrosyls: terminal bridging and bent.
UNIT-V	**NUCLEAR CHEMISTRY:-** Radioactive decay - Nuclear structure: mass-energy relationship, nuclear binding energy, nuclear stability rules. Q value - threshold energy-cross reaction. Various types of nuclear reactions - photonuclear, spallation, Transmutation and thermonuclear reaction. Nuclear fission and Fusion: Probability, mass and charge distribution, Nuclear reactors and their uses for power production. nuclear fusion - conditions necessary - energy released in fusion - steller energy. Usage of radioisotopes in neutron activation analysis and isotopic dilution analysis; radioactive waste management and disposal.

REFERENCES AND TEXTBOOKS:-

Arnikar, H.J. (2011). *Essentials of Nuclear Chemistry* (4th ed.) NAEP Ltd.

Atkins, P., & Overton, T. (2010). *Shriver and Atkins' inorganic chemistry*. Oxford University

<table>
<tr><td colspan="2">Press, USA.
Crabtree, R. H. (2009). The organometallic chemistry of the transition metals. John Wiley & Sons.
Emeléus, H. J., & Anderson, J. S. (1942). Modern aspects of inorganic chemistry.
Gupta, B. D. (2011). Basic Organometallic Chemistry: Concepts, Syntheses and Applications. Universities Press.
Huheey, J. E., Keiter, E. A., Keiter, R. L., & Medhi, O. K. (2006). Inorganic chemistry: principles of structure and reactivity. Pearson Education India.
Kotz, J. C., Treichel, P. M., & Townsend, J. (2012). Chemistry and chemical reactivity. Cengage Learning.
Lee, J.D. (2008).Concise Inorganic Chemistry (5th ed.). Oxford.
Sodhi, G. S. (2006). Inorganic Chemistry (Ist ed.) VB (P) Ltd.</td></tr>
<tr><td>Outcomes</td><td>The students will have advanced knowledge in:-
➢ The substitution reactions in complexes and its uses.
➢ The chemistry of cages and clusters.
➢ 18-electron rule for mono- and poly-nuclear complexes and bonding nature of alkenes and alkynes to metals.
➢ They will have expertise in nuclear reactions and its radio isotopes application.</td></tr>
</table>

Name of the Course Teacher
Dr. G. Gopu, Assistant Professor
Dr. N. Sengottuvelan, Assistant Professor

SEMESTER – II			
Course Code: 536202	**SUBJECT: ORGANIC CHEMISTRY- II**	**Credits: 5**	**Hours: 90**

Objectives	The major objectives of this course are to understand the concepts of:- ➢ The course deals primarily with principles to understand the preparation, properties, stability and reactivity of intermediates formed during organic reactions. ➢ Emphasis is on the construction of organic compounds through the reactive intermediates. ➢ You will be taught on the basic concepts on how an organic compound undergoes photochemical or pericyclic reactions.
Unit-I	**CARBANIONS AND ADDITION REACTIONS :-** C-X bond (X = C, O, N) formations through the intermediacy of Carbanions: Chemistry of enolates and enamines, Kinetic and Thermodynamic enolates, Lithium and boron enolates in aldol and Michael reactions, Alkylation and acylation of enolates, Nucleophilic additions to carbonyls and stereochemical aspects through various models (Cram / Cram chelation / Felkin-Anh models); Organolithium, Organomagnesium, Organozinc, Organocopper reagents (restricted to 1,4-addition) in synthesis, Name reactions under carbanion chemistry - Claisen, Dieckmann, Knoevenegal, Stobbe, Darzen, Acyloin condensations, Shapiro reaction, Julia olefination, Peterson olefination. **Ylides:** Chemistry of Phosphorous and Sulfurylides.
Unit-II	**MOLECULAR REARRANGEMENTS:-** Classification of Rearrangements- Electron deficient and electron rich skeletal rearrangementsWagner-Meerwein, Pinacol-pinacolone, semi-pinacol rearrangement, Migratory attitude- Memory effect-C-C bond formation involving carbocations, Oxymercuration, halolactonisation. Stevens-Wittig-Sommelet-Hauser-Grovenstein-Zimmermann rearrangements, non-cyclic rearrangements, Chapman - Wallach rearrangement. **Carbenes and Nitrenes**: Structure of carbenes, generation of carbenes, addition and insertion reactions, rearrangement reactions of carbenes such as Wolff rearrangement, Structure of nitrene, generation and reactions of nitrene and related electron deficient nitrogen intermediates, Curtius, Hoffmann, Schmidt, Beckmann rearrangement reactions.
Unit-III	**STEREOCHEMISTRY AND REACTIVITY:-** Stereoselectivity: Classification, terminology, principle of stereoselectivity, examples of diastereoselectivity using Cram, Cram-Chelate, Felkin-Ahn, anti-Felkin, Houk models, Cieplak and cation coordination models, and Zimmerman-Traxler transitionstates, enantioselectivity. Desymmetrization and kinetic resolution, methods of determination of absolute configuration. Topicity and prostereoisomerism-topicity of ligands and faces, and their nomenclature – NMR and Steroisomers- Axial, planar and helical chirality – examples – stereochemistry and absolute configuration of allenes, biphenyls and binaphthyls, ansa and cyclophanic compounds, spiranes, exo-cyclic alkylidene cycloalkanes.
Unit-IV	**RADICALS AND PHOTOCHEMICAL REACTIONS:-** **Radicals:** Generation of radical intermediates and its (a) addition to alkenes, alkynes (inter & intramolecular) for C-C bond formation and Baldwin's rules(b) olefin metathesis(c) fragmentation and rearrangements. **Organic Photochemistry:** Thermal versus photochemical reactions - Photochemical reactions of Ketones - Norrish I and II type reactions - Photoreduction - Paterno-Buchi reaction - Photosensitization - Reactions of □□□-unsaturated ketones - isomerization and cycloadditions - cis-trans isomerisation of simple olefins - di-pi-methane rearrangement - Photooxidation - Oxidative coupling- Sandmeyer reaction,

	Gomberg-Bachmann reaction, Pschorr reaction, Ullmann reaction and Hunsdiecker reaction Barton deoxygenation and decarboxylation, and McMurry coupling.
UNIT-V	**CONCERTED REACTIONS:-** **Pericyclic Reactions**: Classification, electrocyclic, sigmatropic, cycloaddition, chelotropic and ene reactions, Woodward Hoffmann rules, Frontier Orbital and Orbital symmetry correlation approaches, examples highlighting pericyclic reactions in organic synthesis such as Claisen, Cope, Diels-Alder and Ene reactions (with stereochemical aspects), introductory dipolar cycloaddition. **Unimolecular pyrolytic elimination reactions:**Cheletropic elimination, Decomposition of cyclic azo compounds, beta-eliminations involving cyclic transition states such as sulfoxides, selenoxides, N-oxides, acetates, xanthates eliminations.

REFERENCES AND TEXTBOOKS:-

Bruckner, R., & Harmata, M. (2010). Organic mechanisms. *Reactions, Stereochemistry and Synthesis (Springer)*.

Bruice, P. Y. (2010). *Organic Chemistry* (6th ed.) Prentice Hall.

Carey, F. A., & Sundberg, R. J. (2007). *Advanced Organic Chemistry: Part B: Reaction and Synthesis*. Springer Science & Business Media.

Carruthers, W. & Coldham, I. (2005).*Modern methods of Organic Synthesis.* First South Asian Edition, Cambridge University Press.

Clayden, J., Geeves, N. & Warren, S. (2012).*Organic Chemistry* (2nded.). Oxford University Press.

Fleming, I. (1977). *Frontier orbitals and organic chemical reactions*.Wiley.

Fleming, S. A., Norton, W.W & Compound. (2010)*Organic Chemistry* (4th ed.).London.

Harris, J. M., & Wamser, C. C. (1976). *Fundamentals of organic reaction mechanisms*. Wiley.

Kalsi, P. S. (2014). *Organic reaction and their Mechanism* (2nd ed.). New Age International Private Limited, New Delhi.

Klán, P., & Wirz, J. (2009). *Photochemistry of organic compounds: from concepts to practice*. John Wiley & Sons.

Lowry, T. H., & Richardson, K. S. (1987). *Mechanism and theory in organic chemistry* (pp. 143-149). New York: Harper & Row.

Moloney, M. G. (2008). *Structure and Reactivity in Organic Chemistry* (Ist ed.).Wiley-Blackwell.

Mukherji, S.P. & Singh, S.P. (2004). *Reaction Mechanism in Organic Chemistry* (3rd ed.). New Delhi: Macmillan India Ltd.

Narain, R.P. (2011). *Fundamentals of Reaction Mechanisms in Organic Chemistry.* New Delhi: PHI Learning Private Limited.

Sankararaman, S. (2005). *Pericyclic reactions: a textbook: reactions, applications and theory*. Vch Verlagsgesellschaft Mbh.

Singh, J. (2005). *Photochemistry and pericyclic reactions*. New Age International.

Smith, M. B., & March, J. (2007). *March's advanced organic chemistry: reactions, mechanisms, and structure*. John Wiley & Sons.

Turro,N. J., Ramamurthy, V. & Scaiano, J. C. (2010).*Modern Molecular Photochemistry of Organic Molecules.* University Science Books, Sausalito.

Outcomes	The students will have advanced knowledge in:- ➢ Understand and be able to apply and evaluate simple organic reaction transformations, functional group interconversion and C-C bond formation reactions. ➢ Understand the scope and limitations as well as the mechanisms of organic reactions. ➢ Understand the importance of photochemistry and pericyclic reaction. ➢ Describe and explain currently held views of chemical reactions and account for the chemical reactivity of different reagents and intermediates.

Name of the Course Teacher

Dr. S. Viswanathan, Assistant Professor

Dr. S. Umadevi, UGC Assistant Professor

SEMESTER – II			
Course Code: 536203	**SUBJECT: PHYSICAL CHEMISTRY-II**	**Credits: 5**	**Hours: 90**

Objectives	The major objectives of this course are to understand the concepts of:- ➢ To study the wave properties, one-dimensional potentials, three-dimensional centrosymmetric potentials and also examines perturbation theory. ➢ Provides a mathematical tool for studying symmetries of various molecules and their spectroscopy application of group theory. ➢ To study the solution and gas phase kinetics and some fast reaction kinetics. ➢ To study adsorption isotherm for adsorption on to solid surfaces and to understand heterogeneous catalysis.
Unit-I	**QUANTUM CHEMISTRY:-** **Application of wave mechanics:** Rigid rotor, harmonic oscillators, shapes of orbitals, shape quantization. Solution of the Schrodinger equation for exactly solvable problems for bound states such as particle-in-a- box, particle-in-a-ring, distortions, John-teller effect, quantum numbers, zero-point energy, tunneling, perturbation theory.
Unit-II	**SPECTROSCOPY APPLICATION OFGROUP THEORY:-** **Spectroscopy application:** Direct product representation, Spectroscopy application of group theory to IR spectral activity of vibrational modes of ammonia molecule, selection rules for vibrational IR and RAMAN spectra, Mutual exclusion rule for molecules with center of symmetry, selection rules for rotational spectroscopy. Selection rules for n-π^* and π-π^* transitions in formaldehyde molecule. SALC procedure, Applications of SALC procedure to ethylene and butadiene molecules.
Unit-III	**CHEMICAL KINETICS:-** **Solution and gas phase kinetics:** Chain reactions and its rate laws, Hydrogen-bromine reaction, chain-branching explosion reactions, Polymerization kinetics: stepwise and chain polymerizations. Homogeneous catalysis: Features of acid-base catalysis. **Enzymes:** Michaelis-Menten mechanism of enzyme catalysis, Salt effects, catalytic efficiency of enzymes, Enzyme reaction, mechanisms of enzyme inhibition. **Fast reaction kinetics:** Relaxation methods (T- and P-jump methods), Stopped flow methods, Shockwave technique, Flash photolysis.
Unit-IV	**CLASSICAL THERMODYNAMICS:-** **Thermodynamics concept:** Concept of entropy, reversible and irreversible processes, Free energies. Fundamental equations for open systems, Partial molar quantities and chemical potential, Gibbs-Duhem equation, Real gases and Fugacity. **Thermodynamics of ideal and non-ideal solutions:** Liquid-liquid solutions, liquid-solid solutions, multi component systems and mean ionic activity coefficients. Debye-Huckel limiting law and its extensions, Applications of Debye-Huckel Theory.
UNIT-V	**SURFACE CHEMISTRY AND HETEROGENEOUS CATALYSIS:-** **Surface and interfaces:** Surface tension, solid-liquid interfaces; contact angle and wetting; Solid-gas interface; Physisorption and chemisorptions, Freundlich, Gibbs, Langmuir, and BET adsorption isotherms; Surface area determinations. Surface relaxation and reconstruction; Dynamics and energetics of surfaces. **Heterogeneous catalysis:**Kinetics of surface reactions involving adsorbed species, Langmuir-Hinshelwood mechanism, Langmuir-Rideal mechanism, Rideal-Eley mechanism, Basic aspects of semiconductor catalysis and applications. Model catalysts: Ammonia synthesis; Hydrogenation of carbon monoxide; Hydrocarbon conversion.

REFERENCES AND TEXTBOOKS:-

Adamson, A. W., & Gast, A. P. (1967). *Physical chemistry of surfaces* (Vol. 15). New York: Interscience.Roy S. Morrison, Roy, S. (1990). *The chemical physics of surfaces*.

Atkins, P. W., De Paula, J., & Keeler, J. (2018). *Atkins' physical chemistry*. Oxford university press.
Berry, R. S., Rice, S. A., Ross, J.(2007).*Physical Chemistry*(2nd ed.). Oxford University
Cotton, F. A. (2003). *Chemical applications of group theory*. John Wiley & Sons.
Gasser, R. P. H. (1985). *An introduction to chemisorption and catalysis by metals* (pp. p-215). Oxford: Clarendon Press.
Laidler, K. J., Harper & Row. (1998).*Chemical Kinetics* (3rd ed.).New York.
Masel, R. I. (2001). *Chemical kinetics and catalysis* (pp. 717-725). New York: Wiley-Interscience.
McQuarrie, D. A. (1983).*Quantum Chemistry.* University Science Books.
Press, Oxford.
Steinfeld, J. I., Francisco, J. S., & Hase, W. L. (1989). *Chemical kinetics and dynamics* (Vol. 3). Englewood Cliffs (New Jersey): Prentice Hall.

Outcomes	The students will have advanced knowledge in:- ➢ Recognize the importance of quantum chemistry and of its applications. ➢ Describe and understand the basic group theory and its applications. ➢ Understanding the use of free energies as equilibrium criteria and also determine the equilibrium state of a wide range systems, ranging from mixture of gases and mixture of liquids and solids that can each include multiple components. ➢ Understanding and analyze the chemical reactions at surfaces and interfaces.

Name of the Course Teacher

Dr. T. Stalin, Assistant Professor
Dr. M. Muthumareeswaran, DST Inspire Faculty

SEMESTER – II			
Course Code:536204	**SUBJECT: ORGANICCHEMISTRYPRACTICAL**	**Credits: 4**	**Hours: 144**

Objectives	The major objectives of this course are to understand the concepts of:- ➢ Develop practical skill with reference to organic qualitative analysis and organic preparations. ➢ Have expertise in the chromatographic separations. ➢ Know the extraction of organic compounds from natural products. ➢ Understand how to solve the structure of organic compounds using spectroscopies.
UNIT-I	**Qualitative analysis:-** Separation and Identification of components in a two component mixture and preparation of their derivatives. Determinations of boiling point/melting point for components and melting point for their derivatives.
UNIT-II	**Double stage Organic preparation:-** ❖ Benzanilide from benzophenone. ❖ Eosin from phthalic anhydride. ❖ Methyl orange from Aniline. ❖ Benzoic acid from Aniline.
UNIT-III	**Thin layer and Column Chromatographic separation of mixtures of organic compounds:-** ❖ Purification of anthracene. ❖ Separation of aminoacids. ❖ Separation of benzoic acid from benzaldehyde.
UNIT-IV	**Extraction of natural products such as** ❖ Piperine, Casein, Caffeine.
UNIT-V	**Identification of functional groups of organic compounds prepared and extracted.** ❖ UV-VIS spectra of □, □-unsaturated carbonyl systems. ❖ FT IR spectra of few organic compounds. ❖ Determination of C, H, N, S, O in an organic compound using elemental analyser.

REFERENCES AND TEXTBOOKS:-

Bansal, R. K. (1996).*Laboratory Manual of Organic Chemistry* (3rd ed.). New Age International (P) Ltd.

Furniss, B. S. (1989). *Vogel's textbook of practical organic chemistry*. Pearson Education India.

Vogel,A. I. (2011).*Elementary practical organic chemistry: Quantitative organic analysis Part-III, 2e (pb).*Pearson Education Asia.

Vogel, A.I. (2011). *Elementary practical organic chemistry: Qualitative organic analysis Part-II.* Pearson Education Asia.

Outcomes	The student would have through practical knowledge in the ➢ Separation of organic mixture and identification of organic compounds. ➢ Double stage preparations. ➢ Chromatographic separations. ➢ Extraction of compounds from natural products. ➢ Confirmation of structure of organic compounds using spectroscopic methods.

Name of the Course Teacher

Dr. M. Sundrarajan, Assistant Professor

Dr. S. Viswanathan, Assistant Professor

SEMESTER – III			
Course Code:536301	**SUBJECT: ADVANCED INORGANIC CHEMISTRY**	**Credits: 5**	**Hours: 90**

Objectives	The objectives are to understand the advanced concepts of:- ➢ Synthetic procedure of metal alkyl, alkene, alkyne, and arene complxes. ➢ To describe the various organometallic reaction mechanisms. ➢ Spectral and magnetic properties of octahedral complexes. ➢ Distribution of metal ions in bioligands. ➢ Role of metals in medicine and their structure and properties.
Unit-I	**SYNTHESISOF ORGANOMETALLICCOMPLEXES:-** Synthesis and reactivity of metal alkyls, alkene, alkynes and complexes; pi-complexes with olefins, acetylenes. Metal (W, Cr, Rh, Ru, Mo) carbene complexes, Fischer, Schrock and Grubbs type carbene complexes, comparison of their stability and reactivity, simple and cross metathesis reactions, ring opening, ring closing metathesis in organic synthesis, Alkene complexes - synthesis by ligand substitution, reaction with metal salt-structure and bonding with transition metals; cyclopentadienyl complexes- bonding with transition metals- metallocenes-ferrocene; Metal arene complexes- synthesis and reactivity.
Unit-II	**REACTIONS OF ORGANOMETALLIC COMPLEXES:-** Reaction mechanism- Ligand substitution, oxidative addition, reductive elimination, migratory insertion and hydride elimination, transmetallation, Nucleophilic and Electrophilic attack on coordinated ligands in organometallics. Fluxional molecules. Catalysis - Hydrogenation, Hydroformylation, hydrosilation, Hydrocynation, pauson Khand reaction, Monsanto process, Wacker process, alkene polymerization- Ziegler-Natta Polymerisation. Protection of double and triple bond.
Unit-III	**SPECTRAL AND MAGNETIC PROPERTIES OF COMPLEXES:-** Electronic spectra of coordination compounds - Determining the Energy terms, Spin-orbit (L-S) coupling scheme, Hund's rule, Hole Formulation, Derivation of the term symbol for a d^2 configuration, Electronic spectra of transition metal complexes – Laporte 'orbital' selection rule, spin selection rule. Characteristics of d-d transitions. Nephelauxetic effect, energy level diagrams of Orgel and Tanabe- Sugano Diagrams of octahedral complexes with d^2 & d^8 configuration., Magnetic susceptibility - Gouy balance , VSM and SQUID magnetometry, Magnetic properties of coordination compounds -dia, para – ferro and antiferromagnetism – spin cross over phenomena. Spin contribution to magnetic moment, orbital contribution to magnetic moment, Spin-Orbital coupling. Importance of symmetry in the reduction of orbital contribution to the magnetic moment of transition metal complexes.
Unit-IV	**BIOINORGANIC CHEMISTRY:-** Essential and trace metal ions in biology and their distribution -bioligands - amino acids, proteins, nucleic acids, nucleotides and their potential metal - binding sites; Metal storage and transport - molecular mechanism of ion transport across membranes - ionophores. Na^+ /K^+ pump.Electron transport, Monooxygenase, dioxygenase, phosphorylase, reductase, Processes in Photosynthesis – Photosystems I and II. Metals in medicine - therapeutic applications of *cis*-platin, radio-isotopes (e.g., Tc & I_2) and MRI agents. Toxicity of metals –Al, Cd, Hg and Cr toxic effects with specific examples, detoxification by chelation.
UNIT-V	**METALLOENZYMES AND METALLOPROTEINS:-** Transport & Storage of Dioxygen- Heme proteins & oxygen uptake, structure and functions ofhaemoglobin, myoglobin, hemocyanins & hemerythrin. Perutz mechanism showing structuralchanges in porphyrin ring system. Oxygenation and deoxygenation.Metallo enzymes- The principle involved and role of various metals in i) Zinc containing enzymes-carboxypeptidase-A and carbonic anhydrase. ii) Fe-enzyme - Cytochrome P-450 iii) Cu-enzyme:-Super Oxide dismutase iv) Co-enzyme

	- Vit.B12.Electron transfer in Biology- Structure and functions of metalloproteins in electron transfer proteins, cytochromes & Fe-S proteins, Non-heme iron proteins; Rubredoxins, Biological Nitrogen fixation (in vitro and in vivo) Structure and properties of Chlorophyll.
REFERENCES AND TEXTBOOKS:-	
Cotton, F. A., Wilkinson, G., Murillo, C. A., Bochmann, M., & Grimes, R. (1988). *Advanced inorganic chemistry* (Vol. 6). New York: Wiley. Das, A. K., Das, M. & Arunabha Sen. (2018).*Biophysical, Bioorganic and Bioinorganic Chemistry Books* and Allied (P) Ltd. Gopalan, R. (2009).*Concise Co-ordination Chemistry*. 1E 2nd reprint, VPH (P) Ltd. Huheey, J. E., Keiter, E. A., Keiter, R. L., & Medhi, O. K. (2009). *Inorganic chemistry: principles of structure and reactivity*. Pearson Education India. Jolly, W. L. (1984). *Modern inorganic chemistry*. McGraw-Hill College. Malik, W. U., Tuli, G. D., & Madan, R. D. (2013). *Selected topics in inorganic chemistry*. S. Chand Publishing. Sathyaprakash, J. D., Tuli, S. K., Basu, K. & Madan, R. D. (2006). *Advanced Inorganic Chemistry* (I^{st} ed.). (Vol I&II). S. Chand& Co.	
Outcomes	The students will have advanced knowledge in:- ➢ Predict the reaction mechanisms of organometallic complexes and catalysis. ➢ To appreciate the uses of organometallic complexes. ➢ The electron transitions in complexes and its effect on magnetic properties. ➢ The role of metalloenzymes and metalloproteins.

Name of the Course Teacher
Dr. S. Tambidurai, Professor
Dr. G. Gopu, Assistant Professor

SEMESTER – III			
Course Code:536302	**SUBJECT: ADVANCED ORGANIC CHEMISTY**	**Credits: 5**	**Hours: 90**

Objectives	The primary objective of this course is to introduce the student to the advanced concepts of organic chemistry and to develop critical thinking skills. The objectives are:- ➢ To learn the about the oxidizing and reducing reagents in organic synthesis. ➢ To learn the mechanisms of modern organic synthesis. ➢ To be familiar with the retro synthetic analysis and the role of protecting groups in organic reactions. ➢ To understand the importance of target molecules and their synthesis. ➢ To be able to interpret the reaction pathways. ➢ To begin to be able to do multiple step transformations of simple organic molecules, i. e. begin to learn organic synthesis and perform retro-synthetic analysis.
Unit-I	**OXIDIZING REAGENTS IN ORGANIC SYNTHESIS:-** Metal based and non-metal based oxidations of alcohols to carbonyls (Cr, Mn, Al, hypervalent iodine and TEMPO based reagents), phenols (Fremy's salt, silver carbonate), alkenes to epoxides (peroxides/per acids based), Sharpless asymmetric epoxidation, alkenes to diols (Mn, Os based), Sharpless asymmetric dihydroxylation, Prevost reaction and Woodward modification, alkenes to carbonyls with bond cleavage (Os and Ru,ozonolysis), alkenes to alcohols/carbonyls without bond cleavage (hydroboration-oxidation, Wacker oxidation, Se, Cr based allylic oxidation) and ketones to ester/lactones (Baeyer-Villiger).
Unit-II	**REDUCING REAGENTS IN ORGANIC SYNTHESIS:-** Catalytic hydrogenation- Heterogeneous: Pd/Pt/Rh/Ni, Homogeneous, Wilkinson, Li/Na/Ca in liquid ammonia - Birch, Pinacol formation, McMurry, Acyloin formation, dehalgenation and deoxygenations, Hydride transfer reagents from Group III and Group IV in reductions – $LiBH_4$, $NaBH_4$, triacetoxyborohydride, L-selectride, K-selectride, Luche reduction; $LiAlH_4$, DIBAL-H; Trialkylsilanes, Meerwein-Pondorff-Verley reduction - Stereo/enantioselectiviey reductions -Chiral Boranes, Corey-Bakshi-Shibata.
Unit-III	**MODERN ORGANICSYNTHESIS:-** Baylis-Hillman reaction, Henry reaction, Nef reaction, Ritter reaction, Sakurai reaction and Tishchenko reaction. Tebbe olefination. Metal mediated C-C and C-X coupling reactions: Heck, Stille, Suzuki, Negishi and Sonogashira, Nozaki-Hiyama, Buchwald-Hartwig Ullmann coupling reactions, directed ortho metalation. Phase transfer catalysts, crown ethers, Solid state synthesis-Merrifield resin.Robbinson annulations, Nazarov cyclization-radical-olefin cyclization
Unit-IV	**CONSTRUCTION OF RING SYSTEMS**:- (a) Different approaches towards the synthesis of three, four, five, and six-membered rings. (b)Pauson-Khand reaction, Bergman cyclization; Nazarov cyclization, cation-olefin cyclization and radical-olefin cyclization, inter-conversion of ring systems (contraction and expansion). (c) Construction of macrocyclic rings and ring closing metathesis.
UNIT-V	**RETROSYNTHESIS AND FUNCTIONAL GROUP PROTECTION:-** Basic principles and terminology of retro-synthesis, synthesis of aromatic compounds, one group and two group C-X disconnections, one group and two group C-C disconnections, amine and alkene synthesis, important strategies of retro-synthesis, functional group transposition, important functional group inter-conversions. Protection and deprotection of hydroxy, carboxyl, carbonyl, carboxy amino groups, alkene, 1,3 butadiene, alkyne, ; chemo- and regioselective protection and

	deprotection. Systematic synthetic routes for jasmone, ascorbic acid, retinol.Asymmetric Synthesis- Basics, Classical reactions and stereochemistry involved in the synthesis.

REFERENCES AND TEXTBOOKS:-

Ahluwalia, V. K. &Parashar, R. K. (2002).*Organic Reaction Mechanisms*. Narosa Publishing House.

Carey, F. A. & Sundberg, R. A. (2007).*Advanced Organic Chemistry, Part A: Structure and Mechanisms*(5th ed.). Springer, New York.

Carrothers, W. (1982).*Some modern methods of organic synthesis.* OUP.

Finar, I. L. (2004). *Organic Chemistry Vol. I &II*(5thed.). Pearson Education, Singapore.

House, H. O.*Modern synthetic reactions.* Allied publishers.

Kalsi, P. S. (2000). *Organic Reactions and Mechanisms,* (2nd ed.). New Age International Publishers.

Mackie, R. & Smith. K. (1990).*Organic Synthesis* (2nd ed.). Longman Group UK Ltd.

Morrison, R.T. & Boyd's, R. N. (2008). *Organic Chemistry* (6thed.): Springer.

Mukherji, S. M. & Singh, S. P. (1984). *Reaction Mechanism in Organic Chemistry* (3rded.).1984, MacMillan.

Mukherji, S. P. & Singh, S. P. (2004). Reaction Mechanism in Organic Chemistry (3rd ed.). Macmillan India Ltd, New Delhi.

Norman, R. O. C. (1978). *Principles of Organic Synthesis* (2nd ed.).Chapman and Hall.

Pine, S. H., Hendrickson, J. B., Cram, D. J. & Hammond, G. S. (1980).*Organic Chemistry* (4thed.). McGraw-Hill Company.

Smith, M. B., & March, J. (2007). *March's advanced organic chemistry: reactions, mechanisms, and structure*. John Wiley & Sons. .

Outcomes	The students will have advanced knowledge in:- ➢ Recognize the mechanism of oxidation and reduction reactions in organic synthesis. ➢ Understand how systematic the advanced organic syntheses are carried out. ➢ Recognize and distinguish the retro synthetic analysis. ➢ Construct target molecules through acceptable synthetic procedures. ➢ Know about the importance and usefulness of protecting groups in organic synthesis.

Name of the Course Teacher

Dr. M. Sundrarajan, Assistant Professor

Dr. S. Umadevi, UGC Assistant Professor

SEMESTER – III			
Course Code: 536303	**SUBJECT: ADVANCED PHYSICAL CHEMISTRY**	**Credits: 5**	**Hours: 90**

Objectives	The objectives are to understand the advanced concepts of:- ➢ To study the advanced Quantum Chemistry including the atomic orbital's and their energies, and structure of many-electron atoms. ➢ To study the molecular spectroscopy, this covers the Microwave spectroscopy, Vibrational spectroscopy, Electronic spectroscopy and the Raman spectroscopy. ➢ To study the ion-solvent interactions and types of over potential. ➢ To study the crystallographic structure of colloids.
Unit-I	**ADVANCED QUANTUM CHEMISTRY :-** **Structure and spectra of hydrogenic atoms:** Separation of internal motion and radial solutions. **Structure of many-electron atoms:** Helium and Hydrogen atoms, hydrogen molecule ion, hydrogen molecule, Pauli principle, electron affinities, Self-consistent field, atomicorbitals, Slater Type Orbitals, Slater exponents and the periodic properties of elements; LCAO-MO, Hückel orbitals; Born-Oppenheimer approximation, Potential energy surface, Hellman-Feynman theorem. **Spectra of complex atoms:** Quantum defects and ionization limits, spin-orbit couplings and term symbols and selection rules.
Unit-II	**MOLECULAR SPECTROSCOPY:-** Introduction to spectral energy domains and measurement of spectra, Implications of discrete energy levels, Population of States – Boltzman Distribution, Interaction of radiation with matter, origin of line widths in molecular spectra, Transition dipole moment and Fermi's Golden Rule, Einsteins Coefficients, Lasers and Masers; Rotational (Microwave) spectroscopy, Molecular vibrations - Infrared spectroscopy, Normal mode analysis, Raman Scattering, Molecular electronic spectra, Photophysical processes, Non-Linear Spectroscopy, Nuclear Quadrupolar Resonance.
Unit-III	**ELECTROCHEMISTRY OF SOLUTIONS AND INTERFACES:-** Electrochemistry of solutions: Ion-solvent interactions, ion-ion interactions, ionic migration and diffusion. Theories of Double-Layer structure, diffuse-double-layer theory of Gouy and Chapman, the Stern Model, Adsorption of ions and neutral compounds, Electrocaplillary and differential capacitance measurements; Influence of double layer on charge transfer processes. Equilibrium electrode potentials, IUPAC convention for electrode potentials, classification of electrodes. Reference electrodes: polarizable and non-polarizable systems. Types of reference and working electrodes Current-potential relationship (derivation of Butler-Volmer and Tafel equations). Types of overpotentials: origin and minimization; mechanism. Origin of emf and classification of electrochemical cells.
Unit-IV	**MOLECULAR ENERGETICS AND DYNAMICS:-** Statistical view of entropy. Laws of thermodynamics from statistical considerations Molecular view of temperature and heat capacity. Boltzmann distribution. Thermodynamic quantities in terms of partition functions. Statistical mechanics of simple gases and solids. Equilibrium constant in terms of partition functions. Bose-Einstein and Fermi-Dirac statistics. Overview of rate laws and determining rates and orders of reactions. Complex Reactions. Catalysis. Temperature dependence and Arrhenius law. Potential energy surfaces. Kinetic theory of collisions. Transition state theory. RRK and RRKM theories. Reaction cross-sections, rate coefficients, reaction probabilities.
UNIT-V	**MACROMOLECULAR CRYSTALLOGRAPHY:-** Basic Diffraction Theory, Bragg's law, Miller Indices, Laue Equations, Protein and Nucleic acid Structure, X-ray major sources and production, Xray detectors,

	Crystallization techniques and principles, symmetry and space groups, reciprocal space, Fourier transform, structure factor equation, phase problem, data collection and processing, methods of structure determination, heavy atom solutions like direct methods, patterson methods, Multiple Anomalous diffraction, Single Anomalous diffraction, sulpur phasing, Isomorphous replacement, Molecular replacement, structure refinement and validation, structure deposition, elucidation of mechanism from structure, biological crystallography examples of virus, ribosomes, membrane proteins, macromolecular assemblies.

REFERENCES AND TEXTBOOKS:-

Atkins, P. & De Paula, J. (2006). *Atkins' Physical Chemistry* (8th ed.). Oxford University Press.

Bagotsky, V. S. & Hoboken. (2006). *Fundamentals of Electrochemistry* (2nd ed.). Wiley-Interscience.

Banwell, C. M. & McCash, E. M. (1983). *Fundamentals of Molecular Spectroscopy*. Tata McGraw Hill.

Barrow, G. M. (1962).*Molecular Spectroscopy*. McGraw Hill.

Bockris, J. J. & Reddy, A. K. N. (1998). *Modern Electrochemistry* (2nd ed.). Vol. I & II, Plenum Press.

Dill, K. A. & Bromberg, S. (2003). *Molecular Driving Forces: Statistical Thermodynamics in Chemistry and Biology.* Garland Science.

Drenth, J. (2007). *Principles of protein X-ray crystallography*. Springer Science & Business Media.

Houston, P. L. (2001). *Chemical Kinetics and Reaction Dynamics.* McGraw-Hill Higher Education.

Ladd, M. F. C., Palmer, R. A., & Palmer, R. A. (1985). *Structure determination by X-ray crystallography* (p. 71). New York: Plenum Press.

Levine, I. R. (1995).*Quantum Chemistry*. Prentice Hall India (Ltd).

McQuarrie, D. A. & Simon, J. D. (2004). *Molecular Thermodynamics*. Viva Books.

McQuarrie, D. A. (1983). *Quantum Chemistry.* Oxford University Press.

Rhodes, G. (2010). *Crystallography made crystal clear: a guide for users of macromolecular models*. Elsevier.

Outcomes	The students will have advanced knowledge in:- ➢ Advanced concepts in quantum mechanics which make the students to understand the atomic orbitals and their structures. ➢ Advanced theoretical aspects of various spectroscopies.

Name of the Course Teacher

Dr. T. Stalin, Assistant Professor
Dr. M. Muthumareeswaran, DST Inspire Faculty

SEMESTER – III			
Course Code:536304	**SUBJECT: PHYSICAL CHEMISTRY PRACTICAL**	**Credits: 4**	**Hours:144**

Objectives	The objectives are to understand the advanced concepts of:- ➢ The physical chemistry practical course is designed such that to provide deep knowledge and hands on experimenting the more advanced physical chemistry practicals such as kinetics, distribution studies, conductometry, potentiometry, molecular weight determination and construction of phase diagrams.
1.	Kinetics - Acid hydrolysis of ester.
2.	Kinetics - Acid hydrolysis of ester - Comparison of strengths of acids / determination of Ea.
3.	Distribution Law - Study of iodine – Iodide equilibrium.
4.	Acid- Alkali titration by conductometry.
5.	Determination of dissociation constants of weak acids by conductometry.
6.	Determination of Critical Micelle Concentration by conductometry.
7.	Potentiometric Titrations - Redox titration.
8.	Determination of dissociation constant of weak acids by Potentiometric Titrations.
9.	Determination of the activities by freezing point.
10.	Determination of the dipole moments.
11.	Determination of the quantum yields.
12.	Distribution Law - Study of iodine – Iodide equilibrium.
13.	Determination of the heats of vaporisation and depressions of freezing points of solutions.
14.	Determination of the Electrodes with different substrates for H_2 evolution.
15.	Determination of the Photoelectrochemical solar cells.

REFERENCES AND TEXTBOOKS:-

Gurtu, J., Kapoor, N. & Chand R. (1980).*Advanced Experimental Chemistry.* Vol.I, New Delhi: S. & Co

Levitt, B. P. (1985).*Findlay's Practical Physical Chemistry*Revised (9th ed.). Longman, London.

Rajbhoj, S. W. & Chondhekar, T. K. (2017). *Systematic Experimental Physical Chemistry.* Anjali Publication, Aurangabad.

Viswanathan, B. & Raghavan, P. S. (2015).*Practical Physical Chemistry*. ViVa Books.

Outcomes	The students will have advanced knowledge in:- ➢ Carry out electrical experiments such as Conductometric and Potentiometric Titrations ➢ Determine out the kinetic parameters in the esterhydrolysis ➢ Understand the equilibrium reactions.

Name of the Course Teacher

Dr. T. Stalin, Assistant Professor

Dr. S. Viswanathan, Assistant Professor

SEMESTER – IV			
Course Code:536401	**SUBJECT: COMPREHENSIVE CHEMISTRY**	**Credits: 5**	**Hours: 90**
Objectives	The objectives are to understand the advanced concepts of:- ➢ Provide comprehensive knowledge about various topics in chemistry. ➢ Realize how the principles of chemistry are applied. ➢ Understand interlinking aspects of various topics in chemistry. ➢ Prepare the students to appear for competitive examinations.		
	Inorganic Chemistry:- 1. Chemical periodicity 2. Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory). 3. Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents. 4. Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds. 5. Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms. 6. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications. 7. Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis. 8. Cages and metal clusters. 9. Analytical chemistry- separation, spectroscopic, electro- and thermoanalytical methods. 10. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine. 11. Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-vis, NQR, MS, electron spectroscopy and microscopic techniques. 12. Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.		
	Physical Chemistry:- 1. Basic principles of quantum mechanics: Postulates; operator algebra; exactly solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling. 2. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications. 3. Atomic structure and spectroscopy; term symbols; many-electron systems and antisymmetry principle. 4. Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated π-electron systems. 5. Chemical applications of group theory; symmetry elements; point groups; character tables;		

	selection rules. 6. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance. 7. Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions. 8. Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities – calculations for model systems. 9. Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations. 10. Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions. 11. Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis. 12. Solid state: Crystal structures; Bragg's law and applications; band structure of solids. 13. Polymer chemistry: Molar masses; kinetics of polymerization. 14. Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.
	Organic Chemistry:- 1. IUPAC nomenclature of organic molecules including regio- and stereoisomers. 2. Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction. 3. Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions. 4. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes. 5. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways. 6. Common named reactions and rearrangements – applications in organic synthesis. 7. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regio and stereoselective transformations. 8. Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups. 9. Asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction –

	substrate, reagent and catalyst controlled reactions; determination of enantiomeric and diastereomeric excess; enantio-discrimination. Resolution – optical and kinetic. 10. Pericyclic reactions – electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry. 11. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S). 12. Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids. 13. Structure determination of organic compounds by IR, UV-Vis, 1H &13C NMR and Mass spectroscopic techniques.
	Interdisciplinary topics 1. Chemistry in nanoscience and technology. 2. Catalysis and green chemistry. 3. Medicinal chemistry. 4. Supramolecular chemistry. 5. Environmental chemistry.
Outcomes	The students will have advanced knowledge in:- ➢ Have a comprehensive understanding of important concepts of inorganic, organic and physical chemistry. ➢ Provide proper explanations for the chemical reactions. ➢ Solve problems in all the topics of chemistry. ➢ Appear for the competitive examinations confidentially. ➢ Clear CSIR NET examinations and to purse Ph.D.

Name of the Course Teacher

Dr. G. Paruthimal Kalaignan, Senior Professor
Dr. S. Thambidurai, Professor
Dr. M. Sundrarajan, Assi. Professor
Dr. T. Stalin, Assi. Professor
Dr. G. Gopu, Assi. Professor
Dr. S. Viswanathan, Assi. Professor
Dr. S. Umadevi, Assi. Professor
Dr. P. Muthu mareeswaran, Inspire Faculty
Dr. N. Sengottuvelan, Assi. Professor

SEMESTER – IV			
Course Code:536402	**SUBJECT: ANALYTICAL CHEMISTRY PRACTICAL**	**Credits: 4**	**Hours: 144**
Objectives	The major objectives of this course are to understand the concepts of:- ➢ Develop practical skill with reference to quantitative estimation and semi-microqualitative analysis. ➢ Have expertise in the mixture of inorganic salt separations.		
1.	**Quantitative estimations:-** ➢ Aniline ➢ Phenol ➢ Ethylmethylketone ➢ Nitrobenzene ➢ Glucose		
2.	**Semi-microqualitative analysis:-** Analysis of mixtures containing two ions: ➢ Less familiar cations: Ce, W, Mo, Zr, Ti, V, and Li. ➢ Familiar cations : Pb, Cu, Bi, Cd, Mn, Ni, Co, Zn, Ca, Ba, Sr and Mg.		

REFERENCES AND TEXTBOOKS:-

Bansal, R. K. (2008). *Laboratory Manual of Organic Chemistry* (3rd ed.). New Age International.

Ekeley, J. B. (1912). *A Laboratory Manual of Inorganic Chemistry*. J. Wiley.

Ramanujam, V. V. (1971). *Inorganic Semimicro Qualitative analysis*. National Publishing Co.

Svehla, G. (2008). *Vogel's Qualitative Inorganic Analysis, 7/e*. Pearson Education India. .

Veeraswamy, R., Kulandaivelu, A., Venkateswaran, V., Sultan (2012). *Basic Principles of Practical Chemistry* (2nd ed.). Chand & Sons.

Outcomes	The student would have through practical knowledge in the:- ➢ Determination of the strength of given unknown solution from estimation. ➢ To identify the familiar and less familiar cations form the given inorganic mixture of salts.

Name of the Course Teacher

Dr. G. Gopu, Assistant Professor
Dr. S. Umadevi, UGC Assistant Professor

SEMESTER – IV			
Course Code:536403	**SUBJECT: PROJECT WORK & VIVA-VOCE**	**Credits: 6**	**Hours: 216**
Objectives	The major objectives of this course are to understand the concepts of:- The main objective of this project work is exchange of experiences in promoting Chemistry as a science of the future, as well as stimulating and encouraging the students to find new, innovative, modern and interactive findings in Chemistry. Concrete objectives of the course are to: ➢ Encourage thestudents to have research experience in the subjects taught or discussed in the classroom. ➢ Make students aware of how to handle with instruments in the laboratories and the safety or dangers in the laboratories. ➢ Make students aware of the importance of using/handling safe, toxic and carcinogenic chemicals. ➢ Promote awareness of the basic and advanced researches in chemical sciences. ➢ Expose the students to the present trends in chemical science research and activities.		
Outcomes	The student would have through practical knowledge in the:- ➢ Understand the how the chemical reactions taught and discussed in the classroom are carried out in the laboratories. ➢ Carry out research in the field of chemical sciences. ➢ Understand how to handle the instruments and equipments in the laboratories. ➢ Have practical knowledge about the precautions and safety measures in the laboratories. ➢ Go for higher studies in research.		

Name of the Course Teacher

ELECTIVE COURSES			
Course Code:536051	**SUBJECT:INSTUMENTAL METHODS OF ANALYSIS**	**Credits: 5**	**Hours: 90**

Objectives	The objectives are to understand the advanced concepts of:- To acquire the knowledge in fundamental aspects, instrumentation and applications of ➢ Separation techniques. ➢ Thermal and spectrometric techniques. ➢ Electroanalytical methods.
Unit-I	**SEPARATION TECHNIQUES:-** Theory of chromatography, mechanism-adsorption and partition-classification-column, paper and thin layer chromatography –Gas Chromatography (GC) –GC/MS, LC/MS-High Performance Liquid Chromatography (HPLC)–Ultra-performance liquid chromatography (UPLC)-Size Exclusion Chromatography (SEC)- Ion Exchange Chromatography-Supercritical fluid chromatography-Applications.
Unit-II	**ERROR ANALYSIS ANDSPECTROSCOPIC TECHNIQUES:-** Statistics for analytical experimentation: Probability, Regression analysis, Accuracy and propagation of errors, data analysis and signal enhancement. Principle, instrumentation and applications of UV-Visible spectrophotometer, Circular Dichroism (CD) and Optical Rotatory Dispersion (ORD), Infrared spectrometer, Raman spectroscopy, Nuclear Magnetic Resonance Spectroscopy, Molecular Mass spectrometry-Hyphenated Mass Spectral methods.
Unit-III	**SPECTROMETRIC TECHNIQUES:-** Principles and applications of Atomic Absorption Spectrometry (AAS), Atomic Fluorescence Spectrometry, Atomic Emission Spectrometry (AES)-Spectrofluorimetry, Turbidimetry - Flame photometry-Atomic Mass spectrometry.
Unit-IV	**THERMAL AND SURFACE ANALYSIS:-** Principles and applications of Thermogravimetry(TG) - Differential Thermal Analysis(DTA) - Differential Scanning Calorimetry (DSC)- Thermo Mechanical Analysis (TMA) – BET Surface Area Analyzer - X-ray diffractometer (XRD)-X-ray photo electron spectroscopy (XPS)-Scanning Electron Microscopy (SEM) -Transmission Electron Microscopy (TEM) **-** Atomic Force Microscopy (AFM).
UNIT-V	**ELECTROANALYTICAL METHODS:-** Electroanalytical techniques: Applications to chemical & biological systems: Principles of Potentiometry, Electrogravimetry, Voltammetry, Stripping methods, Chronoamperometry, Quantitative applications of Potentiometry and Voltammetry: Electrochemical sensors, ISFETs, CHEMFETs,Electrochemical Quartz Crystal Microbalance.

REFERENCES AND TEXTBOOKS:-

Bard, A. J., Faulkner, L. R., Leddy, J., & Zoski, C. G. (1980). *Electrochemical methods: fundamentals and applications* (Vol. 2). New York: wiley.

Chatwal & Anand. (2000). *Instrumental methods of chemical analysis.* New Delhi: Himalaya publishing House.

Gary, D. & Christian, J. (2003).*Analytical Chemistry***.** New York: Wiley and Sons

Lakowicz, J. R. (2006).*Principles of Fluorescence Spectroscopy* (3rd ed.). Springer, New York.

Schoog, Holler, Crouch. (2004). *Principles of Instrumental Analysis*,(6th ed.). Asia Pvt. Ltd., Singapore.

Skoog & Wests. (2014). *Fundamentals of Analytical Chemistry* (9th ed.).Winston Publications.

Skoog, D. A. & West, D. M. (2004).*Fundamentals of Analytical Chemistry* (4th ed.). Winston Publication.

Valcarcel. (2000).*Principles of Analytical Chemistry*, Berlin: Springer-Verlag.

Vogel, A.I. (1987).*Text Book of Quantitative organic Analysis* (3rd ed.). ELBS. Willard, H. H., Merritt Jr, L. L., Dean, J. A., & Settle Jr, F. A. (1988). Instrumental methods of analysis.	
Outcomes	The students will have advanced knowledge in:- ➢ Gain knowledge regarding the separation techniques using various chromatography. ➢ Improve their analytical skill to use thermometric and spectrometric techniques. ➢ Get deep knowledge in fundamental aspects ofelectroanalytical techniques and sensors.

Name of the Course Teacher

Dr. S. Umadevi, UGC Assistant Professor
Dr. G. Gopu Assistant Professor

ELECTIVE COURSES			
Course Code:536052	**SUBJECT:NATURAL PRODUCTS AND INTRODUCTORY BIOCHEMISTRY**	**Credits: 4**	**Hours: 90**

Objectives	The objectives are to understand the advanced concepts of:- ➢ To know the fundamentals of natural products and biochemistry of living things. ➢ To promote understanding of the significance of natural products in terms of their biosynthesis, biological activity and chemical synthesis, combining organic chemistry and biological chemistry.
Unit-I	**HETEROCYCLIC COMPOUNDS:-** **Heterocyclic compounds:**Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms; Synthesis and properties of imidazole, oxazole, thiazole and indole, Anthocyanidins, Cyanidin Chloride, flavones and isoflavones, pyrimidines, purines, uric acid and caffeine.
Unit-II	**STEROIDS, ORD AND CD:-** **Steroids:** Types of steroids – structure, stereochemistry of cholesterol – Structural features of bile acids – Sex harmones – androsterone, testerosterone, estrone, estriol, estradiol, progesterone - Structure of ergosterol. **ORD and CD:** Circular bireferegence, optical rotary dispersion, circular dichroism – Cotton effect curves – octant rule –axial haloketone rule - Applications of chiroptical properties in configurational assignments.
Unit-III	**ALKALOIDS AND TERPENOIDS:-** **Alkaloids:** General methods of structure elucidation of alkaloids - structure and stereochemistry of the following alkaloids - Quinine, Morphine and Lysergic acid - Biosynthesis of alkaloids. **Terpenoids:** Classification - Structure, stereochemistry of Camphor, Zingiberene and Abietic acid - Biosynthesis of terpenoids.
Unit-IV	**ANTIBIOTICSANDVITAMINS:-** **Antibiotics**: A detailed study of structureand stereochemistry of penicillin, cephalosporin and griseofulvin- structural features of streptomycin. **Vitamins**: Chemistry and physiological action of ascorbic acid, thiamin, riboflavin and pyridoxine – Elementary aspect of vitamin A, E, K and $B_{12.}$
UNIT-V	**BIOCHEMISTRY:-** **Structure and functions**: Aspects of structure and classification of carbohydrates, lipids, amino acids, proteins and nucleic acids. Flow of genetic information, nature of genetic code, replication of DNA, transcription and translation, regulation of gene expression. **Metabolism:** Bioenergetics, thermodynamic considerations, redox potentials, bioenergetic principles. Catabolism and anabolism; Enzymes involved, catalytic mechanism and regulatory steps in glycolysis, TCA cycle, mitochondrial electron transport and oxidative phosphorylation.

REFERENCES AND TEXTBOOKS:-

Agarwal, O. P. (1988).*Chemistry of Organic Natural Products*. Vol I &II, Goel publishing House.

Ahluwalia, V. K. (2013). *Heterocyclic Chemistry- II,* New Delhi: Narosa International Private Limited.

Ahluwalia, V. K., Lalita S. Kumar., Sanjiv Kumar. (2006). *Chemistry of Natural Product*. New Delhi, India: Ane Book's.

Atta-Ur-Rahman & Choudhary, M. I. (1998).*New Trends in Natural Product* Chemistry (Ist ed.) Gordon & Breach Science Publishers.

Chatwal, G.R. (2007).*Organic Chemistry of Natural Produ***cts** (4th ed.). New Delhi.

Finar, I. L. (2004). *Organic Chemistry* (5th ed.). Vol. I & II. Singapore: Pearson Education.

Gupta, R. R., Kumar, M. & Gupta, V. (2009). *Heterocyclic Chemistry- II* (2nd ed.). New Delhi.

Joule, J. A. & Smith, G. F. (1978).*Heterocyclic Chemistry*. Van Notrand Reishord Co., London.

<table>
<tr><td colspan="2">Kalsi, P. S. & Sangeetha Jagtap. (2013). Pharmaceutical Medical and Natural Product. New Delhi: Narosa International Private Limited.
Krishnamoorthy, N. R. (2010).Chemistry of Natural Products (2nd ed.) Hyderabad.
Syed Aftab Iqbal. (2011). Chemistry of Natural Products. New Delhi: Discover Publishing House Private Limited.</td></tr>
<tr><td>Outcomes</td><td>The students will have advanced knowledge in:-
To understand the role of natural products in living organisms, their biosynthesis and will have a greater understanding of organic synthesis with natural product targets.
To solve by knowing natural sources and their chemical and biochemical reactions.</td></tr>
</table>

Name of the Course Teacher

Dr.M. Sundrarajan, Assistant Professor
Dr. S. Viswanathan, Assistant Professor

ELECTIVE COURSES			
Course Code: 536053	**SUBJECT:ADVANCED SPECTROSCOPIC TECHNIQUES**	**Credits: 6**	**Hours: 90**
Objectives	The primary objective of this course is to introduce the student to the advanced concepts of applications of spectroscopy in organic and inorganic chemistry. The objectives are: ➢ To learn about the basic principles and applications of UV-VIS, FT IR and Raman spectroscopic techniques. ➢ To be familiar with the principles and applications of NMR, Mass and Mossbauer spectroscopies. ➢ To be able to interpret the spectra and work out conjoined problems in spectroscopy.		
Unit-I	**UV-VIS, IR AND RAMAN SPECTROSCOPY:-** **UV-Visible spectroscopy:** Simple chromophoric groups-conjugated and aromatic systems-electronic excitations-factors that affect the position and intensity of absorption bands-Beer's-Lambert's law- Woodward –Fisher rules for spectra of dienes, α,β-unsaturated ketones and aromatic carbonyl compounds–- charge transfer complexes**.** **IR Spectroscopy:** Predicting number of active modes of vibrations-Hook's law-Characteristic group frequencies of organic and inorganic compounds- Effects of substitution, conjugation, bond angle and hydrogen bond on carbonyl vibrational frequencies- IR spectra of metal complexes- **Raman Spectroscopy**: Raman spectra of simple organic and inorganic molecules-resonance and surface enhanced resonance Raman scattering.		
Unit-II	**NMR SPECTROSCOPY:-** **NMR Spectroscopy:** NMR Phenomenon – NMR spectroscopy of compounds containing spin ½ nuclei (^{1}H, ^{13}C, ^{31}P, ^{19}F, Al, B, Si) - chemical shift (δ) –^{1}H NMR-inductive and anisotropic effects on δ– spin –spin coupling and coupling constant, J – geminal, vicinal and long range coupling-factors that affect these parameters, Karplus equation ^{13}CNMR Broad-band and off-resonance decoupling and gamma gauche effect - Nuclear Overhauser Effect -Applications of NMR in inorganic and organometallic chemistry Simplification of complex NMR spectra – shift reagents-double resonance - deuterium exchange reactions – high fields.		
Unit-III	**TWO DIMENSIONAL NMR AND EPR SPECTROSCOPY:-** **Two dimensional NMR:** COSY (H-H, C-H), INADEQUATE, HMBC, DEPT and NOESY **EPR Spectroscopy:** Zeeman splitting, introduction to zero-field splitting, g-values, anisotropy in g-values, hyperfine and super hyperfine coupling constants, - selected applications in organic inorganic compoundsCu, Mn and V complexes, EPR of complexes having spin> 1/2.		
Unit-IV	**MASS AND MOSSBAUER SPECTROSCOPY:-** **Mass Spectroscopy:** molecular ion, isotope abundance, fragmentation processes of organic molecules, McLafferty Rearrangement-deduction of structure through mass spectral fragmentation, high resolution MS, soft ionization methods, ESI-MS and MALDI-MS, studies of inorganic/coordination and organometallic representative compounds. Hypnated techniques **Mossbauer spectroscopy** - Mossbauer effect, recoilless emission and absorption, hyperfine interaction, chemical isomer shift, magnetic hyperfine and quadruple interaction and interpretation of spectra -Fe, Sn.		
UNIT-V	**SPECTROSCOPIC LABORATORY:-** Use of spectroscopic instrumentation to obtain familiarity with important types of		

	spectrometers and spectroscopic method spectrometers include electronic ultraviolet/visible absorption, fluorescence, Raman, Fourier transform infrared and nuclear magnetic resonance, Mass and EPR spectroscopic techniques.

REFERENCES AND TEXTBOOKS:-

Banwell, C. N., E. M. McCash, E. M. (1994). *Fundamentals of Molecular Spectroscopy*4th ed.). New York: McGraw-Hill.

Chatwal & Anand. (2000).*Instrumental methods of chemical analysis.* New Delhi: Himalaya publishing House.

Hollas, M. J. (2004). *Modern Spectrscopy* (4th ed.). Wiley.

Kalsi, P. S. (1995). *Spectroscopy of Organic Compounds*. Wiley Eastern Ltd., Madras.

Keelar, J. (2002).*Understanding NMR Spectroscopy*. Germany:Wiley.

Kemp, W. (1986). *NMR in Chemistry.* MacMillan Ltd.

Kemp, W. (1987). *Organic Spectroscopy* (2nd ed.). ELBS-Macmillan.

Mchale, J. L.*Molecular Spectroscopy*. Florida: CRC press.

Mermet, J. M.,Otto, M. &Kellner, R. (2004).*Analytical chemistry: a modern approach to analytical science.* Wiley-VCH.

Rouessac, F. & Rouessac, A. (2011).*Chemical Analysis: Modern Instrumentation Methods and Techniques* (2nd ed.). USA: Wiley & sons.

Schoog, Holler, Nieman & Thomson. (2004). *Principles of Instrumental Analysis*. Singapore: Asia Pvt. Ltd.

Silverstein, R. M., Bassler, C. G., Morril, T.C. (2002).*Spectrometric identification of organic compounds* (6thed.). New York: John Wiley & Sons.

Skoog D. A., West, D. M. (2004). *Fundamentals of Analytical Chemistry* (4th ed.). Winston Publications.

Willard, R., Merit Dean & Settle. (1986).*Instrumental Methods of Analysis* (4th ed.). CBS Publishers.

Williams, D. H. &Fleming, I. (1988). *Spectroscopic methods in organic chemistry.* Tata McGraw Hill.

Outcomes	The students will have advanced knowledge in:- ➢ Understand and appreciate the significance of spectroscopy in structural elucidation. ➢ Recognize and distinguish the different molecules by applying the spectroscopic techniques. ➢ Solve spectral problems. ➢ Know about the importance and usefulness of various spectroscopic techniques in organic and inorganic chemistry.

Name of the Course Teacher

Dr. S. Umadevi, UGC Assistant Professor
Dr. N. Sengottuvelan, Assistant Professor

<table>
<tr><th colspan="4">ELECTIVE COURSES</th></tr>
<tr><td>Course Code:536054</td><td>SUBJECT: ENVIRONMENTAL AND GREEN CHEMISTRY</td><td>Credits:4</td><td>Hours: 72</td></tr>
<tr><td>Objectives</td><td colspan="3">The major objectives of this course are to understand the concepts of:-
➢ To provide, thorough well designed studies of theoretical and experimental chemistry, a worthwhile educational experience for all students.
➢ To acquire deep knowledge in fundamental aspects of all branches of chemistry.
➢ To acquire basic knowledge in the specialized thrust areas like Supramolecular chemistry, Materials Chemistry, Chemistry in Nanoscience and Technology etc. and
➢ To develop abilities and skills that:
❖ Are relevant to the study and practice of science.
❖ Are useful in everyday life.
❖ Are encouraging efficient and safe practice and effective communication.
➢ To develop attitudes relevant to science such as:
❖ Concern for accuracy and precision,
❖ Objectivity,
❖ Integrity,
❖ Enquiry,
❖ Initiative and
❖ Inventiveness</td></tr>
<tr><td>Unit-I</td><td colspan="3">AIR AND WATER:-
Air Quality and pollution: Bio-geo chemical cycles: Carbon, Oxygen, Nitrogen, Phosphorous and Sulphur. Classification of air pollutants, sources of air pollution and control methods. Effects of air pollutants: ozone depletion, acid rain, green-house effect, climate change, global warming.
Water Quality and pollution: Water Quality parameters: colour, odour, temperature, turbidity, hardness, alkalinity, pH, conductivity, cations, anions, SS, VOC, TDS, DO, BOD, COD, micro nutrients, heavy metals and Coli-form. Potable water quality - Industrial water quality, Sources of water pollution.</td></tr>
<tr><td>Unit-II</td><td colspan="3">WATER TREATMENT:-
Pre and primary methods: aeration, filtration, sedimentation, precipitation, coagulation and flocculation, disinfection. Secondary methods: activated sludge, trickling filters, RBC, anaerobic digestion, lagoons and ponds. Tertiary/Advanced methods: activated carbon, ultrafiltration, ion-exchange, electrodialysis, reverse osmosis, Industrial waste water treatment.</td></tr>
<tr><td>Unit-III</td><td colspan="3">GREEN CHEMISTRY BASICS:-
Define Green chemistry – Difference between green and environmental chemistry - The need of green chemistry – basis of green methods and green products - twelve principles of green chemistryand their illustrations with examples -Synthesis involving principles of green chemistry(caprolactam, adipic acid, vanillin, methyl methacrylate, paracetamol, ibuprofen, citrol, and polycarbonate) - Planning a green synthesis in a chemical laboratory - Commercial green products - Advantages and disadvantages of green products.</td></tr>
<tr><td>Unit-IV</td><td colspan="3">DESIGNING GREEN SYNTHESIS:-
Choice of starting materials, reagents, catalysts, biocatalysts, polymer supported catalysts, solvents (water, ionic liquids, fluorous solvents, supercritical CO_2). Green reactions of Arndt – Eistert synthesis, Barton reaction, Claisen rearrangement, Darzen reaction, Grignard reagent, Heck reaction, Knoevenagel condensation, Mukaiyamma raction, Reformatsky reaction, Streker synthsis, Ullmann raction, Wurtz reaction - Renewable chemicals from biomass and sustainable polymers (polylactide). Ultrasound assisted reactions: esterification, reduction, coupling</td></tr>
</table>

	reactions. Electroorganic synthesis.
UNIT-V	**SUSTAINABLE AND ENVIRONMENTAL BENIGN TECHNOLOGIES:-** Solvent free microwave assisted organic synthesis - Reactions on solid supports, phase transfer catalysis, solvent free esters saponification - Reactions without support reagent or catalyst(microwave assisted reactions in water, oxidation of toluene to benzoic acid) - Microwave induced green synthesis - Benefits and limitationsof microwave. Traditional and green synthesis of some organic compounds- Reduce or reduction in materials, energy, waste, non-renewable, cost and risk hazards as greener alternatives for sustainable development. Carbon capture, carbon storage, carbon sequestration, carbon footprint and carbon trading.

REFERENCES AND TEXTBOOKS:-

Ahluwalia, V. K. (2006). *Green Chemistry- Environmentally benign Reactions*. Ane Books India.

Anasta, P. T. (2000).*Green Chemistry: Theory & Practice*. Oxford University Press.

Bear, J. M. (2013). *Environmental Chemistry in Society*. CRC press.

De, A. K. (2003). *Environmental Chemistry*. New Age International.

Harnung, S. E. & Johnson, M. S. (2012).*Chemistry and the Environment.* Cambridge University Press.

Jacobson, M. Z. (2012).*Air Pollution and Global Warming* (2nd ed.).Cambridge University Press.

Marteel-Parrish, A. E., Abraham, M. A. (2014).*Green Chemistry and Engineering: A Pathway to*

Shangi, R. & Srivatsava, M. M. (2003). *Green Chemistry*. New Delhi: Narosa Publishers. *Sustainability*. Wiley.

Outcomes	The students will have advanced knowledge in:- ➢ Understand and identify the pollution problems. ➢ Efficient knowledge in the chemical toxicity and causes of environment. ➢ Understand the green chemistry principles. ➢ Create a valuable design and synthesis of compounds by greener methods.

Name of the Course Teacher

Dr. M. Sundrarajan, Assistant Professor
Dr. S. Viswanathan, Assistant Professor

ELECTIVE COURSES			
Course Code:536055	**SUBJECT:MATERIALS CHEMISTRY**	**Credits: 4**	**Hours: 72**

Objectives	The course content has been structured to help the student to achieve the following objectives The objectives of this course are: ➢ To discuss important contemporary topics in the field of materials chemistry ➢ To educate chemistry students about changes in energy level and properties of crystals in the transition from molecular bonds to crystal bonding; ➢ To understand the physical and chemical synthesis of semiconductor nanocrystals; ➢ To understand the role of chemistry in materialssynthesis; ➢ To acquire advanced knowledge about semiconductor anddielectrics; ➢ To possess basic conceptual skills to understand new materials and applications.
Unit-I	**STRUCTURE OF CRYSTALS:-** Amorphous vs crystalline solids, types of bonding in solids – Unit cell – Crystal lattices – Crystal imperfections – Phase transformation diagrams - Physical properties of crystals – Classification of solids based on zone theory – Energy bands in solids – Band theory – Classification of solids based on band theory.
Unit-II	**SUPERCONDUCTORS AND SEMICONDUCTORS:-** Introduction – Properties and types of superconductors - High temperature superconductors – Applications of superconductors. Semiconducting materials - Properties of semiconductors – Determination of band gap and types of semiconductors - Various applications of semiconducting materials.
Unit-III	**DIELECTRIC /INSULATING MATERIALS:-** Introduction - Physical, chemical and electrical properties - Classification – Testing of insulating materials – Important applications of insulators. Ferroelectric materials – Classification of ferroelectric materials – Piezoelectric materials – Applications of ferroelectric materials.
Unit-IV	**MAGNETIC MATERIALS :-** Introduction – Types of magnetic materials –Diamagnetism – Paramagnetism – Ferrromagnetism – anti-ferromagnetism – Magnetic hysteresis – Soft and hard magnetic materials – Ferrimagnetic materials (or) Ferrites – Applications of ferrites.
UNIT-V	**PREPARATIVE METHODS:-** Introduction – Solid state thermal reaction method, sol-gel method, combustion method, hydrothermal method and microwave heating method. - physical methods – vacuum evaporation, sputtering, pulsed laser deposition, molecular beam epitoxy methods. Chemical methods – chemical vapour deposition, chemical solution deposition, electrochemical deposition, spray pyrolysis.

REFERENCES AND TEXTBOOKS:-

Blake, A. J., Cole, J. M., Evans, J. S., Main, P., Parsons, S., & Watkin, D. J. (2009). *Crystal structure analysis: principles and practice* (Vol. 13). Oxford University Press.

Callister, W. D., & Rethwisch, D. G. (2007). *Materials science and engineering: an introduction* (Vol. 7, pp. 665-715). New York: John wiley & sons.

Goswami, A. (1996).*Thin Film Fundamentals.* New Delhi: New Age International (P) Ltd.

Jayakumar, S. (2002).*Materials Science.* Coimbatore: R.K. Publishers.

Khanna, O. P., Dhanpat Rai & Sons. (1996).*A Textbook of Materials Science and Metallurgy*. Delhi.

Langel, W. (2003). Peter Y. Yu, Manuel Cardona, Fundamentals of semiconductors; physics and materials properties, 3rd rev. and enlarged edn. (Advanced texts in physics).

Naresh, R., Choudhary, P., Patri, S.K (2009). *Dielectric Materials: Introduction, Research and Applications.* Nova Science Publishers.

Raghavan, V. (2004).*Materials Science and Engineering* - a first course, (5th ed.). Prentice Hall of India. Vanvlak L.H. (1975).*Elements of Materials Science and Engineering*. New York: Addision & Wiley. Ward, D. J. (2008).*Material Science*. Lerner Publishing Group.	
Outcomes	The students will have advanced knowledge in:- ➢ Basic concepts on crystal structure, reciprocal lattice, chemical classifications of solids, the electronic structure of solids, materials of solids, lattice dynamics, surfaces. ➢ Important contemporary topics in the field of materials chemistry, e.g. Superconductors and semiconductors, dielectric / insulating materials, magnetic materials. ➢ In□depth view of the material synthesisusing physical and chemical routes.

Name of the Course Teacher

Dr. N. Sengottuvelan, Assistant Professor
Dr. M. Muthumareeswaran, DST Inspire Faculty

ELECTIVE COURSES			
Course Code:536056	**SUBJECT:POLYMER CHEMISTRY**	**Credits:4**	**Hours: 72**

Objectives	The objectives of the course are to acquire basic knowledge in area of:- ➢ Fundamental concepts of polymer chemistry. ➢ Polymerization reactions. ➢ Polymerization techniques. ➢ Structure and properties of polymers. ➢ Characterization of polymers.
Unit-I	**BASIC CONCEPTS OF POLYMER CHEMISTRY:-** Definition, nomenclature of polymers, functionality of monomers, degree of polymerization. Types of polymerization: addition, condensation and copolymerization. Mechanism and kinetics of free radical, cationic and anionic polymerization. Copolymerization: free radical, ionic. Copolycondensation.
Unit-II	**POLYMERIZATION REACTIONS:-** **Principles of polymer reactivity**: Photolytic,photosensitized polymerization. Cyclo, electro-initiated, cross-linking, graft and block copolymerization. Polymer reagents, polymer catalysis. **Stereochemistry of Polymerization** Types of stereoisomerism in polymers, properties of stereoregular polymers. Stereospecific polymerization. Ziegler-Natta polymerization.
Unit-III	**POLYMERIZATION TECHNIQUES:-** Various methods of polymerization: solution, bulk, emulsion and suspension. Electropolymerisation. Comparative accounts. Recycling of polymers. **Speciality Polymers** Fire retardant polymers, thermally stable polymers, biodegradable polymers, conducting polymers, polymer electrolytes and liquid crystalline polymers.
Unit-IV	**CRYSTAL STRUCTURE AND PROPERTIES OF POLYMERS:-** Polymer crystallization, factors affecting crystallisability. Morphology of crystalline polymers, effect of crystallisability on the properties of polymers. Glass transition temperature (T_g) and its determination. Dependence of T_g on polymer structure. Melting temperature. Physical and mechanical properties of crystalline and amorphous polymers.
UNIT-V	**CHARACTERIZATION OF POLYMERS:-** Number average, weight average and viscosity average molecular weight of polymers. Molecular weight determination by light scattering, osmotic, centrifuge and viscosity methods. Gel permeation chromatography. Analysis and testing of polymer by FT-IR, NMR, XRD, TGA/DTA/DSC.

REFERENCES AND TEXTBOOKS:-

Bhatnagar, M. S. (2004). *A Textbook of Polymers.* Vol I. S.Chand & Company Ltd.

Bill Meyer. (1994).*A Text Book of Polymer Chemistry,* Singapore: John Wiley & Sons.

Carraher, E.C. (2006). *Introduction to Polymer Chemistry.* Taylor & Francis, Inc.

Gowariker & Viswanathan. (1986). *Polymer Science.* Wiley Eastern.

Mishra, S. P. (1993). *Polymer Chemistry.* New Delhi: Wiley Eastern Ltd.

Outcomes	The students will have advanced knowledge in:- ➢ Acquire the knowledge about nomenclature of polymer, degree, types, mechanism and kinetics of polymerization. ➢ Understand the principles of polymer reactivity and stereochemistry of polymerization ➢ Get deep knowledge about various methods of polymerization and speciality polymers ➢ know the polymer crystallization, glass transition temperature and Physical and mechanical properties of crystalline and amorphous polymers

	➢ Improve their analytical skill to analysis and testing of polymer by FT-IR, NMR, XRD, TGA/DTA/DSC.

Name of the Course Teacher

Dr. M. Muthumareeswaran, DST Inspire Faculty
Dr. G. Gopu, Assistant Professor

ELECTIVE COURSES			
Course Code:536057	**SUBJECT:SUPRAMOLECULAR CHEMISTRY**	**Credits:5**	**Hours: 72**

Objectives	The objectives of the course are to acquire basic knowledge in area of:- ➢ To explain the various aspects of supramolecular chemistry. ➢ To explore about the weak interactions between the host and guest ➢ To explore the interactions between self-assembled systems. ➢ To explore about the applications supramolecules in various fields.
Unit-I	**SUPRAMOLECULES:-** Introduction to supramolecules: crowns, cryptands, spherands. Supramolecular Chemistry: key-lock principle and induced fit. Molecular Recognition: concept, definitions, receptor, design principles. Preorganization, self-assembly, template effects, allosterics, cooperativity, multivalency **Supramolecular Interactions**: Ion-ion interactions; Ion-dipole interactions; dipole-dipole interactions; hydrogen bonding and supramolecular synthons, halogen bonding; cation-π-interactions; π-π-interactions; van der Waals interactions; hydrophobic effect; metal-coordination bonds.
Unit-II	**Host-Guest concepts:-** **Host-Guest**: Calixarenes as receptors and molecular scaffolds. Hydrogen bonding anion receptor system (amidopyrroles and calixpyrroles). Ion pair receptors (cascade complexes, ditopic receptors and zwitterionic receptors). Hosts for Cation Binding; Host for Anion Binding; Hosts for the Binding of Neutral Guests; Synthetic consideration.
Unit-III	**TEMPLATES AND ASSEMBLIES:-** **Templates**: Programmed Supramolecular Systems; Kinetic and Thermodynamic Considerations; Self-assembled closed shell compounds; Helicates **Assemblies.** Introduction, Supramolecular Aggregates and Assemblies. Types of surfactant spontaneous self-assemblies, micelles, microemulsions, vesicles; methods of characterizing of aggregate formation**.**
Unit-IV	**FUNCTIONAL MOLECULES AND DEVICES :-** Examples of molecular-scale machines including: brakes, gears, plugs and sockets, shuttles, switches, syringes and motors. Logic gates, artificial photosynthesis. Discrete molecular electrochemical and optical systems.
UNIT-V	**CONTROL OF REACTIVITYAND SENSITIZERS:-** Aggregates structure, micelles, vesicles (reaction and transport), DNA and drug delivery functionalized surfactants, mixed micelles, cyclodextrins. **Metal complex sensitizers**: Electron relay, semiconductor supported metal oxide systems, water-photolysis, nitrogen fixation and CO_2 reduction.

REFERENCES AND TEXTBOOKS:-

Cragg, P. J. (2010). *Supramolecular Chemistry: From Biological Inspiration to BiomedicalApplications.* Springer.

Ariga, K., Kunitake, T. (2006). *Supramolecular chemistry: fundamentals and applications.* Springer.

Steed, J. W., Atwood, J. L. (2009).*Supramolecular Chemistry: A Concise Introduction,* (1st ed.). J.Wiley and Sons.

Schneider, H., Yatsimirsky, A. (2000). *Principles and Methods in Supramolecular Chemistry*(1st ed.). J. Wiley and Sons.

Gale, P. A. (2010).*Anion Recognition in Supramolecular Chemistry*.Springer.

Rurack, K.&Martínez, R. (2010).*The Supramolecular Chemistry of Organic-Inorganic HybridMaterials*.John Wiley.

John, A. H. (2012). *Supramolecular Polymer Chemistry.* Wiley & Sons.

Jean-Marie Lehn. (2006). *Supramolecular Chemistry: Concepts and Perspectives*.WileyOnline

Library.	
Outcomes	The students will have advanced knowledge in:- ➢ Control the self-assembly of the molecules. ➢ Make a drug carrier cargo vehicle system using supramolecules. ➢ Design the sensor systems using host-guest strategy. ➢ Design supramolecular storage systems which can be utilized in various fields.

Name of the Course Teacher

Dr. S. Viswanathan, Assistant Professor

Dr. M. Muthumareeswaran, DST Inspire Faculty

ELECTIVE COURSES			
Course Code:536058	**SUBJECT:MEDICINAL CHEMISTRY**	**Credits:4**	**Hours: 72**

Objectives	The objectives of the course are to acquire basic knowledge in area of:- ➢ To educate on the basic terminologies of the drugs and mechanism of drug action. ➢ To develop knowledge about inorganic and organic pharmaceuticals. ➢ To create awareness regarding the causes and control of life-threatening diseases such as AIDS. ➢ To provide information regarding some of the important medicinal products and their manufacturing principles.
Unit-I	**BASICS:-** Important terminologies in the study of drugs – pharmacy, pharmacology, medicinal chemistry, pharmakinetics, LD_{50}, ED_{50} etc; Classification of drugs – Biological and chemical classification; Mechanism of drug action; Therapeutic Index – their use in selecting drugs ; Assay of drugs.
Unit-II	**INORGANIC PHARMACEUTICALS:-** Electrolytes – extracellular and intracellular; Replenishes – sodium, potassium and calcium replenishes; Acid-Base regulators – Sodium, potassium and ammonium regulators; Acidifiers – HCl and ammonium chloride; Antacids – Sodium, potassium and magnesium antacids; Adsorbents; Pharmaceutical Aids – Suspending agents, colorants, antidotes; Topical agents – Astringents, silicone polymers; Miscellaneous Aids – Antidepressants – Plaster of paris, Antithyroid agents – potassium perchlorate.
Unit-III	**ORGANIC PHARMACEUTICALS:-** Preservatives, antioxidants and sequestrants, emulsifying agents, colouring favouring and sweetening agents, stabilizing and suspending agents, ointment bases, solvents and miscellaneous substantes; Diagnostic agents – drugs used as X-ray contrast media, drugs used to test organ function; Rh factors – blood pressure high, normal and low, Antianaemic drugs; Coagulanta and anticoagulants; Causes and Control of AIDS.
Unit-IV	**MANUFACTURING PRINCIPLES** Compressed tablets, wet granulation, dry granulation or slugging; Direct compression, tablet presses formulation; Coating pills, capsules sustained action dosage forms, parential solutions, oral liquids, injections;Ointments; Standard of hygiene and manufacturing practice.
UNIT-V	**PHARMACEUTICAL AND MEDICINAL PRODUCTS:-** Antibiotics – Assay and structures of penicillin; Sulpha drugs – Preparation, mechanism and action of sulphapyridine and sulphathiazole drugs; Vitamins – Fat soluble Vitamin A and K, Water soluble Vitamin B group and C; Analgesic – Morphine and Paracetamol; Anaesthetics – Chemistry of anaesthetic ether and cocaine; Alkaloids – Isolation, colour reaction and SAR of quinine, Tranquilizers and sedatives; Antineoplastic agents (cancer drugs) – Alkylating and antimetabolites; Diabetes – Insulin.

REFERENCES AND TEXTBOOKS:-

Ashutosh Kar. (1996).*Medicinal Chemistry*. New Age International.

Daniels, T. C., Jorgensen, E.C. & Lippincott. J. B. (1977).*Text book of organic medicinal and pharmaceutical chemistry.* Philadelphia.

Gordon, M. (1965).*Psychopharmacological agents*. Academic press, New York.

Hoover, J. E. (1975).*Remington's Pharmaceutical sciences* (15th ed.). Mack Publ. Company, Easton.

Jayashree Ghosh, M. (2012).*A Textbook of Pharmaceutical Chemistry.* New Delhi: S. Chand & Company.

Jayashree, G. (2012). *A textbook of pharmaceutical chemistry*. S. Chand Publishing.

Lednicer, D. & Mitscher, L. A. (1959). *Organic Chemistry of drug synthesis*. John Wiley & Sons, New York.

Madan, R. D. & Anita Madan. (2009).*Pharmaceutical Inorganic Chemistry*. New Delhi: S. Chand &Company Ltd.

Pandi, Veerapandian. (1997).*Structure based drug design.* New York: Marcel Dekker, inc.

Rawlines, E. A. (1977).*Bentyleys Textbook of Pharmaceutics* (3rd ed.). London: Bailliere Tindall.

Ritchie, J. M. & Cohen, P. J. (1975). *The pharmacological basis of therapeutics* (5th ed.). Macmillan, New York.

Smith H.J. &Williams H, eds. (2006).*Introduction to the principles of Drug Design.* Philadelphia, USA: Wright Boston.

Yalkonaky, S. H. & Swarbick, J. (1975). *Drug and Pharmaceutical Sciences.* New York: Marcel Dekkar.

Outcomes	The students will have advanced knowledge in:- ➢ Acquire basic knowledge about drugs, classification of drugs and mechanism of their action. ➢ Get details about inorganic and organic pharmaceuticals. ➢ Have awareness about the various medicinal products available for many diseases and critical conditions. ➢ Be able to apply the knowledge of fundamental concepts and principles of drug design, synthesis and manufacture in pharmaceutical industry.

Name of the Course Teacher

Dr. M. Sundrarajan, Assistant Professor
Dr. S. Viswanathan, Assistant Professor

ELECTIVE COURSES			
Course Code:536059	**SUBJECT:CHEMICAL AND ELECTROCHEMICAL ENERGY SYSTEMS**	**Credits:4**	**Hours: 72**

Objectives	The objectives of the course are to acquire basic knowledge in area of:- ➢ This course presents the basic principles and theory of Chemical and Electrochemical energy systems like Nuclear Energy, Electrochemical energy, Hydrogen energy and Solar energy.
Unit-I	**ENERGY AND ENVIRONMENT :-** Available energy options, their advantages and disadvantages. Environmental effects, comparative evaluation of energy options and energy needs. Fossil fuels: petroleum, natural gas and coal - Origin, processing and production of value added products - available current conversion technologies.
Unit-II	**NUCLEAR ENERGY:-** Nuclear Energy: Principles of Fission - Fission reactors, U enrichment and processing of spent fuels. Nuclear reactor kinetics and control - nuclear fusion - magnetic and other confinement - evaluation of the option of nuclear energy. Nuclear power in India.
Unit-III	**ELECTROCHEMICALENERGY:-** Electrochemical power sources - theoretical background on the basis of thermodynamic and kinetic considerations. Primary cells - various types, especially magnesium and aluminium based cells - magnesium reserve batteries. Secondary cells: classification based on electrolyte type, temperature of operation on the basis of electrodes - chemistry of the main secondary batteries - Batteries for electric vehicles - present status.
Unit-IV	**FUEL CELLS AND HYDROGEN FUEL:-** Fuel cells - classification - chemistry of fuel cells - detailed description of hydrogen/oxygen fuel cells - methanol - molten carbonate solid polymer electrolyte and biochemical fuel cells. Hydrogen as a fuel - production (thermal, electrolysis, photolysis and photoelectrochemical) storage and applications of hydrogen storage.
UNIT-V	**SOLAR ENERGY:-** Solar energy conversion devices - photovoltaic cells - photoelectrochemical cells - semiconductor electrolyte junctions photocatalytic modes for fuel conversion process - photobiochemical options.

REFERENCES AND TEXTBOOKS:-

Appleby, S. J. & Foulkes, F. K. (1989).*Fuel cell Hand Book.* Von Nostrand Reinhold. Gratzel, M. (1983). *Energy Resources through photochemistry and catalysis*. Academic Press. Linden, D. (1984).*Hand book of batteries and Fuel cells*. McGraw Hill Book Company.

Narayanan, R. & Viswanathan, B. (1997).*Chemical and Electrochemical energy systems*. Orient Longmans.

Ohta, T. (1979*). Solar Hydrogen energy systems.* Peragamon Press.

Ohta, T. (1994). *Energy Technology, Sources, Systems and Frontiers conversions,* Pergamon. Speight, J. G. (1980).*The chemistry and technology of petroleum.* Marcel Dekker Inc.

Sriram, K. (1990).*Basic Nuclear Engineering*. Wiley Eastern.

Vincent, C. A. (1984). *Modern Batteries,* Edward Arnold.

Outcomes	The students will have advanced knowledge in:- ➢ It enables the students to acquire more knowledge about the various types of energy systems and their applications. ➢ On successful completion of the course the students should have learnt more about the energy systems and expertise in this field.

Name of the Course Teacher Dr. G. Paruthimal Kalaignan, Senior Professor Dr. T. Stalin, Assistant Professor

NON MAJOR ELECTIVE COURSES			
Course Code:536071	**SUBJECT:BASIC CONCEPTSIN POLYMER CHEMISTRY**	**Credits: 2**	**Hours: 54**
Objectives	The objectives of the course are to acquire basic knowledge in area of:- ➢ Fundamental concepts of polymer chemistry ➢ Polymerization reactions ➢ Polymerization techniques		
Unit-I	**Introduction:-** Definition – Nomenclature of polymers -Functionality of monomers - Degree of polymerization. Types of polymerization – addition, condensation and copolymerization. Mechanism of free radical, cationic and anionic polymerization.		
Unit-II	**Polymerization Reactions:-** Principles of polymer reactivity - Photolytic and electrolytic polymerization reactions - Photosensitized polymerization - Cyclopolymerization - Electrointiated polymerization -Cross linking polymerization - Graft and block copolymerization - Polymer reagents - Polymer catalysis.		
Unit-III	**Polymerization Techniques :-** Various methods of polymerization - Solution, bulk, emulsion and suspension polymerization- Comparative accounts. **Speciality Polymers** Fire retardant polymers - thermally stable polymers -bio-degradable polymers - conducting polymers, polymer electrolytes and liquid crystalline polymers.		
Unit-IV	**Crystal Structure and Properties of Polymers:-** Crystallisability – Polymer crystallization - Factors affectingcrystallisability – Morphology of crystalline polymers – Effect of crystallisability on the properties of polymers. Glass transition temperature (T_g) and its determination and importance - Melting temperature - Physical properties of crystalline and amorphous polymers.		
UNIT-V	**Characterization of Polymers:-** Number average, weight average and viscosity average molecular weight of polymers – Molecular weight determination by light scattering, osmotic,centrifuge and viscosity methods –Gel permeation chromatography method. Analysis and testing of polymer by FTIR spectroscopy – X-ray diffraction – Thermal analysis (TG/DTA) - Physical testing.		

REFERENCES AND TEXTBOOKS:-

Allcock, H. R., & Lampe, F. W. (1990). *Contemporary polymer chemistry*. Prentice Hall.

Bhatnagar, M. S. (2004). *A Textbook of Polymers*. VolI, S.Chand & Company Ltd.

Bill Meyer. (1994). A *Text Book of Polymer Chemistry*. John Wiley & Sons, Singapore.

Carraher, C. E. (2006). *Introduction to Polymer Chemistry*, Taylor & Francis, Inc.

Gowariker & Viswanathan. (1986).*Polymer Science*. Wiley Eastern.

Mishra. (1993). *Polymer Chemistry*. New Delhi: Wiley Eastern Ltd.

Odian, G. (2004). Principles of Polymerization, John Wiley& Sons. *Inc.: Hoboken, NJ*.

Ruiden, A (1998). *Elements of Polymer Science and Engineering*. Elsevier Science.

Outcomes	The students will have advanced knowledge in:- ➢ The students will understand the fundamental knowledge about nomenclature of polymer and types. ➢ The students will come to know about the basic principles of polymer reactivity, structure and properties.

NON MAJOR ELECTIVE COURSES			
Course Code:536072	**SUBJECT:BASICS IN ENVIRONMENTAL SCIENCE**	**Credits:2**	**Hours: 54**

Objectives	The objectives of the course are to acquire basic knowledge in area of:- ➢ To educate on the basic terminologies of the environment ➢ To develop knowledge about air, water and soil ➢ To create awareness various pollutions and abatements
Unit-I	**Environment:-** Definitions of environment, ecology, pollution. Types of pollution and effects.Industrial effects on environment, general waste categorization. Hazardous materials and their ill effects**.** Acid rain, photochemical smog, ozone hole and green-house effect.
Unit-II	**Types of Pollution:-** Types of pollution and effects: air pollution, water pollution, land pollution, pesticide pollution, thermal pollution, noise pollution, radioactive pollution.Basic information about the nature and type of contaminants in industrial effluents of tannery, distillery, paper and pulp, textile, fertilizer and electrochemical.
Unit-III	**Water pollution abatement:-** Basic information about the water pollution abatement methods: Pretreatment methods, Primary treatment methods, Biological or secondary treatment methods, Advanced or tertiary treatment methods.
Unit-IV	**Sustainable Development:-** Industrial hazards: types, guidelines and safety methods. Health hazards due to industrial chemicals in the category of poisons, corrosives and flammables. The need for Green Chemistry.Definition and 12 principles of Green Chemistry. Use of non-traditional "Greener" alternatives for sustainable development.
UNIT-V	**Recent advances in Sustainable Science:-** Environmentally benign technologies using Greener concepts: microwave, photochemical degradation, enzymes for pulp and paper manufacture, biochemical removal of phosphorous: Exploring Green resources for drug development, essential oils.

REFERENCES AND TEXTBOOKS:-

Agarwal. (1986). *Engineering Chemistry*. Meerut: Kedar Nath Ram Nath.

Banerji, S. K. (2003). *Environmental Chemistry*. New Delhi: Prentice Hall of India.

Eckenfelder, W. W. (1980).*Principles of Water Quality Management*. CBI Publishers, Boston.

Heaton, C. A. (1984). *Industrial Chemistry*. Glasgow: Leonard Hill Publisher.

Manahan, S. E. (2001). *Environmental Chemistry*. London: Lewis Publishers.

R. Shangi, R., Srivatsava, M.M. (2003) *Green Chemistry*. New Delhi: Narosa Publishers.

Rao, M. N. & Dutta, A. K. (1979). *Wastewater Treatment* (2/e). Delhi: Oxford and IBH Publishing Co.

Sharma, B. K., Kaur, H. (2000). *Environmental Chemistry*. New Delhi: Krishna Publishers.

Srivatsava, M. M. & Shangi, R. (2005).*Chemistry for Green Environment*. New Delhi: Narosa Publishers.

Tchobanoglous, G. & Schroeder, E.D. (1985). *Water Quality*. Addison-Wesley, California.

Trivedi, R. N. (1998).*A Text book of Environmental Pollution Control*. Anmol Publications, New Delhi.

Outcomes	The students will have advanced knowledge in:- ➢ The students will acquire basic knowledge about environment ➢ Environmental awareness about the various types of pollution and their control.

NON MAJOR ELECTIVE COURSES			
Course Code:536073	**SUBJECT:PHARMACEUTICAL CHEMISTRY**	**Credits:2**	**Hours: 54**

Objectives	The objectives of the course are to acquire basic knowledge in area of:- ➢ To provide the basic knowledge about the drugs. ➢ To educate the basic details about the antibiotics, analgesics and other pharmaceuticals. ➢ To create awareness regarding the pharmaceutical awareness.
Unit-I	**Introduction:-** Important terminologies-pharmaceuticals, drugs, pharmacodynamics, pharmacokinetics, pharmacopoea, virus, bacteria, fungus, actinomycetes, metabolites, antimetabolites, LD50 and ED50 - Therapeutic index- their use in selecting drugs; assay of drugs - Use of plaster of paris in bone fracture.
Unit-II	**Antibiotics and Vitamins:-** Antibiotics-structure and uses of 59enicillin, chloramphenicol and tetracyclines – Sulphonamides- action of sulpha drugs – uses of sulphadiazine, sulphapyridine, sulphathiazole and sulphafurazole – Vitamins: classification as water soluble and liquid soluble vitamins, sources, deficiencies and assay of vitamins A,B_1, B_2 and C.
Unit-III	**Analgesics and Antiseptics:-** Narcotic analgesics-pharmacological action and uses of morphine, heroin and codeine - Synthetic analgesics-pethidine and methodone - Antipyretic analgesics-action of methyl salicylate, aspirin, paracetamol and phenacetin - Antiseptics and disinfectants-phenol as disinfectant and phenol coefficient.
Unit-IV	**Anaesthetics and Other Pharmaceuticals:-** Anaesthetics-classification as general, local and intravenous anaesthetics, chemistry of anaesthetic ether, nitrous oxide, halothane, chloroform, thiopental sodium methohexitone, cocaine and benzocaine - Alkaloids-detection of alkaloids, colour reagents - colour reaction - Tranquilisers -detection sugar and serum in urine - cause and control of diabetes - Oral hypoglycemic agents - causes and control of cancer.
UNIT-V	**Pharmaceutical Aids:-** Organic pharmaceutical aids-their role as preservatives and antioxidants, colouring, flavouring and sweetening agents and ointment bases - Blood-blood groups, Rh factor, blood pressure normal, high and low - control of pressure - Causes and control of anaemia-antianaemic drugs, coagulants and anticoagulants - Causes and control of AIDS.

REFERENCES AND TEXTBOOKS:-

Ashutosh, K. (1996). *Medicinal Chemistry*. New Age International.

Daniels, T. C., Jorgensen, E. C., Lippincott. J. B.(1977). *Text Book of Organic Medicinal and Pharmaceutical Chemistry.* Philadelphia.

Hoover,J. E. (1975). *Remington's Pharmaceutical Sciences* (15th ed.). Easton: Mack Publishing Company.

Lednicer, D. & Mitscher, L. A. (1959). *Organic Chemistry of Drug Synthesis*. New York: John Wiley &Sons.

M.Gordon, M. (1965).*Psychopharmacological Agents.* New York: Academic Press.

Ritchie, J. M. & Cohen, P.J. (1975). *The Pharmacological Basis of Therapautics* (5th ed.). New York: Macmillan.

Outcomes	The students will have advanced knowledge in:- ➢ The students will acquire basic knowledge about drugs and their action. ➢ It creates awareness about the various medicinal products available for many diseases and critical conditions.

NON MAJOR ELECTIVE COURSES			
Course Code:536074	**SUBJECT:CHEMISTRY IN EVERYDAY LIFE**	**Credits:2**	**Hours: 54**

Objectives	The objectives of the course are to acquire basic knowledge in area of:- ➢ To educate on the basic terminologies and functions of the drugs and vitamins. ➢ To develop knowledge about water and food used in daily life. ➢ To create awareness about the cleansing agents, cosmetics and colouring substances. ➢ To provide information regarding some of the important polymers, fuels, batteries, corrosion and prevention.
Unit-I	**Drugs and Vitamins:-** Drugs: Definition – Classes of drugs: Antacids, Analgesics, Antibiotics, Antiseptics, Disinfectants, Tranquilizers, Antifertility Drugs. Vitamins: Water soluble vitamins: Vitamin B and C; Fat soluble vitamins: A, D, E & K - Sources - Physiological functions and deficiency symptoms.
Unit-II	**Water and Food:-** Water: Hydrosphere - Hydrological cycle - Water quality parameters – Potable water - Types of water pollutants - organic, inorganic, toxic metals – Treatments: filtration, chlorination, adding bleaching powder, UV irradiation and Ozonation. Food: Artificial Sweetening Agents - Food Preservatives – Food additives
Unit-III	**Cleansing Agents:-** Soaps - Preparation, Types, Disadvantages of soaps - Synthetic Detergents: Anionic Detergents, Cationic Detergents and Non-ionic Detergents - Advantages of synthetic detergents over soaps **Chemistry in Cosmetics**:- Creams – Perfumes – Talcum Powder – Deodorants **Chemistry in Colouring Matter**: Natural and synthetic colouring matters – Dyes – Classification on the basis of Constitution and applications
Unit-IV	**Chemistry of polymers:-** Synthetic fibres - nylons, polyester – synthetic rubber - polyurethane rubber – reclaimed rubber - sponge, foam rubber, thermocole. **Fuels and Energy Resources** Types of fuels - liquid fuels - petroleum products – gaseous fuel - coal gas, producer gas and biogas - Rocket fuels - solid and liquid propellants - nuclear fuels - difference between nuclear and chemical fuels. Renewable sources of energy - solar energy, wind energy and tidal energy.
UNIT-V	**Battery, Corrosion and Surface Coatings:-** Batteries -Basic concepts, battery characteristics, classification of batteries– primary, secondary and reserve batteries, fuel cells and super capacitors. Corrosion - Definition of chemical corrosion, types of corrosion, corrosion prevention- Pretreatment of the surface metallic coating, galvanizing, tinning, inorganic coatings, organic coatings, oil paints, water paints, special paints, enamels and lacquers.

REFERENCES AND TEXTBOOKS:-

Jain, P. C. & Monica Jain. (2006). *Engineering Chemistry* (15th ed.). Dhanphatrai and Sons.

Sharma, B. K. (2000). *Environmental Chemistry* .Goel Publishing House.

Sharma, B. K. (2001). *Industrial Chemistry* (12th ed.). Goel Publishing House.

Shrive, George and T Austin. (1984). *Chemical Process Industries*. McGraw Hill Book Co.

Outcomes	The students will have advanced knowledge in:- ➢ Acquire basic knowledge about drugs and vitamins. ➢ Get details about the constitution, pollution and usage of water and composition and contamination of food. ➢ Have awareness about the usage of cleansing agents and cosmetics. ➢ Be able to apply the knowledge of fundamental concepts of batteries, fuels, corrosion and protection.

Name of the Course Teacher

NON MAJOR ELECTIVE COURSES			
Course Code:536075	**SUBJECT:POLYMERS AND PLASTICS: A CHEMICAL INTRODUCTION**	**Credits:2**	**Hours: 54**

Objectives	The objectives of the course are to acquire basic knowledge in area of:- ➢ Polymers – nomenclature, types and uses. ➢ Plastics – classification, properties and uses.
Unit-I	**Introduction:-** Definition - Nomenclature of polymers - Functionality of monomers. Types of polymerization – addition, condensation and copolymerization. Homopolymers, copolymers and Block copolymers.
Unit-II	**Polymerization Reactions:-** Principles of polymer reactivity - Photolytic and electrolytic polymerization reactions- Photosensitized polymerization - Cyclopolymerization - Electrointiated polymerization.
Unit-III	**Polymerization Techniques:-** Various methods of polymerization - Solution, bulk, emulsion and suspension polymerization- Comparative accounts.
Unit-IV	**Plastics:-** Introduction, Thermoplastics – amorphous, semi-crystalline - Thermoset plastics. Elastomers, Dendrimers. Biopolymers- polypeptides, nucleic acids and polysaccharaides.
UNIT-V	**Important polymers and plastics:-** Polyethylene terephthalate (PET), Polyethylene (PE) – high density and low density, Polyvinyl chloride (PVC), Polypropylene (PP), Polystyrene (PS), Polyamide (PA, Nylon), Polyurethane foam (PUF), Polytetrafluoroethylene (PTFE) and Polyesters.

REFERENCES AND TEXTBOOKS:-

Bhatnagar, M.S. (2004).*A Textbook of Polymers*. Vol I. S.Chand & Company Ltd.

Charles, C. (2003).*Giant Molecules: Essential Materials for Everyday Living and Problem Solving*. Wiley Interscience.

Gowariker & Viswanathan. (1986).*Polymer Science.* Wiley Eastern.

Mishra. (1993).*Polymer Chemistry*. New Delhi: Wiley Eastern Ltd.

Outcomes	The students will have advanced knowledge in:- ➢ The students will understand the significance of polymers and where and how they are using in daily life. ➢ The students will come to know about the polymers and plastics used in day to day life.

Name of the Course Teacher

S.No	BROAD BASED BOARD OF STUDIES MEMBERS	
1.	**Dr.G.PARUTHIMAL KALAIGNAN,** Senior Professor and Head, Department of Industrial Chemistry, Alagappa University, Karaikudi.	Chairman
2.	**Dr.JERZY RADECKI**, Professor, Polish Academy of Science, Tuwima Olsztyn, Poland.	Member
3.	**Dr.HANNA RADECKA**, Professor, Polish Academy of Science, Tuwima Olsztyn, Poland	Member
4.	**Dr.G.RAJARAMAN**, Professor, Department of Chemistry, IIT-Bombay, Powai, Mumbai. (Subject Expert)	Member
5.	**Dr.M.JEGANMOHAN**, Professor Department of Chemistry, IIT-Madras, Chennai, Tamilnadu. (Subject Expert)	Member
6.	**Dr.C.SIVAKUMAR**, Senior Scientist, CSIR -CECRI, Karaikudi & ALUMNI of Dept. of Industrial Chemistry.	Member
7.	**Dr.S.KASTHURIBAI**, Assistant professor & Head, Department of Chemistry, Alagappa Govt. Arts College, Karaikudi & ALUMNI of Dept. of Industrial Chemistry.	Member
8.	**Dr.G.A.PATHANJALI**, Managing Director, High Energy Batteries (India) Ltd., Pakkudi Road, Mathur (Industry).	Member
9.	**Dr.S.THAMBIDURAI**, Professor, Department of Industrial Chemistry, Alagappa University, Karaikudi.	Member
10.	**Dr.M.SUNDRARAJAN**, Assistant Professor, Department of Industrial Chemistry, Alagappa University, Karaikudi.	Member
11.	**Dr.T.STALIN** Assistant Professor, Department of Industrial Chemistry, Alagappa University, Karaikudi.	Member
12.	**Dr.G.GOPU**, Assistant Professor, Department of Industrial Chemistry, Alagappa University, Karaikudi.	Member
13.	**Dr.S.VISWANATHAN**, Assistant Professor, Department of Industrial Chemistry, Alagappa University, Karaikudi.	Member
14.	**Dr.N. SENGOTTUVELAN**, Assistant Professor, DDE, Department of Industrial Chemistry, Alagappa University, Karaikudi.	Member
15.	**Dr.S.UMADEVI,** UGC Assistant Professor, Department of Industrial Chemistry, Alagappa University, Karaikudi.	Special Invitee
16.	**Dr.P.MUTHU MAREESWARAN**, DST- INSPIRE Faculty, Department of Industrial Chemistry, Alagappa University, Karaikudi.	Special Invitee
17.	**Dr. E. KANNAPIRAN,** Director, Curriculum Design and Development Cell.	Member

CURRICULUM VITAE

Name: Dr. G. PARUTHIMAL KALAIGNAN
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Educational qualification:

- M.Sc., Ph.D

Professional experience:

- 30 Years and 6 Months

Honours and Awards:

- "Alagappa Excellance Award for Research" for the year 2015-2016
- Visiting Researcher – KAIST, South Korea for the year 2000-2001
- Visiting Scientist – KIST, South Korea for the year 2004-2005
- SHIKSHA RATTAN PURASKAR (Education ICON Award) and CERTIFICATE OF EXCELLENCE from India International Friendship Society (IIFS), New Delhi, April, 2010.

Recent publications:

- P.Naveenkumar, **G.Paruthimal Kalaignan**,Electrodeposited $Ni(OH)_2$-modified CuS core shell-like hybrids as binder-free electrodes for high-performance Supercapacitors, New Journal of Chemistry 43(2019), 12785-12794. Impact Factor: **3.069**

- P.Naveenkumar, **G.Paruthimal Kalaignan**, Fabrication of core-shell like hybrids of $CuCo_2S_4$@$NiCo(OH)_2$ nanosheets for supercapacitor applications, Composite Part B: Engineering 173(2019), 106864. Impact Factor: **6.864**

Total Citation: 2040
h- index: 26
i10- index: 48

CURRICULUM VITAE

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Poland
Phone:
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Email:

Educational qualification:

- M.Sc., Ph.D, D.Sc,

Professional experience:

- 30 Years and 6 Months

Honours and Awards:

- Editor in chief of the polish Journal of Environmental Studies
- Co-Ordinator for safety Food Network
- Founder and Local coordinator of polish supramolecular Chemistry.

Recent publications:

- UnniSivasankaran, **Jerzy Radecki**, Hanna Radecka, Krishnapillai Girish Kumar,Copper nanoclusters: an efficient fluorescence sensing platform for quinoline yellow, Luminescence (2019), 10.1002/bio.3601, Impact Factor: **1.69**
- PiotrGołębiewski[a]BartłomiejPuciłowski[a]FabianSommer[b]StefanKubik[b]MathiasDaniels[c]WimD ehaen[c]UnniSivasankaran[d]KrishnapillaiGirishKumar[d]HannaRadecka[a]**JerzyRadecki**[a], Electrochemical sensing of sulfate in aqueous solution with a cyclopeptide-dipyrromethene-Cu(II) or Co(II) complex attached to a gold electrode, Sensors and Actuators B-Chemical(2019), 10.1016/j.snb.2019.01.083,Impact Factor: **6.4**

Total Citation: 1478
h- index: 21
i10- index: 48

CURRICULUM VITAE

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Educational qualification:

- M.Sc., Ph.D,

Professional experience:

- 30 Years and 6 Months

Honours and Awards:

- Executive Editor in of the Polish Journal of Environmental Studies
- Editorial board member of Journal of Sensors and Instrumentation.

Recent publications:

- UnniSivasankaran, Jerzy Radecki, **Hanna Radecka**, Krishnapillai Girish Kumar, Copper nanoclusters: an efficient fluorescence sensing platform for quinoline yellow, Luminescence (2019), 10.1002/bio.3601, Impact Factor: **1.69**
- PiotrGołębiewski[a]BartłomiejPuciłowski[a]FabianSommer[b]StefanKubik[b]MathiasDaniels[c]WimDehaen[c]UnniSivasankaran[d]KrishnapillaiGirishKumar[d]**HannaRadecka**[a]JerzyRadecki[a], Electrochemical sensing of sulfate in aqueous solution with a cyclopeptide-dipyrromethene-Cu(II) or Co(II) complex attached to a gold electrode, Sensors and Actuators B-Chemical(2019), 10.1016/j.snb.2019.01.083, Impact Factor: **6.4**

Total Citation: 1478
h- index: 21
i10- index: --

CURRICULUM VITAE

Name: **Dr. G. Rajaram**
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Email:rajaraman@chem.iitb.ac.in

Educational qualification:

- M.Sc., Ph.D

Professional experience:

- 11 Years

Honours and Awards:

- Qualified Lectureship-NET in National Eligibility Test (NET) conducted by CSIR-UGC, India in December-2000
- Overseas Scholarship scheme (OSS) and University funded research studentship (URS) awarded by University of Manchester for doctoral studies.
- Awarded several thousand hours computing time in EPSRC High performance computing centre -RAL, London by submitting several successful scientific proposal.
- INSA medal for Young scientist, Indian national science academy, 2013.

Recent publications:

- T Rajeshkumar, R Jose, PR Remya, G Rajaraman, Theoretical Studies on Trinuclear {MnIII2GdIII} and Tetranuclear {MnIII2GdIII2} Clusters: Magnetic Exchange, Mechanism of Magnetic Coupling, Inorganic chemistry (2019)- Accepted, Impact Factor**: 4.8.**
- J Acharya, A Swain, A Chakraborty, V Kumar, P Kumar, JF Gonzalez, Slow Magnetic Relaxation in Dinuclear$Co^{II}Y^{III}$ Complexes, Inorganic chemistry(2019- Accepted, Impact Factor**: 4.8.**
- S Tripathi, S Vaidya, KU Ansari, N Ahmed, E Rivière, L Spillecke, C Koo,Influence of a Counteranion on the Zero-Field Splitting of Tetrahedral Cobalt (II) Thiourea Complexes, Inorganic chemistry 58 (14), 9085-9100, Impact Factor**: 4.8.**
-

Total Citation: 5135
h- index: 41
i10- index: 128

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Email: mjeganmohan@iitm.ac.in

Educational qualification:

- M.Sc., Ph.D

Professional experience:

- 30 Years and 6 Months

Honours and Awards:

- ISCB Award of Appreciation for Chemical Science -2014.
- Alkyl Amines – ICT Young Scientist Award – 2013.
- Science Academy Medal for Young Scientists - 2013
- Science Academy Medal for a young associate – 2012-2015.
- DAE Young Scientist Research Award– 2011

Recent publications:

- Jambu, S.; Jeganmohan, M., "Rhodium(III)-Catalyzed Redox-Neutral Weak O-Coordinating Vinylation and Allylation of Arylacetamides with Allylic Acetates" Org. Lett., 2019, 21, 14, 5655-5659, Impact Factor: **6.5.**
- Manoharan, R.; Jeganmohan, M.,"Alkylation, Annulation and Alkenylation of Organic Molecules with Maleimides via Transition□Metal□Catalyzed C−H Bond Activation" Asian J. Org. Chem - Just accepted (invited review) :Impact Factor**: 2.5.**
- Sivasakthikumaran, R, Jambu, S.; Jeganmohan, M"Ruthenium(II) Catalyzed Distal Weak O-Coordinating C H Alkylation of Arylacetamides with Alkenes: Combined Experimental and DFT Studies". J. Org. Chem.,2019,84,7,3977-3989Impact Factor**: 4.7.**

Total Citation: 2040
h- index: 26
i10- index: 48

CURRICULUM VITAE

Name: Dr. S. Thambidurai
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Educational qualification:

- M.Sc., Ph.D.

Professional experience:

- 18 Years

Honours and Awards:

-

Recent publications:

- Immobilization of ZnO on Chitosan-Neem seed composite for enhanced thermal and antibacterial activity (2019)
- Cytotoxic, antioxidant and antibacterial activities of copper oxide incorporated chitosan-neem seed biocomposites (2019)

Cumulative Impact factor: 120
Total Citation: 689
h- index: 15
i10- index: 24

CURRICULUM VITAE

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Educational qualification:

- M.Sc., Ph.D

Professional experience:

- 13.6 Years

Honours and Awards:

- Best Citizens of India Award(2017) from Best Citizens of India- New Delhi.
- Alagappa Excellence Award for Research – 2016 given by AURF, Alagappa University, Karaikudi.

Recent publications:

- Ornamental morphology of ionic liquid functionalized ternary doped N, P, F and N, B, F-reduced graphene oxide and their prevention activities of bacterial bio-film-associated with orthopedic implantation (2019).
- Ionic liquid – A greener templating agent with Justicia adhatoda plant extract assisted green synthesis of morphologically improved Ag-ZnO nanostructure and it's antibacterial and anticancer activities (2019).

Cumulative Impact factor: 315
Total Citation: 1412
h- index: 21
i10- index: 39

CURRICULUM VITAE

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Educational qualification:

- M.Sc., M.Phil., Ph.D.

Professional experience:

- 11 Years

Honours and Awards:

- YOUNG SCIENTIST AWARD, Department of Science & Technology (INDIA) – SERC Fast Track 2011-2014.
- Raman Fellowship for Post-Doctoral Research in USA for a period of 12 months at Department of Chemistry, University of Miami, USA, by the UGC, New Delhi(2017-2018).

Recent publications:

- Encapsulation of triclosan within 2-hydroxypropyl–β–cyclodextrin cavity and its application in the chemisorption of rhodamine B dye, Journal of Molecular Liquids, 282 (2019) 235-243.
- Poly (ethylene glycol) stabilized synthesis of inorganic cesium lead iodide polycrystalline light-absorber for perovskite solar cell, Materials Letters 240(2019)132-135.

Cumulative Impact factor: 126.15
Total Citation: 976
h- index: 19
i10- index: 30

CURRICULUM VITAE

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Educational qualification:

- M.Sc., PGDCA, Ph.D.,

Professional experience:

- 9 Years

Honours and Awards:

- Alagappa Excellence Award for Research – 2016, given by AURF, Alagappa University, Karaikudi.

Recent publications:

- Sonochemical driven simple preparation of nitrogen-doped carbon quantum dots/SnO_2nanocomposite: A novel electrocatalyst for sensitive voltammetric determination of riboflavin (2019)
- N-doped carbon quantum dots @ hexagonal porous copper oxide decorated multiwall carbon nanotubes: A hybrid composite material for an efficient ultra-sensitive determination of caffeic acid (2019)

Cumulative Impact factor:43.42
Total Citation: 170
h- index: 7
i10- index: 7

CURRICULUM VITAE

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Educational qualification:

- M.Sc., B.Ed., Ph.D

Professional experience:

- 17 Years

Honours and Awards:

- Extended senior research fellow- Council of industrial research anddevelopment, India-2003.
- Marie Curie Postdoctoral fellow- European Union Marie Curie Actions - Transfer of Knowledge- 2007.

Recent publications:

- Voltammetric immunosensor for the simultaneous analysis of the breast cancer biomarkers CA 15-3 and HERZ-ECD (2018)
- Label‐free Voltammetric Immunosensor for Prostate Specific Antigen Detection (2018)

Cumulative Impact factor: 139
Total Citation: 1876
h- index: 25
i10- index: 33

CURRICULUM VITAE

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Fax: .....
Email: nsvelan1975@yahoo.com

Educational qualification:

- M.Sc., B. Ed., Ph.D.

Professional experience:

- 11 Years

Honours and Awards:-

Recent publications:

- Investigation on biomolecular interactions of nickel(II) complexes with monoanionic bidentate ligands
- *In-situ* nickel(II) complexes of 3-(dimethylamino)-1-propylamine based Schiff base ligands: Structural, electrochemical, biomolecular interaction and antimicrobial properties

Cumulative Impact factor: 94.2
Total Citation: 608
h- index: 14
i10- index: 20

CURRICULUM VITAE

Name: Dr. S. Umadevi
Designation: UGC Assistant professor
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Tamil Nadu, INDIA
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Email: umadevilc@gmail.com

Educational qualification:

- M.Sc., Ph.D.

Professional experience:

- **2014- till date UGC Assistant Professor** under Faculty Recharge Programme Department of Industrial Chemistry, Alagappa Univeristy, Karaikaudi, Tamilnadu
- **2012-2014** CECRI, Karaikudi, India ─ Women Scientist (WOS-A) DST, New Delhi
- **2011-2012** University of Manitoba, Canada─ **Postdoctoral** research with Dr. Torsten Hegmann

Honours and Awards:

- Early Career Research (ECR) Award from Science and Engineering Research Council (SERB), India.
- Selectee in Faculty Recharge Programme from UGC as UGC Assistant Professor, 2013
- Lectureship from CSIR, India
- 2 Gold medals for performance in M.Sc. Chemistry – II rank, Mysore University, Mysore
- 2 Gold medals for performance in B.Ed. – I rank, Mysore University, Mysore
- 5 Gold medals for performance in B.Sc. – I rank, Mysore University, Mysore

Recent publications:

- R. Mangaiyarkarasi, S. Selvam, V. Ganesh and S. Umadevi, (2019) Cholesterol based imidazolium ionic liquid crystal: Synthesis, characterisation and its dual application as an electrolyte and electrode material, *New J. Chem.* **43**, 1063 - 1071 (**I. F.-3.0**)
- B.Sivaranjini, R. Mangaiyarkarasi, V.Ganesh and S. Umadevi, (2018)Vertical Alignment of Liquid Crystals Over a Functionalized Flexible Substrate, Scientific Reports, **8:8891**, 1-19 (**I. F.-4.5)**

Cumulative Impact factor: 115.73
Total Citation: 383
h- index: 12
i10- index: 13

CURRICULUM VITAE

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Email: mareeswaran@alagappauniversity.ac.in, muthumareeswaran@gmail.com

Educational qualification:

- M. Phil., Ph.D.

Professional experience:

- 4.8 Years

Honours and Awards:

- Brain Pool Korea Fellowship, South Korea
- DST INSPIRE Faculty Award

Recent publications:

- Selective Carbon Dioxide Capture Using Silica□Supported Polyaminals (2019)
- Imine-linked polymer/silica composites for CO_2 sequestration (2019)

Cumulative Impact factor: 49.29
Total Citation: 277
h- index: 11
i10- index: 12